



Where Does Novelty Come From? Transnational Municipal Networks in Global Climate Governance

Thèse

Marielle Papin

Doctorat en science politique
Philosophiæ doctor (Ph. D.)

Québec, Canada

**Where Does Novelty Come From?
Transnational Municipal Networks in Global Climate
Governance**

Thèse de doctorat

Marielle Papin

Sous la direction de :

Jean-Frédéric Morin, directeur de recherche

Résumé

Au cours des dernières années, les villes ont investi la scène de la gouvernance climatique mondiale. Si elles s’y présentent parfois en leur nom propre, elles sont souvent représentées par les réseaux municipaux transnationaux (RMT). Les RMT forment des structures à l’intérieur desquelles les villes échangent de l’information et des bonnes pratiques et collaborent sur diverses problématiques urbaines. Ils sont aussi des acteurs promouvant les intérêts des villes au niveau mondial. Les chercheurs se sont intéressés à l’émergence des RMT, leurs fonctions et leurs effets. En ce qui concerne ces derniers, une certaine confusion règne quant à la capacité des RMT de générer de nouvelles pratiques de gouvernance et la manière dont ces pratiques émergent.

Ce travail se focalise sur les instruments de gouvernance comme nouvelles pratiques des RMT. Les RMT créent ces instruments pour orienter le comportement de leurs villes membres. Ils en mettent en œuvre certains directement, mais en mettent d’autres à disposition des villes pour qu’elles les emploient. Constatant que tous les RMT ne génèrent pas autant de nouveaux instruments, ce travail pose la question suivante : pourquoi certains RMT génèrent-ils plus de nouveautés que d’autres?

Pour répondre à cette question, un cadre théorique utilisant la théorie des réseaux et les approches sur les systèmes complexes est construit. Il perçoit les interactions comme étant la condition principale d’émergence de nouveaux instruments. Il emprunte aussi à la théorie des organisations pour étudier l’âge et les ressources organisationnelles des RMT comme possibles autres variables expliquant l’émergence de nouveaux instruments.

Ce cadre théorique est testé par le biais d’une étude empirique des interactions et instruments de gouvernance dans un système de 15 RMT. Une analyse de réseaux sociaux et une analyse transversale montrent que la combinaison de la centralité, la diversité et l’âge expliquent les nouveaux instruments des RMT. Une analyse comparative du C40 et du 100RC souligne que lorsque ces variables sont absentes, la présence d’un entrepreneur de gouvernance et d’importantes ressources organisationnelles pourraient également encourager l’émergence de nouveaux instruments de gouvernance.

Cette étude contribue aux travaux sur l'influence des RMT dans la gouvernance environnementale et climatique en montrant comment émergent de nouveaux instruments de gouvernance. En ce sens, elle répond à des considérations plus larges sur la nécessaire diversification des instruments permettant de gouverner les villes et les autres acteurs de la gouvernance climatique mondiale.

Abstract

In recent years, cities have become visible in the realm of global climate governance. While they sometimes talk in their own name, they are often represented by Transnational Municipal Networks (TMNs). TMNs are structures in which cities discuss and exchange information and good practices, and collaborate on a variety of urban issues. They can also be considered actors promoting the interests of cities at the global level. Scholars have looked at the emergence of TMNs, their functions, and their effects. There is some confusion regarding the latter, especially the capacity of TMNs to generate novel practices and the way in which these might emerge.

This study focuses on governance instruments as novelties generated by TMNs. Considering the fact that not all TMNs generate novel instruments, it asks: why do some TMNs generate more novel governance instruments than others?

To answer this question, this research uses a network and complex system framework, seeing interactions as the main enabling condition for the emergence of novel instruments. It also uses some insights from organisational theories to study TMN age and organisational resources as possible variables explaining the emergence of novelty.

This study then conducts an empirical analysis on the interactions and governance tools emerging in a system comprising of 15 TMNs. A social network analysis and cross-case analysis show that the combination of centrality, diversity, and age explain TMN novel instruments. A comparative case study of C40 and 100RC underline that, in the absence of high centrality, diversity, and age scores, the presence of a governance entrepreneur and high organisational resources might also explain the rise of novel governance instruments.

This research contributes to studies on the influence of TMNs in environmental and climate governance by showing how novel governance instruments emerge. Accordingly, it answers wider concerns about the need for a diversification of tools in order to govern cities as well as other transnational actors of global climate governance.

Table of contents

Résumé	ii
Abstract.....	iv
Table of contents	v
List of figures.....	ix
List of tables	x
List of abbreviations	xi
Acknowledgements	xiv
Introduction	1
Chapter 1 TMNs and novelty in global climate governance	14
1.1 The current literature on transnational municipal networks	15
1.1.1 The definitions of TMNs.....	15
1.1.2 The emergence of TMNs in the context of multilevel governance.....	17
1.1.3 The functions of TMNs	19
1.1.4 The effects of TMNs	21
1.1.5 Identified gaps and definition efforts for a new research question	25
1.2 A new research question in global environmental and climate governance.....	28
1.2.1 Definition of the main concepts	28
1.2.2 Research question.....	40
1.3 Concluding remarks	43
Chapter 2 Explaining novelty through networks and complex systems.....	45
2.1 A perspective of networks as structures and actors for the study of novelty.....	46
2.1.1 Two visions of networks	46
2.1.2 Reconciling structure and agency in the network	53
2.1.3 Explaining the emergence of novelty using network theory.....	61
2.2 The embeddedness of networks in a complex system	67
2.2.1 The relevance of complexity approaches	68
2.2.2 Complexity approaches for the study of the TMNs complex system	73
2.3 A system made of networks and organisations.....	81
2.3.1 The relevance of organisational theories.....	81
2.3.2 A few insights from organisational theories	82
2.3.3 The imbrication of network theory, complexity approaches and organisational theories	85
2.4 Hypotheses.....	87

2.4.1 Centrality and diversity	88
2.4.2 Age and organisational resources.....	89
2.4.3 Social learning and evolution.....	91
2.5 Concluding remarks	92
Chapter 3 Analysing novelty and its roots.....	94
3.1 The identification of the TMNs of the complex system	95
3.1.1 The criteria for the selection of the TMNs under study	95
3.1.2 The TMNs of the complex system under study	97
3.2. Data collection	99
3.2.1 Documentary observation and literature survey.....	100
3.2.2 Interviews	105
3.3 Data analysis	108
3.3.1 Social network analysis	109
3.3.2 Cross-case analysis and synthesis	117
3.3.3 Comparative case study.....	118
3.4 Concluding remarks	120
Chapter 4 The novel governance instruments of TMNs.....	122
4.1 Introducing TMNs and their novelty ranking	123
4.1.1 A thirty-year span for the launch date of the selected TMNs	123
4.1.2 The diversity of actors behind the founding and funding of TMNs.....	128
4.1.3 Distinct organisational resources	130
4.1.4 Distinct novelty ranks.....	133
4.2 The governance practices of TMNs.....	137
4.2.1 What TMNs mostly do.....	137
4.2.2 What TMNs mostly do not do.....	144
4.2.3 Some unexpected governance characteristics	146
4.3 Novelty in governance instruments and styles.....	151
4.3.1 The increase and variety of novel TMN governance instruments	152
4.3.2 A novel governance style for new-generation TMNs	156
4.4 Concluding remarks	159
Chapter 5 The roots of novelty	161
5.1 Is your network your net worth? Relational variables and the emergence of novelty	162
5.1.1 Centrality	162
5.1.2 Diversity	167

5.2 A story about time and money? Actor attribute variables and the emergence of novelty.....	175
5.2.1 Organisational age.....	175
5.2.2 Organisational resources	180
5.3 Neither connections nor time and money? Control variables and novelty emergence	185
5.4 Uncovering the causal relationship: a cross-case analysis of the 15 TMNs.....	188
5.4.1 Qualitative data confirming the theory.....	189
5.4.2 Qualitative data specifying the theory.....	201
5.4.3 Some unexplained results.....	208
5.5 Concluding remarks	211
Chapter 6 Interacting to survive	214
6.1 C40 and 100RC: differences, similarities, and synergies	215
6.1.1 The main differences between the two TMNs	216
6.1.2 The main similarities between the two TMNs	219
6.2 Why interact? A common need for interactions	227
6.2.1 The need to survive	228
6.2.2 Different types of resources for various purposes.....	232
6.3 A distinguishing feature: the presence of a governance entrepreneur	238
6.3.1 Defining governance entrepreneurs	238
6.3.2 The significance of governance entrepreneurs in the absence of centrality, diversity, and time?	242
6.4 Concluding remarks: The significance of interactions at different levels	253
Conclusion	256
Why do some TMNs generate more novel governance instruments than others?.....	256
Rival explanations for the emergence of novel TMN governance instruments?.....	259
Change in policy learning and networks.....	259
Multilevel and polycentric governance theories	261
Delegation and orchestration theories.....	264
Contributions of this study.....	265
Limitations of the study and future contributions.....	267
References	270
Appendix A Presentation of interviews.....	289
Appendix B Data collection strategy for missing data.....	291
Appendix C Novel TMN governance instruments.....	293

List of figures

Figure 3.1 Representation of structural diversity in an undirected graph	114
Figure 4.1 Comparative timeline of international climate governance and the TMNs system	126
Figure 4.2 Membership of the 15 selected TMNs	132
Figure 4.3 The distribution of novelties among the 15 TMNs	134
Figure 4.4 Information sharing instruments in the TMNs system.....	138
Figure 4.5 Compulsory and voluntary TMN governance instruments	149
Figure 4.6 Timeline of the launch of the 15 selected TMNs and the production of novelty	155
Figure 5.1 The degree of TMNs according to their novelty ranking in the entire network	163
Figure 5.2 The degree of TMNs in the members subgraph.....	164
Figure 5.3 The degree of TMNs in the partners subgraph.....	165
Figure 5.4 The institutional diversity of TMNs.....	168
Figure 5.5 The novelty scores of TMNs in relation to their structural diversity scores.....	170
Figure 5.6 The novelty scores of TMNs in relation to their substantial diversity scores...	171
Figure 5.7 The novelty scores of TMNs in relation to their institutional diversity scores.	172
Figure 5.8 The novelty scores of TMNs in relation to their topical diversity scores	172
Figure 5.9 The novelty scores of TMNs in relation to their age	176
Figure 5.10 The age of TMNs when generating novelties	179
Figure 5.11 The novelty scores of TMNs in relation to their organisational resources	183
Figure 6.1 The 2018 C40 and 100RC memberships and partnerships Error! Bookmark not defined.	
Figure 6.2 The causal process between interactions and novelty.....	228

List of tables

Table 1.1 An analytical framework for the study of governance instruments 38

Table 3.1 List of the TMNs under study in the TMNs complex system 98

Table 4.1 The 15 selected TMNs..... 124

Table 4.2 Ranking of the 15 identified TMNs in terms of novelty 135

Table 4.3 Summary of the 15 TMNs’ use of the distinct tool governance characteristics. 151

Table 5.1 Degree centrality scores of TMNs in the entire network and in the members and the partners subgraphs 166

Table 5.2 The diversity of members and partners of the 15 selected TMNs in the entire network 173

Table 5.3 The novelty ranking of TMNs according to the number of novelties created per year of life..... 177

Table 5.4 The number of novelties per tool created by each TMN 182

Table 5.5 The organisational resources of the 15 selected TMNs..... 184

Table 5.6 Control variables to explain the rise of novelty..... 186

Table 5.7 The independent and dependent variable scores of ICLEI and CIVITAS 190

Table 5.8 The independent and dependent variable scores of GCCP, MUFPP, and CNCA 195

Table 5.9 The independent and dependent variable scores of Energy Cities and Metropolis 198

Table 5.10 The independent and dependent variable scores of Climate Alliance and Alliance in the Alps 202

Table 5.11 The independent and dependent variable scores of the Covenant of Mayors .. 205

Table 5.12 The independent and dependent variable scores of Eurocities, Polis, and UBC 208

Table 5.13 The independent and dependent variable scores of 100RC and C40 210

List of abbreviations

100RC: 100 Resilient Cities—Pioneered by the Rockefeller Foundation

ACCCRN: Asian Cities Climate Change Resilience Network

AllAlps: Alliance in the Alps

ANT: Actor-Network Theory

C40: C40 Cities Climate Leadership Group

CCP: Cities for Climate Protection

ClimA: Climate Alliance

COP: Conference of the Parties

CNCA: Carbon Neutral Cities Alliance

CoM: Covenant of Mayors for Climate and Energy

EnCit: Energy Cities

EuCit: Eurocities

EU: European Union

GHG: Greenhouse Gas

GCCP: Global Compact Cities Programme

GDP: Growth Domestic Product

ICLEI: ICLEI—Local Governments for Sustainability

IGO: Intergovernmental Organisation

IPCC: Intergovernmental Panel in Climate Change

LGMA: Local Governments and Municipal Authorities

Metrop: Metropolis

MUFPP: Milan Food Urban Policy Pact

NGO: Non-Governmental Organisation

R20: R20-Regions of Climate Action

RMT: Réseaux Municipaux Transnationaux

TMN: Transnational Municipal Network

UBC: Union of Baltic Cities

UN-DESA: United Nations Department of Economic and Social Affairs

UN-Habitat: United Nations Human Settlements Programme

UNFCCC: United Nations Framework Convention on Climate Change

USAID: United States Agency for International Development

A Hervé, Michel et Bulle

Acknowledgements

While expressing my gratitude to all the people that have supported me personally and professionally during the PhD is impossible, I want to mention some who have mattered greatly. I apologise in advance to those I could not acknowledge. I also want to thank the Québec Research Fund on Society and Culture (FRQSC), the Hydro-Québec Institute on the Environment, Development and Society (IHQEDS), and the Faculty of Social Sciences of Laval University for their crucial financial support during my PhD.

I am extremely grateful to my supervisor, Jean-Frédéric Morin, who has gone far beyond what a student might expect from his or her supervisor to help me get to the end of this dissertation. Jean-Frédéric's creativity and scientific rigor have played an undoubtedly crucial role in the strengthening of my project. His support and encouragements to develop my network, gain new skills, and 'punch above my weight' have greatly shaped the researcher I am today. I have been also very lucky to count with the amazing support of Geneviève Cloutier since the beginning of this journey. Geneviève offered me my first research assistant contract, and my first co-authored research article, both of which gave me skills on which I have since counted endlessly. Her optimism and encouragements have often helped me find some lacking confidence.

I would also like to thank the two other members of my committee, Philippe Le Prestre and David Gordon. Philippe Le Prestre has dedicated a gerat deal of time and energy in reviewing the draft chapters of my dissertation. His rigorous and insightful comments have without a doubt strengthened both the content and form of the present research. I am also very grateful to David Gordon, who has accepted to be the external examiner of my committee. David's work has been a great source of inspiration and the conversations we have had have helped me deepen my reflection and arguments on city networks.

Over the years, I have met many people in academic events, several of which have taken some of their time to offer their generous comments. I especially want to thank Hamish van der Ven, Miles Kahler, Charles Roger, Oran Young, Rakhyun Kim, Ina Möller, James Hollway, Kevin Young, Adis Dzebo, Åsa Persson, and Paul Tobin. I have also often benefitted from the comments of members of a network of early career researchers working

on cities and climate governance. My sincere thanks to José Manuel Leal, Anne Bach Nielsen, and Milja Heikkinen for offering their help in reviewing some draft papers on which this dissertation builds.

I have been lucky to receive the assistance of several professors from Laval University. I am particularly grateful to Jean Mercier and Louis Imbeau for taking the time to discuss my project with me and offer some guidance.

Thanks to my supervisor, I was also able to be assisted by Catherine Beaulieu and Jacob Fortier in this dissertation's data collection phase. My special thanks to them for spending countless hours filling large Excel sheets and going through my messy comments and demands. I am also very grateful to all the respondents who have agreed to answer my questions.

I would not have been able to complete this PhD without the support of many friends and family members. I am very grateful to Tom Legler, who encouraged me to start a PhD in the first place. Without Tom, I might have never had the opportunity to write these lines, least of all in Québec. I was extremely lucky to be part of the Research Canada Chair in International Political Economy, where I had incredibly supportive colleagues (Noémie, Mathilde, Véronique, Laurie, and Simon), always ready to read my work, help me move in a new flat, or drag me out of the office when fun and rest were needed. Special thanks to Guillaume and Krystel for so many insightful discussions in the office, the corridor, the cafeteria, the bus, during conferences, coffee breaks, walking, running, or dancing sessions. I also want to thank Philippe Beauregard for great discussions on the philosophy of science, and Audrey Brennan and Marcos Gon for their amazing support in co-chairing the students' association and beyond. I am truly grateful to my parents, sister, brother, and many long-distance friends, among which Carole and Sophie, for continuously listening to or reading my many complaints over the years, encouraging me and believing in me. Last but not least, I want to thank Luis, for following me once again to a new country and new beginnings. For supporting me and helping me in the most stressful times, including a computer crash erasing the penultimate version of this dissertation. For living through the worst and the best with me, and being willing to do it again. I would not have done it without you (and your computer skills).

Introduction

Presenting the problem

Today, slightly more than half of the world's population lives in cities and urban areas.¹ The world's urban population also accounts for around 70% of global greenhouse gas (GHG) emissions (UN-Habitat, 2020). Cities have long been seen as a cause of many environmental issues. Indeed, problems related to urbanisation include soil erosion, biodiversity loss, and high water demands. Besides, many cities have developed in already vulnerable places, such as coastal areas (Bulkeley, 2013). More generally speaking, cities might be where the consequences of climate change will be more severe (IPCC, 2018). For instance, they are more likely to experience deadly heatwaves due to urban heat islands increasing their effects. Projected increases in city population and size will also intensify urban heat islands. Coastal urban areas, which today include most of the world's megacities, are particularly vulnerable to sea level rise (Dawson et al., 2018). Consequences include vast flooding and infrastructure damage. There are obviously differences among cities in terms of environmental impact. Cities vary greatly in terms of economic size and GHG emissions. Some of the largest cities in the world have a growth domestic product (GDP) higher than that of some countries. For instance, the current GDP of New York's metropolitan area is comparable to that of Canada or that of Spain (Florida, 2017). The 100 urban areas that emit the most carbon dioxide represent 18% of the world's carbon footprint, but only contain 11% of its population (Moran et al., 2018). Among the cities of comparable population (i.e. 1.5 to 2 million inhabitants), some rank between 50th and 60th in terms of carbon footprint (e.g. Huhot in China or Denver in the United States), while others rank close to 500th (e.g. Cochin in India or Brasilia in Brazil).

Yet, in the last decades, cities have also started to be perceived as one of the solutions to climate change. For the IPCC, '[u]nless adaptation and mitigation efforts are designed around the need to decarbonize urban societies in the developed world and provide low-carbon

¹ The United Nations Department of Economic and Social Affairs (UN-DESA) maintains that there is no global definition of cities (see United Nations, 2018). While I could set a standard above which cities need to be to be called as such, I choose to use cities as a generic term referring to cities, municipalities, and local governments in general. This enables me to encompass more local entities. As I will discuss later, the member cities included in the networks under study may go from a hundred inhabitants to several million.

solutions to the needs of growing urban populations in developing countries, they will struggle to deliver the pace or scale of change required by 1.5°C-consistent pathways.’ (IPCC, 2018) At the local level, cities have a democratic mandate to address issues affecting them (Bulkeley, 2013). They manage water demand, waste, energy efficiency, and mobility issues. They are also considered laboratories for testing innovative approaches to solving local problems (Bulkeley, 2013; Toly, 2008). Because they concentrate knowledge, and economic and political resources, cities might be where climate policies are most effective. At the global level, some cities appear to be prominent hubs of financial and political resources. Thus, a new paradigm has risen, demanding that cities be considered actors of global climate governance. In many countries, the three most important cities together account for more than 25% of their country’s carbon footprint. For Moran et al., ‘[t]his degree of concentration within countries indicates that, in many cases, local-level governments have jurisdiction over emissions of the same order of magnitude as national governments.’ (2018: 4) The 200 urban areas with the largest carbon footprint include cities from low-emitting countries, such as Senegal or Peru. While these countries might make important climate commitments, better considering their expanding cities remains crucial.

The behaviour of cities towards climate action is all the more important as states have historically had great difficulty coordinating their climate action at the international level. Several international actors and institutions have recently recognised the need to include cities in global climate governance. For instance, the 21st Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) encouraged ‘non-Party stakeholders’ to keep developing their climate action (Hale, 2016). The Intergovernmental Panel on Climate Change (IPCC), through the CitiesIPCC group, organised in 2018 the first Cities and Climate Change Science Conference, gathering scientists and policymakers to discuss the role of cities in climate change and action. Traditionally state-centric, the discipline of International Relations has also acknowledged that states are no longer the only actors that matter in global politics. Drawing from Rosenau, ‘The very notion of "international relations" seems obsolete in the face of an apparent trend in which more and more of the interactions that sustain world politics unfold without the direct involvement of nations or states.’ (1990: 6) There is an increasingly great number of actors acting independently on climate issues across borders without representing a state (i.e.

transnational actors). One example lies in the decision of the U.S. federal government to withdraw from the Paris Agreement, which seems to have encouraged many U.S. nonstate and sub-state actors to pledge to respect the U.S. commitment themselves, through such movements as ‘America’s Pledge’ and ‘We Are Still In’ (America's Pledge, 2017; Bajaj and Thompson, 2017).

This is not to say that cities are the ‘saviours of the planet in the face of climate change’ (van der Heijden, 2019). Rather, the action of cities may add and complement the action of international and nonstate actors for the governing of climate change. Many cities and nonstate actors act through small-scale experiments that generally do not lead directly to GHG emission cuts. However, they may be significant indirectly, through scaling-up operations and the diffusion of new norms (van der Ven et al., 2017; Hoffmann, 2011). This stresses the need for considering cities as crucial actors of climate governance.

While cities may appear in international fora on their own, they are, most of the time, represented by Transnational Municipal Networks (TMNs), which have actively participated in enhancing their visibility. TMNs are structures in which cities discuss and exchange information and good practices, and collaborate on a variety of urban issues. They can also be considered actors promoting the interests of cities at the global level. Acuto and Rayner (2016) maintain there might currently be over 200 city networks (which encompass TMNs) with different forms and goals. TMNs may have a regional (e.g. Asia, or the Baltic sea) or a global focus. Their membership varies as well: the smallest might have around 20 member cities (e.g. Carbon Neutral Cities Alliance); the largest represent thousands of cities (e.g. the Global Covenant of Mayors for Climate and Energy). Some also include some non-city actors as members (e.g. R20-Regions of Climate Action, or R20). They may also focus on distinct issues. For instance, some work on health (e.g. World Health Organisation European Healthy Cities network), or on security (e.g. European Forum for Urban Security). Many others deal with climate change and sustainability; according to Acuto and Rayner (2016), 28% of city networks focus on the environment. Considering that the definition of TMNs used here is more restrictive than that of city networks, I estimate the number of TMNs engaged in climate action today to be around 30 to 40.

While there are overall few TMNs, they represent thousands of cities. In this study, I look at 15 climate-related TMNs which altogether encompass 11,781 cities and local governments from 131 countries. Many of those cities might be small, but the system under study also includes global or capital cities of several million inhabitants (e.g. Beijing, Shanghai, Tokyo, New York, etc.). The 10 largest cities in the world, which amount to more than 230 million inhabitants in total (United Nations, 2018), are part of this system. 81 of the 100 largest cities in the world are part of this system (WorldAtlas, 2018).² These 81 cities represent about 788.7 million inhabitants. Since it also includes 11,700 cities of minor sizes, the system under study represents between 10% and 15% of the world population.

TMNs have emerged progressively in global climate governance since the late 1980s. Discussing the wider global environmental governance context, Bulkeley and collaborators (2003) consider that they differ from traditional forms of representation to which cities and local governments have resorted, including national local government associations that act as membership organisations, and transnational associations that usually act as umbrella organisations for national associations. The authors do not see TMNs as representative because they do not capture the opinion of all local governments. Yet, they ‘provide direct representation from particular groups of local authorities concerned with particular issues and represent an arena for innovation and experimentation on different policy issues.’ (Bulkeley et al., 2003: 236) Member cities often elect their TMN chair (e.g. C40 Cities Climate Leadership Group, or C40). Sometimes, non-city founders or funders choose the TMN chair (e.g. the president of 100 Resilient Cities, or 100RC, was a Rockefeller Foundation employee).

Considering that cities often lack knowledge to pursue climate action, the primary goal of TMNs is to facilitate information sharing among cities. TMNs also diffuse norms on what urban climate action should look like, although some argue these remain embedded in the neoliberal paradigm (Davidson and Gleeson, 2015; Acuto, 2013). TMNs offer cities other benefits as well. Many cities seek to join them for their political and financial resources (Betsill and Bulkeley, 2004). Besides, having connections to other cities and other non-city

² The dataset built in this reference is based on 2016 numbers provided by UN-DESA. The largest city is Tokyo with 38 million inhabitants and the 100th is Kunming, with 3.8 million inhabitants. All the cities considered are thus above 3.8 million inhabitants.

actors is a way for cities to build their social capital and become more attractive to other stakeholders.

Through diverse means, TMNs influence urban climate governance. They can help cities adopt climate strategies (Hakelberg, 2014) or specific adaptation plans (Heikkinen et al., 2020). More generally, they seem to participate in enabling effective local climate action (van der Heijden, 2019). While some question their ability to cut cities' GHG emissions (Bansard et al., 2017), TMNs might have the capacity to shape their ideas as well as their actions (Bulkeley and Newell, 2015). TMNs have their own agendas, which might differ from those of cities (Heikkinen et al., 2019). They might also be able to influence global climate governance. For Hoffmann (2011), this influence is an attempt 'to reframe an issue which is usually considered in global terms within practices and institutions which are circumscribed as local.' (7-8)

Because TMNs influence the climate action of cities and they represent a significant part of the world's population, studying them and their steering practices appears crucial to a more complete understanding of global climate governance. Besides, much work remains to be done regarding research on nonstate and substate actors. This study falls into both categories: it focuses on TMNs as nonstate actors, steering cities, that is, substate actors. We need to understand their role and how they might influence global climate governance.

Because of their unprecedented role, TMNs have had to develop novel practices to steer their member cities. It seems that these governance practices, i.e. finding ways to orient willing cities towards climate action, are what sets TMNs apart. Since joining a TMN is a voluntary commitment of cities, TMNs' member cities are likely already interested in developing climate action.³ In this context, the mission of TMNs might appear as one of preaching to the choir. Yet, we should keep in mind that among TMN member cities are many global cities with high carbon footprints. Because they also represent a large portion of the population, their actions might matter more than that of others. Efforts on their part to curb their emissions and adopt and diffuse climate-friendly norms rapidly are crucial. Accordingly, we

³ For Kern and Bulkeley (2009), TMNs are 'networks of pioneers for pioneers'.

need to identify TMNs' governance techniques to orient the behaviour of those cities in that direction.

It is important to discuss the novelty aspect of these governance techniques. Some, among which TMNs, see cities as laboratories for experimentation and innovation (van der Heijden, 2019). An example lies in Philadelphia's Coolest Block Contest, a 2010 competition supported by public and private actors in which some Philadelphia residents joined forces to win building cooling infrastructures for their blocks' buildings (Bulkeley et al., 2015). Others refute this idea: '[a] common mistake often made in sensationalist reiterations of the 'urban age' mantra is to represent the proactivity of cities today in terms of novelty.' (Acuto and Rayner, 2016: 1155). For instance, while C40 constantly highlights its leadership in urban climate action, most of the solutions it promotes follow the economic status quo built on unlimited growth (Heikkinen et al., 2019) Other researchers stress the innovativeness of TMNs themselves (Román, 2010). The ability of TMNs to generate novelties is the focus of the present study. TMNs started developing novel instruments to steer their members as soon as they emerged. Over time, most have adopted and duplicated the first TMN tools produced, while others have constantly sought to develop new ones. Thus, some TMNs generate more novelties than others, and not all can be considered to have an equal capacity to generate novelties today. Some have acknowledged the inequality of TMNs in terms of innovativeness (Bouteligier, 2013a), but the reasons for this remain unclear, hence this study's research question: why do some TMNs generate more novel governance instruments than others?

Contrary to many other studies on innovation in sustainability (Smith et al., 2010), this study has a non-normative understanding of novelty. It contends that TMNs generate novelties in global climate governance through their practices, as transnational entities generating tools to steer local actors in a global governance system towards climate action. In other words, in this study, I understand novelties as unprecedented arrangements of existing governance characteristics (i.e. governance instruments) generated by TMNs in order to steer their member cities towards climate action. The process of generating novel governance instruments depends first and foremost on structural conditions. The agency of TMNs might play a part in their 'generating' novelties, but this study posits that agency is not the primary driver of TMNs' capacity to generate novelties. In other words, TMNs do not generate

novelties just because they want to. I use the verb 'generate' because it entails the idea of a mechanical or chemical process, that is not necessarily intentional. For the same reason, I often refer to the 'emergence' of novel governance instruments. TMNs generate novelties mostly because their interactions give them access to vast amounts of diverse information, from which they learn, and which leads them to generate novel instruments. The kind of information to which they have access is key in explaining their generating novelties. I posit that being central and having many diverse contacts enables TMNs to have access to this kind of information, and to generate novel governance instruments. Agency is not the primary driver of the emergence of novel governance instruments, yet it is not necessarily absent, as we will see later on.

Some TMNs generate more novelties than others, which does not necessarily make them more effective or efficient. The observation of TMN novelties here is not a way to point to the best governance instruments. Nor is it an attempt to suggest ways to change how we govern cities in the face of climate change. I deem necessary to explain how novelty emerges and why some TMNs generate more novelties than others important because novelty allows for the diversification of governance approaches. Since many scientists emphasise that there is no one-fits-all solution to climate change (IPCC, 2018), and that action must come from a variety of actors in diverse ways, looking at the reasons explaining why some actors generate more novelties than others is pertinent and useful to the study of global climate governance.

Goals of the study

Through this study, I hope to detect the governance characteristics of TMN tools and identify the most and least popular ones. Doing so will help better capture how TMNs intend to steer their member cities and other actors involved in their activities. More specifically, it might allow us to see what they provide their members and compare it to what cities expect to receive when joining a TMN. For instance, do TMNs provide capacity building or funding? Besides, looking at the governance characteristics of TMN tools might help us see whom they seek to influence. It is just some of their members, all of them, or also other actors of global climate governance? Furthermore, many scholars have highlighted the soft governance approach of TMNs. As transnational entities, TMNs cannot coerce their members. Yet, they might still have some authority enabling them to make their members

follow their rules. Do TMNs have compulsory tools? Do they have verification and enforcement mechanisms? How do they make cities follow their direction? Although this research goal is mostly descriptive, it is crucial to understand the action of TMNs regarding their member cities and possibly partners or collaborators.

Simultaneously, I hope to examine how TMNs differ in terms of novelty emergence. I seek to identify which TMNs generate the most novelties and which generate the fewest. In relation to this goal, I want to identify the enabling conditions for the emergence of novel governance instruments. To do so, I will look mostly at relational variables. Indeed, networks are structures of interactions through which information and ideas, which are deemed crucial to the emergence of novelty, flow. Thus, looking at relational variables makes sense when studying networks, even though they have the object of few studies in analyses of TMNs. Drawing a system of climate-related TMNs, I will pay attention to each selected TMN, looking how it is connected to cities and a variety of non-city actors, and directly or indirectly connects them. I will also look at how TMNs are connected among themselves in this system, in order to understand how they share information, collaborate or compete. I will not ignore actor attribute variables, however. More specifically, I will look at time and money as possible drivers of novelty. Older TMNs might have had more time to generate tools. Furthermore, wealthy TMNs, which have a lot of organisational resources, might generate novelties more easily. Several control variables will also be analysed. In addition, I will seek to identify the causal process leading from independent to dependent variable in order to give more strength to this study's demonstration.

Lastly, I hope to offer a dual perspective of TMNs, which sees them as both structures and actors of global climate governance. Like other types of networks (Kahler, 2009), TMNs have often been studied as either structures or actors. Yet, this study posits that seeing them as both might prove fruitful. Envisioning TMNs as structures enables us to pay attention to the composition of their members and partners (who is included and who is excluded) and their interactions (who might interact with whom inside the structure). It helps us capture how information might flow from certain actors to others and how the structure of interactions creates opportunities and constraints. Some actors of the structure, because of their position in the network, may appear more powerful than others. Simultaneously,

envisioning TMNs as actors leads us to look at their interactions with other actors and their strategies to influence them. TMNs are networks of actors as well as they are actors of other networks. As such, it is pertinent to look at how TMNs interact with other TMNs and other actors and how they might seek to influence them and the broader global climate governance system. As stated above, TMNs have agendas of their own. Through the instruments they generate (because of information they receive through their structures of interactions), they might seek to achieve their own goals, which might differ from those of their member cities. By envisioning TMNs as actors, we might better contemplate and understand their agency. Looking at TMNs as both structures and actors therefore enables us to see both how they facilitate interactions, are part of interactions, and use interactions to achieve certain goals. Ultimately, this effort seeks to offer a better understanding of the influence of TMNs in global climate governance.

Hypotheses and possible contributions

This study's research question leads to three hypotheses. First, I posit that the TMNs generating the most novel governance instruments are likely to be central and have diverse contacts in the TMNs complex system. This hypothesis highlights the possible significance of interactions by focusing on two relational variables, i.e. centrality and diversity. I contend that information is crucial to the emergence of novel governance instruments. To generate many novelties, TMNs need to be central (i.e. have many contacts in the system), and have diverse contacts (i.e. contacts other TMNs do not have and contacts of distinct types and who deal with a variety of issues). Second, I posit that the TMNs generating the most novel governance instruments are likely to be among the oldest ones and the ones with most organisational resources. Because this study's measurement of the capacity of TMNs to generate novel instruments is based on a mostly quantitative assessment of the number of novel instruments they generated or quickly adopted, TMNs with more time in the system might have had the opportunity to generate more novelties. Besides, having many resources might facilitate the generation of novel governance instruments. Third, I posit that social learning follows interactions, and precedes the generation or adoption of novel governance instruments, and the evolution of TMNs. This hypothesis seeks to detect the causal process at play between and beyond interactions and the emergence of novelty. Envisioning the

network of TMNs and their members and partners as a complex system, I posit that social learning processes among TMNs, allowed by their interactions, play a fundamental role in the evolution of TMNs. By evolving, TMNs might also enable the adaptation of the system to a constantly changing environment.

As underlined in earlier comments, this study sees TMNs as both structures and actors of global climate governance. It also sees them as entities of a TMNs complex system, in which they and other actors located at distinct levels are interconnected through diverse types of interactions. This system behaves in nonlinear ways and adapts to its evolving environment (i.e. global climate governance, which can also be understood as a system). An ontological position based on complexity implies that we see causes not as general laws, but as possible trajectories or plausible scenarios to be understood in a specific spatial and temporal context. These causes are also complex: they are made of more than one independent variable and are not necessarily linear. In other words, I do not expect centrality on its own or diversity on its own to lead directly to the emergence of novelty. Furthermore, the expected significance of TMN interactions is related to a context in which TMNs have multiplied and developed their contacts with other actors over time. Interactions might not have had the same weight at the end of the 1980s, when TMNs were only starting to emerge and most likely had fewer interactions among themselves and with other actors.

This study intends to offer the following contributions. First, it will identify the interactions of TMNs among themselves and with other actors. Scholars interested in the study of TMNs have mostly looked at them through individual or comparative case studies. Few are those that have examined their relationships with other actors. Observing their interactions might give us a better sense of TMNs as a population. In that context, this research hopes to contribute to new questionings on TMNs. Second, by providing an analysis of TMN governance tools, this study will offer a fine-grained analysis of how TMNs seek to steer their member cities. Some scholars have already paid attention to the governance functions of TMNs. Yet, by looking more closely at the technical arrangements they use to steer their members, we might be able to clarify these functions. These two achievements will thus contribute to the literature on TMNs in global climate governance. Finally, this study might contribute to the literature on governance entrepreneurs by pointing to a new relevant case,

which investigates the involvement of Michael Bloomberg in the C40 network. Doing so, it might also suggest that we need to pay more attention to the role of philanthropic foundations in recent TMNs.

Outline

In that context, Chapter 1 presents the literature on TMNs engaged in global environmental and climate governance. It highlights its development in the last 15 years and points to several areas of interest (i.e. their emergence of TMNs, their role and functions, and their effects). It then focuses on the analysis of their effects, pointing to some confusion regarding the innovativeness of TMNs and their capacity to generate novelties. It then identifies several gaps in the literature. Besides the unresolved question of their capacity to generate novelties, scholars have mostly ignored the analysis of the interactions of TMNs and the diversity of these entities. This leads me to define the most important concepts of this research and to ask a new research question, seeking to explain why some TMNs generate more novel governance instruments than others.

Chapter 2 then presents the theoretical framework of this study. It first argues in favour of an integrated perspective of TMNs, seeing them as both structures and actors of global climate governance. It presents several relevant arguments of network theory which, in this context, appear fruitful, since they might help us explain the emergence of novelty. It then introduces complexity approaches as a supplement to network theory for the study of novelty emergence. Complexity approaches provide a systemic view, which proves useful to this research. The chapter shows how the TMNs system is a complex system, thus enabling the use of complex adaptive system theories. The presence of social learning processes for the evolution of TMNs and the adaptation of the system appears particularly relevant. Then, I add a few insights from organisational theories, which help me integrate some actor attribute variables to the analysis of novelty emergence. The last section of the chapter presents the three hypotheses drawn from the theoretical framework.

The third chapter introduces the methods used for this study. It presents the mixed-methods design elaborated to test the three hypotheses introduced. This design uses a data collection strategy using documentary observation and interviews to gather both dataset and causal

process observations. Furthermore, the design is made of a data analysis process involving social network analysis and a qualitative analysis involving cross-case analysis and a comparative case study. This chapter shows that this mixed-methods design is the most relevant option to test the hypotheses tackling causal relationships and a causal process.

Chapter 4 is the first empirical chapter of this study. It is crucial in that it presents the dependent variable of this study, i.e. the novel governance instruments of TMNs. After presenting some variables which help characterise the 15 TMNs of the system and which will be tested in Chapter 5, it analyses the 535 detected governance tools of TMNs. This enables the characterisation of TMN governance practices, a fundamental step to analyse their novel instruments. It observes the most and least common governance characteristics of TMN governance tools. It also reveals some unexpected characteristics that the literature has mostly ignored. Finally, it presents the novel governance instruments generated by TMNs. It shows there is also novelty in the governance style of new-generation TMNs, even though these TMNs do not generate more novel governance instruments than others.

Chapter 5 then tests the first two hypotheses drawn in this study, which offer causal relationship propositions involving relational and attribute variables. After presenting the results of the social network analysis and the analysis of attribute and control variables, it offers a qualitative cross-case analysis, which looks more closely at each TMN to explain variations in the independent and dependent variables. This leads to the specification of the causal relationships posited. It highlights the presence of a causal relationship between centrality, diversity, and age on the one hand, and the emergence of novel governance instruments on the other hand. It also briefly introduces the causal process at play, but calls for a closer analysis of some TMNs to better understand some seeming inconsistencies.

Chapter 6 seeks to test this study's last hypothesis through a comparative case study of two TMNs (i.e. C40 and 100 Resilient Cities) that have different dependent variable scores, although they appear similar in other variables. It details the causal process identified in Chapter 5, showing the need for interactions of TMNs, and identifies an important difference between the two TMNs, which lies in the presence of a governance entrepreneur in the C40 case. It then studies the profile and strategy of Michael Bloomberg as a governance entrepreneur, and reveals his role in the emergence of novelty in C40. It argues that the

presence of a governance entrepreneur and high organisational resources might also lead to the emergence of novel governance instruments.

Finally, the conclusion of this study answers the research question, and sums up its most important findings. It shows how the theoretical framework built appears to be the most appropriate to answer the research question, considering this study's ontological and epistemological approach. It then highlights the main contributions of this study. Finally, it underlines some limitations that future contributions may consider.

Overall, this study presents an unprecedented analysis of climate-related TMNs as generating novel governance instruments through their interactions with cities and non-city actors. Doing so, it hopes to offer a valuable contribution to the flourishing literature on TMNs in global environmental and climate governance.

Chapter 1 TMNs and novelty in global climate governance

The literature on transnational municipal networks (TMNs) has developed a lot in the last fifteen years. It started by identifying TMNs as a relatively new entity of global governance that was especially visible in environmental issue areas. Part of the literature thus focused on defining this entity. Simultaneously, it sought to present the conditions for the rise of TMNs. Progressively, scholars have looked at their attributes and functions. Furthermore, they have been interested in understanding the effects of TMNs on issues such as climate change and climate governance, at the local and global levels. Their conclusions have been nuanced.

In relation to the effects of TMNs, scholars have also related TMNs to political innovation. While some have identified TMNs as promoters of city innovations, others have detected some products of TMNs as novel themselves. Yet, they have not managed to identify and define where this novelty lies. Although it appears to lack from their discourse or their effects, it might be in their governance practices. It seems that putting cities at the front and steering them transnationally towards climate action, in a neither public nor private, neither local nor international space is novel. It nevertheless remains unclear which specific TMN practices are novel.

Another drawback of the literature on TMNs is that it has failed to note the current diversity of TMNs. There are several definitions of TMNs, but they often stress the same aspects of TMNs, i.e. their voluntary and horizontal nature and the fact that they enable the exchange of information and knowledge among cities. Nevertheless, a preliminary investigation shows that TMNs are nowadays very diverse. Looking at TMNs transversally instead of studying them through case studies might be beneficial to further advances in the literature.

Finally, some point to the need to look at how TMNs interact. Individual case studies have proven useful to define TMNs and their characteristics, but more work is needed to understand the agency of TMNs in global climate governance.

This chapter presents the literature on TMNs. It first defines TMNs and reviews the academic works that have studied them, underlining important discoveries regarding TMNs. Then, it stresses several gaps regarding the study of TMNs, i.e. the understanding of their capacity to

generate novelties, the study of their interactions, and the analysis of their diversity. After defining the most important concepts of this study, it reveals the question on which it focuses, which deals with the novelty associated with TMNs. Doing so, this chapter presents the present study's potential contributions to the literature and introduces the ontology on which it is based.

1.1 The current literature on transnational municipal networks

The review of the literature focuses on the works on TMNs dealing with environmental and climate issues. Nevertheless, it does not ignore the less numerous works on other types of TMNs. The main goal of this survey is to identify the borders of the current knowledge on climate-related TMNs. Favouring works on environmental TMNs thus seems relevant. The literature survey highlights the fact that, over the recent period, scholars have gained an impressive understanding of TMNs. The already rich literature on TMNs has focused on defining them, making sense of their emergence, identifying their functions and internal functioning, and analysing some of their effects in climate governance, either at the local or at the global level. It has mostly done so through individual case studies.

1.1.1 The definitions of TMNs

It seems that students of TMNs have come up with several definitions of this entity of global governance. In a foundational article on TMNs, Bulkeley et al. (2003) first look at TMNs from a local perspective. They distinguish TMNs from local governments associations working at the national level and transnational associations gathering national associations: 'TMNs, in contrast, are networks of municipalities which operate nationally and transnationally, so that TMNs represent and involve cities directly in policy issues at the international and European levels, and across national borders.' (Bulkeley et al., 2003: 236) This broad definition insists on the transnational aspect of TMNs, which contrasts with the traditional view of cities as local actors.

Early works on TMNs also include two articles with an International Relations perspective written in the mid-2000s by Betsill and Bulkeley. In the first one (2004), Betsill and Bulkeley identify TMNs as a type of transnational networks. They emphasise the nation-state bias of epistemic communities and transnational advocacy networks approaches. They show the 'need to move away from viewing the state as the primary target of transnational networks,

toward a more multilevel understanding of governance' (Betsill and Bulkeley, 2004: 490). In another article, they show that regime theory and transnational networks approaches overall offer little help regarding the analysis of TMNs and advocate once again for the use of a multilevel governance approach (Betsill and Bulkeley, 2006). They argue that, instead of simply seeing TMNs as nonstate actors, we should 'view them as multifaceted, having some of the features of nongovernmental, quasi-governmental, and business organizations.' (Betsill and Bulkeley, 2006: 148).

Building on these seminal works, others have sought to define more precisely what TMNs are and do. Kern and Bulkeley (2009) focus on the network aspect of cities' transnational activities. They detect the following TMN characteristics: 1) cities are free to become members and to opt out of the networks; 2) TMNs are self-governed; and 3) member cities implement themselves the decisions of the networks. Kern and Bulkeley's understanding of TMNs is structural. TMNs appear to be a structure in which cities take action. Other works follow this structural understanding of TMNs, underlining their inclusive, voluntary, horizontal and non-hierarchical characteristics (Busch, 2015). Busch uses the voluntary and horizontal aspects of networks to define climate-related TMNs as 'institutionalised spaces where local governments from different countries come together as equitable partners in an exchange on climate change related issues' (2015: 215). The institutionalised characteristic is relevant: as Gordon argues, it is also important to consider the networking of cities without their belonging to specific TMNs (in van der Heijden et al., 2019).

Using a different theoretical perspective (i.e. Actor-Network Theory), Acuto (2013) sees the hybrid character of recent TMNs, that Betsill and Bulkeley (2006) mentioned, as crucial. According to him, TMNs are hybrid governance arrangements made of various components (including city members, private foundations, companies, etc.), which go beyond the individual agency of their members, and influence global climate governance as coherent entities. The literature on TMNs has seldom underlined their hybridity. Yet, as we will see later on, it is crucial to this study, which looks at the interactions of TMNs with city and non-city actors and assumes that both types might influence TMNs and be influenced by them.

Drawing from all these efforts while seeking to focus on the attributes of TMNs and not assume their properties, I define climate-related TMNs, which are the focus of this research,

as, on the one hand, formalised structures of interactions among mostly cities but also non-city actors, and, on the other hand, actors of urban, transnational, and global climate governance, which foster the exchange of information and good practices and and promote the collaboration of cities towards climate action.

Defining what TMNs are has been an important question of the literature. Another one, analysed in the next subsection, deals with the conditions for their emergence.

1.1.2 The emergence of TMNs in the context of multilevel governance

In addition to defining TMNs, many researchers have intended to make sense of their rise using the analytical framework of multilevel governance (Romero-Lankao et al., 2015; Gordon, 2013; Gustavsson et al., 2009; Selin and VanDeveer, 2009; Betsill and Bulkeley, 2006; Davies, 2005). First, regarding the concept of governance, scholars of this line of work seem to agree on a definition drawn from International Relations. Andonova et al. (2009) adapt Rosenau's definition of governance as the 'authoritative steering of social groups towards shared objectives' (2003) by underlining three core elements: the carrying out of public goods; the steering of a determined constituency; and the authority of the actors taking part in it. Multilevel governance approaches then contend that authority and legitimacy, which used to be considered exclusive features of states, have been partly taken up by a multiplicity of nonstate actors, either local, transnational or supranational, public or private (Bulkeley et al., 2003). They claim it is therefore necessary to consider how distinct levels of action and actors interact in this system.

Betsill and Bulkeley (2007), drawing upon Hooghe and Marks (2003; 2001), specify the notion of multilevel governance by distinguishing two types of governance. Type-I highlights the different layers on which governance takes place, but maintains governments as the central authority of the system. By contrast, type-II governance reveals the prominence of networks of both private and public actors that are entangled and tend to behave more horizontally and non-hierarchically. According to Betsill and Bulkeley (2007), type-II governance resembles most the environment in which TMNs have been able to emerge.

The analytical lens of multilevel governance shows that 'Traditional analytical divisions between international and domestic politics, between local, national, and global scales, and

between state and non-state actors no longer suffice.’ (Betsill and Bulkeley, 2006: 154) It thus represents a valuable alternative to regime theory and to most studies on transnational networks which tend to define their object in comparison to the state. Indeed, this relatively recent approach steps away from the dominant state-oriented perspectives of International Relations by defining actors of governance without resorting to the traditional national/international and the public/private dichotomies. Among these actors, TMNs, by enabling cities to obtain authority and influence higher level entities, participate in shaping their environment.

Scholars first developed the concept of multilevel governance to describe the architecture of the European Union (Jänicke, 2017; Hooghe and Marks, 2001). This facilitating context for the decentralisation and deconcentration of power, has enabled the greater climate activism of cities and consequently the emergence of collaborative initiatives such as TMNs (Giest and Howlett, 2013; Labaeye and Sauer, 2013; Kern and Bulkeley, 2009). Analyses focusing on the European space and institutional setting thus often see TMNs as a by-product of European multilevel governance (Mocca, 2017). Similarly, Kern (2019) argues that cities are now embedded in European multilevel governance. This polycentric governance system combines horizontal, vertical, and hierarchical upscaling that involves both pioneer and laggard cities in environmental and climate action.

Simultaneously, some authors have added to this perspective a structural understanding of networks. Transnational networks such as TMNs connect local actors to public, private, local and transnational partners, in contrast to international actors (Lee, 2013). Once again, the traditional distinctions between actors are blurred. The network governance concept (Khan, 2013) has been useful to understand the role of TMNs. For instance, Juhola and Westerhoff (2011) emphasise the interplay of networks and formal institutions in adaptation governance. Overall, the ability of TMNs to durably connect distinct resources would facilitate the successful political engagement of cities (James and Verrest, 2015). Focusing on partnerships as a category encompassing TMNs, some authors argue that they represent a new kind of governance, that is more decentralised and voluntary, less compulsory, and that implies more interactions between public and private actors, compared to the old governance model based on a more traditional way to steer its members (Bäckstrand, 2008: 74-75).

All these studies seem to focus on structures, either of TMNs themselves or of the system in which TMNs are embedded. They facilitate our understanding of how TMNs have come to be and already give us information as to the internal functioning of these entities. The following subsection tackles another crucial concern of the literature on TMNs, i.e. their functions.

1.1.3 The functions of TMNs

To gain a better understanding of TMNs, scholars have also focused on their role and functions in global environmental and climate governance, as well as on their inner functioning, trying to understand, for instance, how they attract cities.

Regarding the role of TMNs, some have identified three governance functions TMNs might have for cities (Bulkeley and Newell, 2015; Andonova et al., 2009): information sharing, capacity building, and rule-setting.⁴ Other authors claim TMNs act as platforms, consultants, commitment brokers and city advocates (Busch, 2015). As platforms, they enable the diffusion of information among cities. As consultants, they offer cities their services for the strengthening of urban climate action. As commitment brokers, they help cities commit to more ambitious mitigation and adaptation goals. Finally, as city advocates, they voice cities' concerns and protect their interests in the global arena.

TMNs might also be intermediaries in orchestration processes directed by intergovernmental organisations (IGOs), private foundations, or else (Gordon and Johnson, 2017; Hale and Roger, 2014). As intermediaries, they might have agency and influence over cities. Pattberg (2010) also sees TMNs as intermediaries, but he ignores their possible agency. He indeed considers TMNs to be policy instruments cities create as autonomous actors to share best practices and information and eventually reduce their greenhouse gas emissions independently from states. Similarly, others see the Covenant of Mayors, a TMN created by the European Commission to enhance European cities' climate action, as a tool for transnational climate governance (Dolšak and Prakash, 2017), or as transnational environmental regulation (Heyvaert, 2013).

⁴ A recently published article presents five governance functions based on the case of 100 Resilient Cities (see Papin, 2019).

As implied above, TMNs are also considered by some as agents of global climate governance (Gordon, 2019), capable of influencing cities but also other actors interested in climate action. In this agency-focused understanding of TMNs, it appears that recent TMNs might be more strategic regarding the cities they accept (Davidson et al., 2019). Indeed, while some TMNs are open to all, others are restrictive and only accept certain cities (Haupt and Coppola, 2019). The membership bias favouring some cities over others may be related to the need of TMNs to promote positive outcomes in order to attract more funding (Bellinson, 2018). This line of works seems to envision TMNs as organisations, and ultimately agents, rather than as structures. It offers different questions regarding the functioning of TMNs, e.g. who chooses who is included in and who is excluded from the network? The answer might be in previously mentioned works on the orchestration of urban climate action through TMNs.

Several researchers have also sought to account for the functioning of TMNs as network structures. For instance, Lee and van de Meene (2012) have shown that, in the C40, cities learn best practices thanks to the presence of a variety of stakeholders governing the network, some important cultural similarities linking cities together, and the presence of some member cities already leaders in local climate policy, thus diffusing practices with higher levels of performance. Here again lies the idea of membership bias in TMNs.

Several scholars have wondered how TMNs attract cities, or why cities join TMNs. They argue that cities have built these network arrangements to learn from each other and attract a variety of valuable partners to develop and implement projects (Bouteligier, 2014). TMNs provide cities with material and financial resources, but also attract members by producing and sharing information, knowledge and norms (Betsill and Bulkeley, 2006; 2004). For Krause (2011), resources and diffusion between cities are factors of participation of cities in TMNs. Being a member of other TMNs might also increase a city's participation in a TMN (Lee, 2018).

We already saw the bias of TMNs regarding which cities to include and exclude. Another bias lies inside the network regarding the allocation of TMN resources. Who gets what and how in TMNs usually depends on cities' attributes and position in the network (Kern and Bulkeley, 2009). Although horizontality and flatness are supposedly characteristics of their network structure, TMNs do display some forms of hierarchy. The North South divide might

remain visible in TMN memberships (Bouteligier, 2013b). The reasons might be structural. Yet, they might also be linked to strategic TMN decisions.

Overall, research on the role and functioning of TMNs shows that scholars have studied TMNs through structural and agency-centred perspectives to understand what they do and how. The next subsection underlines the fact that the literature has also sought to understand what influence they might have on global environmental and climate governance.

1.1.4 The effects of TMNs

A quite fruitful part of the literature has wondered about the effects of TMNs on environmental and climate governance. Some assume that TMNs, as networks, are effective and efficient: ‘Networks are expected to be efficient and effective forms of governance, and networking is therefore presented as the essential basis of successful political engagement.’ (James and Verrest, 2015: 66) Yet, students of TMNs seem to have mixed opinions on that matter. The next paragraphs address TMN effects in terms of mitigation and adaptation to climate change and in terms of innovation, generally understood as novel climate action.

1.1.4.1 The effects of TMNs on climate change

Although TMNs seem to hold a promising potential for mitigation and adaptation to climate change, some scholars warn us that they do not suffice to climate governance. The main reasons for their shortcomings are mainly their voluntary nature and limited resources. Because they are voluntary, they cannot use coercive instruments to change the behaviour of their members. They cannot sanction them either in case they do not comply with the collectively established rules (Hickmann, 2015). They also often lack third-party verification mechanisms guaranteeing that members are respecting their commitments. In that sense, they might be considered pseudo-clubs: although they pretend to offer their members specific benefits, their low entry cost and lack of enforcement mechanisms cause them to have low benefits (Green, 2017b). Another drawback of TMNs lies in their financial capacity. Even though some collect membership fees, most TMNs need to obtain external funding to achieve their actions, usually from states and IGOs. They are thus not a viable alternative to international governance (Hickmann, 2015). Moreover, several scholars question their legitimacy. TMNs contrast with traditional associations of municipalities as they lack representativeness. Besides, they are not democratically responsible for their actions

(Bulkeley et al., 2003). However, they actively take decisions and produce norms that directly impact city members and their populations. Eventually, this might lead to a restraining of the capacity of TMNs to act.

Because of their limited resources and voluntary nature, TMNs tend to recur to softer strategies than do international actors (Bulkeley and Newell, 2015). To govern internally, they give information, fund projects and ensure cooperation, and create and apply certification schemes. Externally, they influence the international community, work with other TMNs and produce some interdependence between them, and serve as intermediary between city members and broader policy networks (Kern and Bulkeley, 2009). This leads some authors to discuss the direct effects of TMNs on climate mitigation, regarding which they remain sceptical. After conducting an empirical study based on sixteen climate-related TMNs, Bansard et al. (2017) conclude that TMNs are unlikely to be a substitute to the mitigation work of the United Nations Framework Convention on Climate Change (UNFCCC). Similarly, Heikkinen et al. (2019) show that most C40 cities' proposed measures actually support the status quo while very few are transformational. For Tosun and Leopold (2019), climate-related TMNs seem to have limited effects on the adoption and implementation of water policy initiatives.

Yet, other scholars argue that we should look at non-quantitative measurements for assessing the effectiveness of TMNs and other nonstate actors. Looking at the transformative potential of subnational and nonstate actors might help better evaluate their effects in global climate governance. This implies looking at the scaling and entrenchment potential of their initiatives (van der Ven et al., 2017). There are indeed several indirect pathways to transformation to consider when looking at the actions of TMNs and their effects on the 1.5°C target (Gordon and Johnson, 2018). Other scholars echo the call for more attention to scaling-up, scaling-out or horizontal network initiatives (Kern, 2019; Smeds and Acuto, 2018).

It is important to note that the effects of TMNs on climate change might vary across TMNs. Some TMNs are very active, while others are more passive. The lack of action might actually harm their survival (Lee and Jung, 2018). The increasing number of TMNs in global climate governance, but also in other spheres of the global realm, threatens the survival of the weakest

ones. Resources (e.g. funding or contacts) are limited. The lack thereof may also affect the survival of TMNs (Acuto et al., 2017).

1.1.4.2 The effects of TMNs in terms of innovative climate action

Many scholars and practitioners link TMNs to the concept of innovation. Yet, they have different understandings of this concept. TMNs often appear to promote and facilitate the innovations of cities understood as new climate policies and instruments. They are also sources of innovation per se. TMNs seem to generate novel practices in global climate governance.

Some researchers have underlined the role of TMNs in promoting and encouraging local climate action (Busch et al., 2018; Rashidi and Patt, 2018; Busch, 2015; Reckien et al., 2015; Hakelberg, 2014). For Busch et al. (2018), TMNs might enable internal mobilisation, help formulate mitigation goals and institutionalise climate plans, facilitate exchange and offer support.

Besides, scholars have described TMNs as an intermediate variable between global cities and climate action (Bulkeley and Schroeder, 2008). Global cities are more likely to join TMNs and consequently to develop climate actions (Lee, 2015; 2013). Moreover, studies have shown how TMNs advance cities' technical and normative innovations (Toly, 2008).

Furthermore, several authors argue that besides diffusing local innovations, TMNs might themselves be a source of innovation. In that sense, Bouteligier (2013a) focuses on the ways in which TMNs follow and depart from conventional practices of environmental governance. By diffusing information and knowledge on sustainability, TMNs would facilitate socio-ecological transitions (Labaeye and Sauer, 2013). They might also define climate-related concepts, such as that of carbon neutral cities (Tozer and Klenk, 2019). They may also finance and sponsor governance innovations in the transnational regime complex for climate change (Abbott, 2013).

In addition, TMNs are examples of new experiments in global climate governance, choosing ways to govern climate change that are different from those of the multilateral system (Hoffmann, 2011). Entering a state-centred space and claiming they must participate in climate governance, they question the norms regarding who governs and how (Gordon,

2013). This leads to rethinking the classical distinction between the local, the national and the international, and strengthening multilevel governance. By including private actors in collaboration with mayors, TMNs also blur the separation between public and private. C40's partnership with Arup has thus led the multinational company to assist various cities in designing climate projects. Moreover, thanks to the collaboration of Arup and the Rockefeller Foundation, cities of the 100RC initiative have access to a technical tool called the City Resilience Framework. Their ignoring traditional borders helps them offer new political geographies in which cities are part of the transnational level (Bouteligier, 2013a).

Combining institutional and market-based elements in their actions, TMNs generate a new system of governance from the middle (Román, 2010). Neither international nor local, neither public nor private, TMNs seem to govern cities in an in-between space. For Acuto and Rayner (2016), this is at least true for a new generation of TMNs that pushes for public-private governance arrangements and cooperation among subnational actors. Here, we see once again the agency of TMNs, which are not just structures, but also increasingly important agents of climate governance. Despite these insightful analyses, we still lack details on the type of change they offer and its impact on how we manage climate issues. For Gordon (2018), we should also look more in depth at the political contestation driven by cities and TMNs. Some also argue we should make a distinction between innovations in governance and governance of innovations (Bellinson and Chu, 2019). Innovations in governance include the TMN governance functions mentioned above (especially information sharing and capacity building). Governance of innovations is led at the city level, and is related to the internal institutionalisation of TMN outputs. It thus does not tell us about the innovations generated by TMNs. Neither do innovations in governance, as they are too broadly described to enable us to clearly distinguish what is so novel about TMN outputs.

Finally, we should underline the fact that several scholars question the innovativeness of TMNs. For instance, the rise of a hybrid form of governance illustrated above could create a new lock-in (Acuto and Rayner, 2016). Besides, even if TMNs promote change, they ultimately need states to facilitate it, as they lack resources to do so on their own (Hickmann, 2015). Others refute the change of discourse they pretend to offer (Davidson and Gleeson, 2015). While enabling the rise of subnational climate governance arrangements, TMNs

maintain some neoliberal roots (Acuto, 2013). Although they promote the actions of cities in the face of the inaction of states, TMNs, like state actors, advocate for actions maintaining the status quo rather than enforcing transformation. In addition, Kern and Bulkeley (2009) argue that TMNs often do not change the behaviour of those cities that are less active in climate governance and thus remain ‘networks of pioneers for pioneers’ (see also Kern and Alber, 2008). As for TMNs focusing on adaptation, some wonder to what extent they can lead to innovation in adaptation governance at the local level (Busch, 2015; Fünfgeld, 2015).

All in all, the review of the literature on TMNs shows the variety of questions raised by scholars regarding these relatively new entities of global environmental and climate governance. It also points to several gaps that need to be filled. Examining these gaps more precisely will help us underline important issues in the study of TMNs, and raise a relevant research question in Section 1.2. In that context, the next subsection furthers the analysis of these gaps to show how we might advance our understanding of TMNs.

1.1.5 Identified gaps and definition efforts for a new research question

Although it has developed a lot in the past fifteen years, the literature on TMNs comprises a few gaps that we need to fill, especially regarding the conceptualisation of innovation, the study of interactions, and a better consideration of the diversity of TMNs. The following paragraphs present these gaps. This is a necessary step to introduce the research question on which this study builds.

1.1.5.1 The innovation in and of TMNs

The concept of innovation in city-related climate governance has been widely used, both at the local (Burch et al., 2018; Hughes et al., 2018; Bulkeley et al., 2015; Hakelberg, 2014; Anguelovski and Carmin, 2011; Toly, 2008; Rabe, 2007) and global levels (Acuto and Rayner, 2016; Bouteligier, 2013a; Gordon, 2013; Román, 2010). However, there seems to be some confusion regarding the source, the nature, and the definition of innovation in studies of TMNs, but also, more generally speaking, in the field of global climate governance. Regarding the source, we may wonder if TMNs are innovative because they bring the novelties of cities to the global arena (Toly, 2008), in which case they would be an intermediary variable for the emergence of novelty. It might also be that they are a source of innovation per se (Acuto and Rayner, 2016; Bouteligier, 2013a; Gordon, 2013; Román,

2010). If this is true, we need to understand where this innovation comes from, and how TMNs manage to produce innovations. We also need to identify the kind of innovation they generate.

Regarding the nature of their innovation, a relevant question relates to whether what makes TMNs innovative is their status of new actors in global governance (Bouteligier, 2013a). Another question is related to whether their practice of governance differs from that of other actors of global climate governance (Gordon, 2013; Román, 2010). They could also innovate in the discourse and the norms they produce (Betsill and Bulkeley, 2004) or in their effects on climate mitigation and adaptation. For now, scholars are being critical about the effects of TMNs on mitigation and adaptation. But their novelty might lie in the indirect and catalytic impact of their action and that of other subnational initiatives on climate governance (Bernstein and Hoffmann, 2018; van der Ven et al., 2017).

The concept of innovation lacks a clear definition in the context of TMNs and global climate governance. Scholarly analyses of innovation in TMN studies often fail to define what they mean by innovation. They might refer to an incremental or to a transformational change in their area of investigation (e.g. Heikkinen et al., 2019). They might also discuss the first implementation of a specific policy in a specific constituency, using the public policy definition of innovation, or a completely new political arrangement (Berry and Berry, 2007; Walker, 1969).

The above comments show that the concept and application of innovation have been ill-defined in the study of TMNs and global climate governance. It is important to clarify what innovation means to see if it applies to TMNs. Ultimately, fulfilling this task will help us assess the effects of these entities on global climate governance.

1.1.5.2 The study of the interactions of TMNs

Another gap of the literature is related to the lack of studies on the interactions of TMNs. The review of literature shows that most studies have focused on observations of different TMNs independently (Bansard et al., 2017). This suggests that there is a paucity of research that compares TMNs and also that studies their interactions (Gordon, in van der Heijden et al., 2019; Busch, 2015; Keiner and Kim, 2007). Some scholars also point to the need for more expert interviews in order to better understand the formal and informal interactions of TMNs

(Haupt and Coppola, 2019). As mentioned above, studies on TMNs have concentrated on the conditions for their rise, their role and functioning, and their effects. They have done so mostly through individual case studies. There have been few empirical analyses of the interactions of TMNs that may explain how their relations influence climate governance. In an increasingly complex world, in which many issues that are themselves deeply linked also reveal the great interdependence of actors, regimes and actors' initiatives overlap, especially in the climate field (Abbott, 2013; 2012; Hoffmann, 2011), and resources are limited (Abbott et al., 2016b), we must pay attention to these interactions. Their repercussions may indeed be significant.

In relation to the lack of interest in the interactions of TMNs, the literature review suggests that there have been few empirical studies using social network analysis across TMNs. A few scholars have used social network analysis in studies on one or several TMN (e.g. Bansard et al., 2017; Lee and van de Meene, 2012). In similar studies, others have referred to actor-network theory (e.g. Acuto, 2013). Nevertheless, the literature on TMNs still lacks studies using complexity science methods (e.g. social network analysis or agent-based modelling) that may give us a better sense of how TMNs interact among themselves and with other actors. Overall, although these approaches facilitate the study of interactions, scholars have seldom applied complexity approaches in studies on TMNs, or global climate governance in general.⁵ This research seeks to fill this gap of the literature by using network theory and complexity approaches in the study of TMNs in global climate governance. Furthermore, one of this study's hypotheses will be tested using social network analysis. Theoretically, network theory and complexity approaches will help us understand the effects of the interactions of TMNs. Methodologically, social network analysis will facilitate the measuring of the significance of these interactions on the emergence of novelty.

1.1.5.3 The diversity of TMNs⁶

Finally, the review of the literature points to a gap in the study of the diversity of TMNs. As argued above, many studies on TMNs have used a multilevel governance theoretical framework. Yet, scholars primarily developed in studies on TMNs to analyse European

⁵ A few exceptions using or referring to complexity approaches include Bernstein and Hoffmann (2018), Hoffmann (2011), and Pattberg and Widerberg (2019).

⁶ This paragraph largely draws on a recently revised and resubmitted paper (Nielsen and Papin, 2020).

TMNs. Generalising that context to other environments is problematic. European TMNs might have the attributes mentioned above (i.e. voluntary, self-governed, and self-execution of decisions by cities) because of the European multilevel governance conditions. Several European TMNs, e.g. Eurocities, Energy Cities or Climate Alliance, work close to the European institutions and lobby to protect their members' interests and make their voices heard by the EU (Kern and Bulkeley, 2009). Non-European or global TMNs are unlikely to be embedded in as strong governance arrangements. Furthermore, the attributes mentioned earlier might apply mostly to older TMNs, which are the ones the multilevel governance literature first studied (here again, examples include Energy Cities and Climate Alliance). With the evolution of global environmental and climate governance, recent TMNs may differ in their functioning and purposes from those created in the 1990s, and abide by different rules.

To analyse the differences that might exist among TMNs, going beyond individual case studies, and conducting more comparative case study and cross-case analyses appear to be crucial tasks. A few scholars have started to work in this direction (Bansard et al., 2017; Bouteligier, 2013a), but more efforts are needed.

To sum up this subsection, reviewing the literature has enabled us to detect and present some gaps. Building on these, the next section defines the main concepts of the current study and presents its research question.

1.2 A new research question in global environmental and climate governance

The literature review has underlined the advances of the studies on TMNs in global environmental and climate governance. Several gaps remain and reveal a contradiction between theory and the world we seek to explain and understand. Reflecting on this contradiction, this section defines this study's main concepts and introduces its research question.

1.2.1 Definition of the main concepts

Several crucial concepts appear in the literature review. The next paragraphs identify them and clarify their meaning in the context of the present study.

1.2.1.1 TMNs and city networks

As mentioned above, this study defines climate-related TMNs as, on the one hand, formalised structures of interactions among mostly cities but also non-city actors, and, on the other hand, actors of urban, transnational, and global climate governance, which foster the exchange of information and good practices and promote the collaboration of cities towards climate action. I here consider TMNs to be formal, in that they have a staff and a functioning website. They also often have a list of members constituting the network. Also, because they are transnational, they have members from different countries.

I see TMNs as a subcategory of city networks. City networks encompass all networks dedicated to cities and to which cities are members. Contrary to TMNs as envisioned here, city networks are not necessarily institutionalised (i.e. they can be the result of informal yet recurrent relationships among three or more cities). Neither do they necessarily cross borders. The U.S. Conference of Mayors or the Federation of Canadian Municipalities are examples of national city networks.

Although this research sometimes refers to city networks in general, it focuses on the subcategory of TMNs.

1.2.1.2 Novelty

This study sees the novel governance instruments of TMNs as the novelty emerging out of TMNs. It is therefore crucial to define the concept of novelty. Although the transformation of global climate governance has been a common theme over the last decade, it appears that scholars have not fully captured novelty in global climate governance. While they have mostly focused on the concept of innovation, they have associated it with related concepts. This makes it harder to understand what makes innovation different from invention, experimentation, diffusion, and evaluation. The following paragraphs go through the bodies of literature on public policy, global governance, and climate governance to look at how they have conceptualised innovation. Building on these efforts, I then provide a definition of novelty as one of the central concepts of this study.

One way to look at innovation, often used in global governance studies, is in opposition to traditional governance practices (Hale and Held, 2012). Yet, this perspective only provides a negative definition of innovation, and fails to identify its substance. Other studies of

international politics tend to associate new policies with new problems (Hollway et al., 2020). While climate change is not a traditional concern of global governance, we can hardly see it as a new problem. Indeed, global climate governance emerged about thirty years ago.

Turning to policy studies is useful. Since the present study identifies the novelty of TMNs in their governance instruments, it is especially relevant here. Those most often relate innovation to invention, diffusion or evaluation (Jordan and Huitema, 2014). For instance, Sørensen and Torfing define innovation as an ‘intentional and proactive process that involves the generation, practical adoption, and spread of new and creative ideas which aim to produce a qualitative change in a specific context’ (2011: 849, cited Bellinson and Chu, 2019: 78; see also Hughes et al., 2018). Here, authors clearly relate innovation to invention and diffusion. In other research, they study innovation as experimentation (Hoffmann, 2011).

Even though scholars often associate innovation to invention, we can distinguish the two concepts. The former intends to improve a way to do things whereas the latter makes up something completely new (Padgett and McLean, 2006; Rogers, 2003). Similarly, Powell argues that:

‘innovation represents spillover from adjacent domains, the bringing together of familiar practices, concepts, and ideas from proximate social worlds. This is an interstitial process in which previously known elements are recombined. By bringing these formerly separate ideas together, existing ways of doing things are improved. In contrast, invention represents transposition across distant social and economic worlds.’ (2017: 291)

In the invention process, creators play and experiment in order to make discoveries (Jordan and Huitema, 2014). The concepts of innovation and experimentation are strongly related. Innovation can be a product of experimenting, i.e. when an experiment succeeds, invention or innovation arises. There can also be innovation in the experimentation process, that is, in the way actors conduct their experimentations and not necessarily in their outcomes (Kivimaa et al., 2015). Innovation may thus lie in the unprecedented configuring of entities and ideas for the production of desired governance outcomes (Voß, 2007). Regarding climate action, experimentation implies innovation and trial and error in attempts that differ from traditional ways to mitigate or adapt to climate change (Hoffmann, 2011).

After some time, during which other actors recognise the innovation as such, it spreads through diffusion. Some scholars of policy studies maintain that this process is more relevant than that of the invention of a policy in one place. They see innovation as the first time a policy is implemented on a given territory, not as an absolutely new arrangement (Walker, 1969). Following this idea, some argue that an innovative policy is only significant depending on the number of jurisdictions that choose to implement it for the first time (Jordan and Huitema, 2014). Likewise, analysing the influence of TMNs, some talk about a ‘governance by diffusion’ to account for TMN strategies to steer members towards the adoption of climate plans by accelerating processes of dissemination of uncoordinated local policies (Hakelberg, 2014).

Finally, students of public policy often associate innovation with evaluation (Jordan and Huitema, 2014). They argue that we can only observe innovation after a thorough evaluation that assesses the disruptive effects of the policy. The evaluation process can also contain innovation.

This brief survey suggests that we can understand innovation either as a process of invention, experimentation, diffusion or evaluation, or as a result of this process. I nonetheless argue that we can analytically separate innovation from the previously mentioned similar concepts. As a process, it entails observing, selecting and arranging existing elements into a new composition. As a result of this process, innovation is a product that is considered novel at a specific time, i.e. when the arrangement has emerged and is acknowledged, but it has not yet disseminated and won over other similar innovations as the new dominant way to do something (in other words, when it has reached the point of diffusion).

This research aims to understand what instruments, as tangible and observable outputs, TMNs generate, and how they might impact global climate governance. It thus focuses on the result meaning of innovation, as an unprecedented arrangement of existing elements aimed at fulfilling a specific goal, in a specific context, before being diffused in the system or to other systems. This definition is closer to the notion of invention than to that of diffusion. However, it underscores the idea that an innovation mostly results from other previous innovations that have diffused. It is usually not the unique masterpiece of a genius who created it on his or her own (Padgett and McLean, 2006). I perceive innovation as a

product occurring after invention and experimentation, and before diffusion and evaluation. It does not seem to have been studied much in the context of global climate governance. Nevertheless, it appears more likely than invention. In the system of global climate governance, in which most elements are interconnected and exchange information, inventions, i.e. unprecedented products consisting of completely new elements, seem indeed unlikely.

The concept of innovation is normatively charged (Smith et al., 2010); it is most often used to describe a positive outcome, or a ‘white novelty’ (Frigotto, 2018). By studying the novel arrangements emerging in TMNs, I do not seek to imply that TMNs necessarily have a ‘good’ impact on global climate governance, hence the inadequacy of the concept of innovation. Using a slightly different concept might lessen the normative value. A concept close to that of innovation as understood here is that of novelty. In International Relations, some identify the emergence of novel ideas as ‘when a set of ideational elements are yoked together and through the re-establishing of boundaries the idea is either recast, renewed or revolutionised’ (Carstensen, 2015). Others consider legal clauses to be novel to a regime complex understood as a system ‘when they are introduced to that system for the first time’ (Hollway et al., 2020: 62). In technology studies, novelty emerges out of the origination or combination or refinement of previous technologies (Strumsky and Lobo, 2015). There are thus several degrees of novelty. Novelty is close to invention, which, as argued earlier, is close to innovation. Although this might not be true for technology studies, it seems that the broader concept of novelty includes both the positive and negative consequences of new objects, processes or structures (Frigotto, 2018). In ecology for instance, the emergence of novel ecosystems due to environmental change is often resisted, as it might be harmful to humans and other species (Rissman et al., 2018). This also shows that the generation of novelty can be intentional, but it may also result from unplanned actions or interactions.

Building on definitions of innovation and novelty, this study understands novelty as an unprecedented arrangement of existing elements that accomplishes a specific function, in a specific context, before being diffused in the system or towards other systems.

It is worth noting that the capacity to create novelty contrasts with isomorphism, the constraint to resemble other organisations to gain efficiency and legitimacy in a crowded

environment (DiMaggio and Powell, 1983). Isomorphism is a form of homogenisation, a broader concept standing for the trend of organisations to increasingly look alike. The literature on organisations also underlines that an organisation that seeks to be the same as others to have legitimacy may also seek to differentiate itself from them to have a competitive advantage (Tan et al., 2013). Besides, in their quest to resemble others, some generate novelties. TMNs might manage to differentiate themselves from others to survive in a world with limited resources. Generating novelty and trying to resemble others are seemingly opposite goals, yet they might both be pursued sometimes. In other words, TMNs might adopt the same institutional structure considering the value of a network, but they may simultaneously seek to act differently by seeking to generate novel tools.

We now need to examine the concept of governance instruments, which this research sees as the tangible novelties TMNs generate.

1.2.1.3 Governance instruments⁷

The review of the literature tends to underline that what distinguishes TMNs from other actors of global climate governance are their practices. Therefore, this study looks at novelty in the instruments TMNs generate to steer their members in global climate governance. To define and analyse governance instruments, it draws on the public policy literature studying change (Peters and Pierre, 2015; Hussein and Le Galès, 2010; Eliadis et al., 2005; Lascoumes, 2007; Lascoumes and Le Galès, 2004; Hood, 1986), which generally sees instruments as devices enabling the implementation of a policy. It also draws on International Relations works defining global governance as a system of rules seeking to steer the global population towards the pursuit of public goals (Andonova et al., 2009; Rosenau, 2003; 1995).

Studying the governance instruments of TMNs as evidences of novelty is useful on several grounds. Public policy studies have used the analysis of instruments as a way to observe change for some time. They see instruments as signs of processes of political change (Lascoumes and Le Galès, 2004). As they are often coded, explained or made explicit by the governors on their targets, it might be easier to observe instruments than implicit, intrinsic practices such as some kinds of internal norms. Thus, this kind of analysis might facilitate the observation of change in governance practices. Furthermore, ‘the real politics only begins

⁷ The following paragraphs largely draw from a recently published article (see Papin, 2019).

when it comes to the choice of implements.’ (Hood, 1986: 137) Instruments are never just neutral technical devices. On the contrary, they always have a normative dimension (Voß and Simons, 2014; Lascoumes, 2007; Lascoumes and Le Galès, 2004). They indeed bear representations and meanings constructed by the authority, influenced by the authority’s goals, and its population and environment. Therefore, analysing the choice of instruments helps better understand both the authority and the constituency. More specifically, in this research, analysing the novelty of TMN governance instruments may give us insights into the changes in the ways TMNs seek to steer the behaviour of cities regarding climate action. Studying these instruments also reaffirms the nature of TMNs as actors that may influence others. It may also deepen our understanding of the ways in which cities aim to conduct climate actions, as they themselves influence the practices of TMNs. The study of instruments may overall be promising to understand the goals and prospects of the role of TMNs for global climate governance.

We should note that TMNs are not traditional actors of global policy. For some, they are in fact not actors, but instruments (Pattberg, 2010). By the same token, cities are not the usual target of global policy. Furthermore, this study envisions TMNs as hybrid rather than public entities.⁸ Yet, using the public policy literature remains relevant. First, as Hood (1986) argues, a variety of private actors might take over governmental tools. Secondly, facing the increasing complexity of climate governance, I follow Peters in arguing that we need to broaden our object of study by going beyond the public actor and its target to include a diversity of agents and principals (in Eliadis et al., 2005; see also Auld et al., 2014). Consequently, it is relevant to use the public policy literature to analyse tools created by non-public actors who have similar goals of steering a population towards certain goals. I deem necessary to focus on governance instruments rather than on policy instruments, however. Indeed, the concept of policy, traditionally used to describe the instruments created by governors on their population, involves the idea of an authority launching a precise set of actions. Nevertheless, the idea of governance is broader and opens the door to more actions that may be implemented to steer a constituency towards realising public goods, not

⁸ The question of the hybridity of TMNs is source of debate. Several authors see TMNs as belonging to public governance (Biermann et al., 2010; Andonova et al., 2009; Bäckstrand, 2008). Because this study sees TMNs as networks of cities but also various non-city public and private actors working at different levels, it sees TMNs as hybrid (see also Nielsen and Papin, 2020).

necessarily forming a coherent series, as should be the case in a policy. Besides, although the public policy literature appears relevant to the analysis of TMN tools, the use of the policy concept is reserved to initiatives launched by public authorities. To avoid confusion, I therefore find best to use the concept of governance in the analysis of instruments.

Considering these comments, I define governance instruments as political, social or technical arrangements that an authority uses to steer its population towards achieving, developing, or managing one or several public goods. A political declaration signed by diverse actors creating mitigation targets, a grant offered to cities willing to implement a public electric transportation plan, or a new standard aimed at assessing the resilience of small municipalities, are examples of climate governance instruments.

The global climate governance literature has referred to the governance activities (Nasiritousi et al., 2016) or, more commonly, the governance functions of transnational actors (Andonova et al., 2017; Hsu et al., 2017; Dzebo and Stripple, 2015; Bulkeley et al., 2014; Andonova et al., 2009). It identifies five governance functions that TMNs might have: information-sharing, capacity-building, target setting, rule-making, and provision of funding (Bulkeley et al., 2014). This functionalist argument is useful, since it might tell us more about the practices of TMNs. Yet, each of these functions does not alone constitute a novelty. In the analysis of novelties, we need to investigate more precisely the arrangement of these governance functions, or how these functions are assembled to produce novelties. The study of governance instruments makes this possible. Besides, it may also give us a better idea of the specific intentions of the authority choosing such techniques to steer its population (Hussein and Le Galès, 2010; Lascoumes, 2007; Lascoumes and Le Galès, 2004; Hood, 1986). Therefore, I favour the concept of instrument to that of function; following other scholars (e.g. Pattberg, 2017), I maintain that policy instruments studies offer fruitful inputs to analyse transnational governance.

There are many classifications of policy instruments (Auld et al., 2014; Giest and Howlett, 2013; Lascoumes, 2007; Howlett, in Eliadis et al., 2005; Lascoumes and Le Galès, 2004; Hood, 1986). Hood (1986), for instance, sees them as coming from four types of resources. Nodality implies having information; authority means possessing some sort of legal or official power; treasure involves the possession of money; and organization implies having

some human and/or material arrangements to one's disposition. Actors make use of these resources to obtain information or influence their environment. Depending on the resources they use and their goals, instruments vary. Lascoumes and Le Galès (2004) analyse the functions of instruments rather than the resources used in instruments. They offer a typology distinguishing among regulatory, economic, contractual or motivational, information and communication-based, and normative instruments, or best practices. For each instrument, they also analyse the political relation to the governor and the type of legitimacy the instrument implies. The first two categories (i.e. regulatory and economic) display a traditional command-and-control vision of the authoritative actor. The last three (i.e. contractual or motivational, information and communication-based, and normative instruments, or best practices) are more recent, and illustrate a soft approach to governance.

The two typologies presented are relevant in a national context, with a state representing the authority. However, they might not be adaptable to a transnational context, where authorities cannot edict laws or deduct taxes. For instance, Hood's concepts of authority or treasure cannot be directly applied to TMNs as those are not public actors. Although they might display some private authority and impose fees or provide funding, these concepts need to be adapted. Consequently, it is necessary to build a framework that applies to the governance instruments of global governance. A new analytical framework may also reveal the purpose of the tools used in global adaptation governance, the differences between the tools used by international and transnational actors, as well as how their initiators perceive and exercise authority. Besides, it may provide encourage a discussion on how the practices of transnational actors might affect global climate governance.

The bodies of literature on global environmental governance and global climate governance highlight the features that differentiate traditional tools from more recent ones. Although this is not sufficient to identify novelty, it is important to consider these arguments in the analysis of novel governance instruments. Recent instruments tend to adopt a managerial approach rather than a 'command-and-control' strategy (Hickmann, 2015). They use a soft and indirect approach that incentivises constituents rather than constrains them. Besides, the authority often does not directly implement the instrument. Instead, it expects the constituents to do so. Similarly, some scholars point to recent 'governing through enabling' practices.

According to them, governments seek to coordinate and facilitate partnerships with a variety of actors (who can be private) as well as encourage community engagement to steer their population (Giest and Howlett, 2013). The literature on global governance tends to share these ideas (Hickmann, 2015; Hale and Held, 2012; Börzel and Risse, 2010).

Governance instruments display certain functions, which can be related to the functions mentioned above (Dzebo and Stripple, 2015; Bulkeley et al., 2014; Andonova et al., 2009; Lascoumes and Le Galès, 2004). Since they have been observed before in the study of TMNs (Andonova et al., 2009), using them might facilitate discussion on TMN effects with the rest of the TMN literature. Thus, they are part of the analytical framework. First, *rule-setting* is the elaboration of ‘rules intended to guide or constrain constituents’ towards climate action (Andonova et al., 2009: 65). It is close to Heyvaert’s understanding of regulation as ‘the deliberate exercise of influence on a target’s behaviour (designed either to stabilize or modify this behaviour), performed with a certain degree of authority and persistence’ (2013: 83). Nevertheless, it does not necessarily imply an obligation for member cities to follow the rules set (i.e. an agreement may or not convey obligations). Second, *funding* is the provision of funds by TMNs to their members in relation to the implementation of climate actions. Then, *direct action* refers to the direct implementation of climate actions by TMNs. The planting of a thousand trees in a member city would be an example of direct action by a TMN. *Norm-setting* deals with the development of norms, standards and best practices for implementing climate action, also visible through discourse. Here, *capacity building* is defined as enabling and capacitating cities to implement actions for climate action. Lastly, *information sharing* is the diffusion of information and knowledge on climate action to city members and others.

Overall, these functions are similar to Lascoumes and Le Galès’s typology of instruments (2004). Therefore, this research considers that the first three governance functions are traditional (rule-setting, funding, and direct action), since they display a harder more direct approach. Like Lascoumes and Le Galès’s regulatory and economic instruments (2004), they imply intervention and control from the authority. In comparison, the last three (norm-setting, capacity building, information sharing), represent a novel, softer and more indirect approach. Although they differ to some extent from Lascoumes and Le Galès’s novel instruments, they

share a concern for communication and concertation rather than for command-and-control approaches.

Characteristic	Description
Rule-setting	Indicates the elaboration of rules to constrain or influence a behaviour
Funding	Indicates the provision of funds to the targeted population
Direct action	Indicates the implementation of actions for the targeted population
Norm-setting	Indicates the elaboration of norms, standards, or best practices
Capacity building	Indicates the enhancement of the capability of the targeted population
Information sharing	Indicates the diffusion of information and knowledge to the targeted population
Obligation	Indicates the compulsory nature of the instrument
Commitment	Indicates the creation of a commitment by the instrument
Directness	Indicates the direct nature of the instrument (i.e. it is direct if the authority applies it on the targeted population and indirect if the authority creates it for the targeted population to use)
Inclusion	Indicates the possibility of the instrument to be used or accessed by non-members

Table 1.1 An analytical framework for the study of governance instruments

In addition to these six governance functions, the analytical framework presented here includes four other governance characteristics: *obligation*, which indicates whether the use of an instrument is compulsory to members; *commitment*, which indicate whether the instrument creates a commitment for the TMN members; *directness*, which indicates whether the TMN directly uses its tool on cities or creates them for cities to use; and *inclusion*, which indicates whether the instrument can be used or accessed by actors who are not members of the TMN. Table 1.1 summarises the distinct categories presented to analyse the climate-related governance instruments of TMNs. The broadness of the categories suggests the framework could be used to analyse the governance practices of other transnational actors.

Here, a semantic precision is necessary. Building on Lascoumes and Le Galès’s distinction between instruments and tools (2004), this research sees instruments as specific combinations of the governance characteristics presented in Table 1.1. In contrast, a tool is an occurrence of an instrument with a specific name. For instance, the Climate Alliance Manifesto and the Energy Cities Charter have the same governance characteristics. They thus represent the same instrument, which is based on rule-setting, information sharing, obligation, commitment, and directedness, and is reserved to members only. Yet, they are different tools,

in that they have different names and are even created by different TMNs,⁹ which makes them different occurrences of the same instrument. Finally, a novelty is the first occurrence of an instrument. In that sense, the Climate Alliance Manifesto, which was the first instrument using such a combination of governance characteristics, is a novelty.

1.2.1.4 Interactions

Another crucial concept used in this study is that of interactions. As will be further exposed in Chapter 2, interactions constitute the main independent variable for explaining the emergence of novelty in this work.

Described simply, interactions are actions between two actors. They differ from relationships, although the two notions are often used synonymously. An interaction describes one action, which can be short or long term; a relationship applies to a series of interactions, describing their content. The interaction can be a unique occurrence of a link between two actors, or an evidence of a specific relationship. By contrast, the relationship is durable. Looking at different types of connections in a structure, interactions precede relationships. Besides, using the generic notion of interactions leads us to referring to a great variety and number of links between two actors. Both interactions and relationships enable the diffusion of information. Nevertheless, the presence of a relationship is not necessary for the diffusion of information, since the occurrence of any type of interaction suffices.

Interactions also differ from flows, defined as ‘purposeful, repetitive, programmable sequences of exchange and interaction between physically disjointed positions held by social actors in the economic, political and symbolic structures of society.’ (Castells, 2000: 442, cited Bouteligier, 2013a: 55) The concept of flow is close to that of relationship, as it has a dimension of durability. However, it differs in that it seems to imply intention between the two actors linked.

Therefore, this study focuses on the notion of interaction rather than on those of relationship or flow. There is a great variety of interactions. Two TMNs can be linked by referring to each other in a press release, by collaborating on a project, by competing on a grant they each want

⁹ One TMN can also create several tools, that is different occurrences, with different names, of the same instrument.

to get, by coordinating their actions for the adoption of a global policy, etc. This adds to the complexity of the global system: actors are not only numerous, they also have different kinds of interactions linking them.

Studying the interactions of TMNs is no substitute to an analysis of the attributes of TMNs, but an additional effort to understanding TMNs and their influence. The literature, by focusing on the analysis of TMNs as units, has built the foundations that now allow us to study them as a group, or as a population (Abbott et al., 2016b). This task is all the more important as ‘the “networking of networks” is an inevitable product of the process’ (Keiner and Kim, 2007: 1385). Some scholars have argued the interactions of TMNs may have an impact on the local level (Busch et al., 2018; Kern and Bulkeley, 2009), but we should also look at their influence on global climate governance. Networks create interactions among their members and connect other actors as well. The structure of TMNs most probably influences the action and behaviour of actors located inside the network. In addition, the agency of TMNs possibly influences actors of the global climate governance system and may also have an impact of the structure of that system. We thus need to consider these diverse interactions to get a more complete picture of TMNs. The present research starts studying the interactions of TMNs examining their membership and partnership relationships. It does not look specifically at the competition interactions, although these might have an impact on the emergence of novelty as well (see Chapters 5 and 6).

The emphasis on the gaps of the literature on TMNs, and the clarification of the concepts of TMNs, novelty, governance instruments, and interactions allow us to present and discuss this study’s research question.

1.2.2 Research question

To introduce this study’s research question, it is crucial to keep in mind the main gaps identified in the literature review. Among them, the confusion regarding novelty stands out. As argued above, scholars have often linked cities and TMNs to innovation and novelty. Even practitioners of urban climate governance constantly praise the innovativeness of their networks. The C40 Cities Climate Leadership Group (C40) has a programme area focusing on ‘Programmes, Business & Innovation’ (C40, 2019b). It also has a special project named ‘Reinventing Cities’ (C40, 2019b). 100 Resilient Cities (100RC) also regularly refers to its

innovative practices and partnerships (Brugmann, 2018; Hall, 2018). For its President, 100RC is ‘helping to catalyze innovation for resilience-building solutions in flood control, energy distribution, transportation, and finance.’ (Clifton, 2017)

Nevertheless, it looks like, when talking about TMNs, both practitioners and scholars refer to innovation as a buzzword more than as a measurable phenomenon. Some do seem to have identified innovation in TMN practices (Gordon, 2013; Román, 2010), or what I call here novelty. Yet, these analyses leave us wondering in which shape this novelty concretely appears, and how we might observe and measure it. Furthermore, we still lack insights into the sources of novelty. We do not know what makes TMNs generate this novelty and how they manage to produce it. In addition, the findings of these analyses apply to one TMN, i.e. C40. Other works relating novelty and TMNs focus on distinct TMNs, such as Metropolis or ICLEI (Bouteligier, 2013a; Toly, 2008). These three TMNs were launched at different times and with different, albeit related, goals. This points to the possibility that TMNs in general might generate novelties. These distinct studies are all based on separate, individual analyses, however.¹⁰ Thus, we cannot generalise their findings. This idea brings us back to another identified pitfall of the current literature on TMNs, i.e. the fact that it has so far has mostly relied on individual case studies. We need to conduct studies looking simultaneously at distinct TMNs to better grasp their diverse attributes and properties.

Finally, another gap in the literature mentioned is related to the lack of understanding of the diversity of TMNs. As mentioned before, the literature seems to consider that Metropolis, ICLEI, and C40 all generate novelties. From the three distinct analyses, we cannot perceive if they generate the same kind of novelties, however. More specifically, we may wonder whether all TMNs generate novelties in the same areas. For instance, some might generate novel governance practices, as argued by some scholars (Román, 2010). Yet, others might generate novelties in the areas of work they tackle (e.g. a focus on wider resilience concerns, as in the case of 100RC). Besides, we may wonder whether all TMNs generate novelties to the same extent, or whether some generate more than others.

¹⁰ With the exception of Acuto and Rayner’s 2016 article, which looks at 170 city networks working on a variety of global governance issues.

With these questions in mind, I conducted a preliminary investigation to help build the research question guiding this study. This investigation was based on the previous literature review, documentary observation (using Carbon Neutral Cities Alliance, 100RC, and C40's annual reports and blog publications) and informal talks with TMN city member and partner staff members. Its results suggested that TMNs indeed have novel governance practices. More specifically, it seems that the novelties of TMNs lie in the novel instruments they generate to steer city members towards certain climate actions. The preliminary investigation also indicated that all TMNs seem to generate governance tools. Yet, they do not do so all to the same extent. Some mostly adopt the instruments of others in a slightly different form, and do not generate novelties. Others produce many tools, but only few of them are actually different from those of other TMNs, and unprecedented in the system of TMNs. The reasons for these discrepancies are nonetheless obscure.

Drawing from these questioning and preliminary findings, this study's research question is: why do some TMNs generate more novel governance instruments than others?

This question includes several subquestions. First, what are the novelties that TMNs generate in their system? We must identify precisely what attributes TMN governance instruments have, and what the differences between conventional governance instruments and novel ones are in the system comprising TMNs. It is important to note that this study will not identify TMN novel governance instruments by considering all the governance instruments generated by actors of global climate governance. It considers novelties as unprecedented combinations of existing elements in a system. Thus, it focuses only on the system comprising TMNs, and their members and partners.

Second, what are the enabling conditions of TMN novel governance instruments? To answer this subquestion, we must look at the independent variables that might explain why some TMNs generate many novelties, and others few or none. This study looks mostly at interactions to explain the emergence of novelty. More precisely, it posits that the centrality of TMNs (i.e. the number of contacts they have) and their diversity of contacts (i.e. the distinct natures of these contacts and the variety of issues they tackle) influence their capacity to generate novelties. Yet, it also considers variables related to the attributes of actors, i.e. organisational age and resources. It posits that it might be the age and the amount of

organisational resources (understood as the number of staff per city member) of TMNs that mainly explain why they generate novelties.

Third, what is the process at play between these potential enabling conditions and the emergence of novelty in TMNs? We need to detect how, or through which process these conditions might lead to the emergence of novelty. Uncovering how interactions (i.e. centrality and diversity of contacts) or actor attributes (i.e. organisational age and resources) facilitate the emergence of novelty is crucial to answer this study's research question.

Overall, these questions belong to an important and vast questioning of social sciences, i.e. where does novelty come from?

To answer this study's research question, Chapter 2 builds a theoretical framework that includes network theory, complex systems approaches, and organisational theories. Together, these approaches help us gather relational and actor attribute variables to explain the emergence of novelty. Chapter 3 then presents the methods used in the empirical study. Chapters 4, 5, and 6 detail the empirical study. Chapter 4 focuses on the novel governance instruments that TMNs generate. Chapter 5 looks more precisely at the enabling conditions for the emergence of novel governance instruments. Finally, Chapter 6 examines the causal process linking independent and dependent variables through two cases which differ in their outcomes, although their independent variables look alike. Altogether, these distinct chapters provide an explanation for the emergence of novelty in TMNs that might be applied in the study of other transnational actors of global climate governance.

1.3 Concluding remarks

This chapter has sought to introduce what this study seeks to do to improve our understanding of TMNs in global climate governance. It has presented the state of the literature on TMNs, emphasising the high number of works seeking to define TMNs, account for their emergence, detect their role and functioning, and identify their effects. The literature review has also shown that TMNs generate novelty in global climate governance, although there is confusion as to what this novelty is. Other gaps include the lack of study of the interactions of TMNs and the lack of account of their diversity. By looking simultaneously at several TMNs, we may see some differences between them. TMNs do not generate novelties to the same extent.

Some generate more governance tools than others, and some generate instruments that are qualitatively more novel. Through a study of the interactions of TMNs, this work seeks to tackle a question on novelty in TMNs that researchers have not addressed so far. Looking generally at the question of how novelty emerges, it focuses on the following research question: why do some TMNs generate more novel governance instruments than others?

By studying novelty in the system of TMNs in global climate governance, this research seeks to better understand the influence of TMNs on the outside, thus treating them as actors of the system. Nevertheless, because it looks at their inner structure and thus takes interest in who is part of them, how the different actors are linked to each other, and are affected by these relations while affecting it, it also envisions them as structures. This type of analysis, looking at the internal and external dimensions of TMNs, has been missing in the literature (Bouteligier, 2013a). The theoretical framework and mixed-methods research design this study offers, based on a social network analysis, cross-case analysis and comparative case study, will help better picture this dual dimension. This study thus hopes to offer a better understanding of the novelty of TMNs.

To conclude, this chapter has opened the door to many questions regarding the novel governance instruments of TMNs. Throughout the next chapters, it will hopefully manage to answer those questions. If it does not, it will at least, arguably, have encouraged researchers to investigate underspecified properties of cities, TMNs, and other transnational actors of global climate governance.

Chapter 2 Explaining novelty through networks and complex systems

Explaining change, of which novelty is a form, has been a crucial quest of social sciences. Some favour structural approaches, observing changes in the structure which affect the behaviour of agents. Others prefer agency-based approaches, arguing that agents inside the structure are the forces pushing for change despite the constraints of the structure.

The present study uses network theory, complexity approaches, and a few insights from organisational theories to answer the question: why do some TMNs generate more novel governance instruments than others? Indeed, these perspectives have offered well-founded explanations for change. This study gives more importance to the structure of interactions in which agents are embedded than to the power of agents to influence the structure as a source of change. It considers that the emergence of novelty is linked to the diffusion of information and ideas in the system more than to the will of actors. The well-positioned actors in the system receive these ideas and learn from them to generate novel instruments out of them. Yet, this study does not ignore the agency of actors as a possible source of change. The use of a dual perspective of networks as both structures and actors and insights from organisational theories shows that agency might indeed matter as well. Social learning processes also require some agency to enable the evolution of TMNs. Even when agency is considered, interactions can hardly be dismissed. Networks can be sources of change both as structures and as agents. Therefore, we need to consider both relational and attribute variables to answer this study's research question.

This chapter starts by introducing network theory as the primary theory that this study uses. Then, it discusses the benefits of complementing this theory with a complex systems approach as a theory of change paying attention to the nature and content of interactions among entities of a system, and to the context in which this system and its environment evolve. The third section presents insights from organisational theories, and highlights the imbrication and coherence of the three sets of theories. The fourth section uses the three sets of theories to introduce this study's hypotheses. These hypotheses are based on network theory, complexity approaches, and organisational theories. While the former two focus on interactions as an explanatory variable for the emergence of novelty, the latter considers actor

attribute variables to be crucial. The last section synthesises the main ideas of the present chapter. The empirical chapters will later test these hypotheses and help us determine the significance of interactions and actor attribute variables in the emergence of novelty.

2.1 A perspective of networks as structures and actors for the study of novelty

The discipline of International Relations seeks to make sense of the interactions of international actors. It should therefore be prone to studying networks, as structures of interactions of three or more actors (Maoz, 2012; 2011; Lazer, 2011). Favouring studies on dyads, scholars have nonetheless left aside the analysis of the webs of relations in which they are embedded. International Relations has been traditionally reluctant to develop an analytical understanding of networks (Le Prestre, 2017; Hafner-Burton et al., 2009; Kahler, 2009).¹¹ Before the boom of network science in the 2000s, the lack of concern for networks in the discipline was visible.¹²

Recently, several notable efforts with distinct goals have emerged (Hafner-Burton et al., 2009). Whereas some scholars have focused on networks as objects of analysis (Keck and Sikkink, 1999; 1998), others have used network theory for a better understanding of global phenomena (Green, 2017b) or applied network analysis principles to test their hypotheses (e.g. Böhmelt and Spilker, 2016; Dorussen et al., 2016; Paterson et al., 2014; Zhukov and Stewart, 2013; Maoz, 2011). The numerous definitions and uses of networks make this concept hard to grasp (Bouteligier, 2013a).

The following subsections show how the discipline has mainly thought about networks in terms of either structures or actors. I argue that an integrated perspective, seeing networks as both structures and actors, might enhance our understanding of networks. This might be particularly useful to analyse TMNs and how they generate novelty.

2.1.1 Two visions of networks

¹¹ Other disciplines of social sciences, such as sociology and psychology, have been paramount in the development of network science.

¹² A few exceptions highlighting some interest in networks before that period include Brams' work on transaction flows, which, at the end of the 1960s, used graph theory to define state groups based on different parameters. Later on, Axelrod also made use of graph theory, but with the purpose of drawing cognitive maps of political elites. A few other studies with similar ambitions followed these efforts but they remained scattered (see Maoz, 2011).

International Relations studies on networks do not generally characterise them explicitly as structures, institutions or actors. Yet, they often implicitly envision them as one of these entities, and only one of them. As Kahler (2009) explains, the approach of networks as structures focuses on explaining or understanding the influence of network effects on the behaviour of the members; the network-as-actor approach underlines the intention in the design of networks and the influence on global outcomes. Nevertheless, envisioning networks as either structures or actors produces a biased research that might impede a comprehensive understanding of TMNs.

2.1.1.1 Networks as structures

Many studies on networks envision structures as their most important dimension (Lazer, 2011; Newman, 2010; Borgatti et al., 2009). They belong to a perspective that defines networks simply as sets of units, or nodes, that may be linked by a variety of relationships, or edges (Dorussen et al., 2016; Wasserman and Faust, 1994). In that context, Lazer claims that '[a]rguably, the biggest single category of network research rests on the conceptualization of networks as a structure through which things circulate.' (2011: 62)

The network-as-structure perspective often refers to network theory, and network analysis. Clarifying their meaning is important to recognise their different purposes. Network theory can be defined as a set of propositions that seek to explain or understand the causes, attributes, processes and impacts of networks.¹³ Network theory is heterogeneous, with arguments coming from various natural and social sciences disciplines. Noteworthy studies belonging to network theory include Granovetter's argument on weak links (1973) and Burt's assertions on structural holes (1995), two theories to which I will return later in this chapter. Goddard defines the goal of social network theory as exploring 'how an actor's structural position affects her capacity to create change' (2009: 253). A generic hypothesis of network theory is that the position of actors determines the constraints and opportunities they face and therefore facilitates outcome prediction (Borgatti et al., 2013).

¹³ Some distinguish network theory from the theory of networks, arguing that the former focuses on the effects of connectivity patterns while the latter looks at the causes of those connectivity patterns. See Kim (2019), and Borgatti and Halgin (2011). This distinction resembles the distinct goals of social sciences and natural sciences when looking at networks (see Borgatti et al., 2009). Although valuable, this study does not use this distinction and refers to the two phrases as synonymous.

In contrast, network analysis serves primarily as a tool for measurement. It can be defined as a method that seeks to identify and measure sustained patterns of relationships between three or more nodes to make causal or statistical inferences on social and political outcomes.¹⁴ Network analysis relaxes the traditional statistical inference assumption of independent observations. It is therefore particularly useful in the study of complex systems and interactions (Dorussen et al., 2016).

I see the main distinction between network theory and network analysis in that the former includes a set of theoretical propositions offering explanations for the occurrence of global phenomena, and the latter does not contain theoretical propositions (although it does rely on theoretically charged concepts), but tests theoretical propositions. The use of network analysis is no substitute to the application of a theoretical framework. To avoid confusion, I identify network analysis as a method rather than a theory or a research programme.¹⁵

Most network theory studies use quantitative network analysis as a primary method. Several measurement concepts were indeed developed to formalise theories on networks (Borgatti and Halgin, 2011). Some qualitative network analysis studies are emerging, however. For Brandes et al., what matters ultimately is that ‘the understanding of the phenomenon treats relational connectivity and dependence as central.’ (2013: 11-12) Qualitative network analysis, a ‘qualitative design to understand social relations and their impact on policy processes’ (Löblich and Pfaff-Rüdiger, 2011: 637), might help understand how actors influence an institutional structure within a network, for example. It thus has the capacity to test network theory propositions. Some studies that see networks as structures use qualitative network analysis only (e.g. Acuto, 2013). Others combine network analysis with other methods, such as statistical models or even case studies. Following these examples, this

¹⁴ In that regard, some scholars are reluctant to depict network analysis as a method and define it as a research programme. See Borgatti and Halgin (2011), and Borgatti et al. (2009).

¹⁵ It should be noted that scholars often associate network analysis with network science (see Watts, 2004). In other publications, it is defined more broadly as the ‘study of the theoretical foundations of network structure/dynamic behavior and its application to many subfields’ (Lewis, 2009: 5). Even then, it is likely to be reduced eventually to network analysis as ‘the new science of networks’ (Lewis, 2009: 1). This research favours a more general understanding of the notion as an umbrella term. Following Brandes et al., network science is understood as the ‘study of the collection, management, analysis, interpretation, and presentation of relational data.’ (2013: 2)

research uses social network analysis on 15 TMNs, but adds a cross-case analysis and comparative case study to strengthen its external validity of its findings.

There are several benefits associated with the use of a network-as-structure approach. As Borgatti et al. argue, ‘a fundamental axiom of social network analysis is the concept that structure matters.’ (2009: 893) Network analysis has evolved around a core of theoretically charged concepts linked to the idea of the structure, including density, clustering, degree, and eigenvector centrality. All these concepts facilitate the description of the structure of networks and the drawing of inferences on their effects.

International Relations scholars have used network theory to observe distinct phenomena, including conflict or cooperation (Dorussen et al., 2016; Borgatti and Halgin, 2011), the impact of IGOs on the interactions of states (Hafner-Burton and Montgomery, 2006), institutional interactions (Böhmeit and Spilker, 2016), or policy change (Zhukov and Stewart, 2013). In the field of environmental governance, studies have focused on the diffusion of rules and norms through transnational networks (Cao and Ward, 2017; Paterson et al., 2014; Lee and van de Meene, 2012) and on the increasing institutional complexity of global climate governance (Widerberg, in Pattberg and Zelli, 2016; Green, 2013), among other issues.

Focusing on networks as structures has enabled scholars to pay attention to the interactions of actors instead of focusing only on their attributes (Borgatti and Halgin, 2011). Looking at these relationships may help them unravel dynamics of opportunities and constraints affecting social, political and economic outcomes (Ward et al., 2011). The network-as-structure perspective is one way to explain the effects of the structure on the units of the system. It contends that the behaviour of actors is highly dependent on the structure of the network, (inter)dependence being another fundamental concept of the field.

Studying networks as structures may also facilitate our understanding of the power logics within networks. Indeed, ‘a structural analysis of networks equates the power of a particular node to its position in the network, defined by its persistent relationships with other nodes.’ (Hafner-Burton et al., 2009: 570) More specifically, it integrates ideas of access as part of network power, as well as brokerage and exit options. The possibility of self-reinforcing power in a network also exists (Hafner-Burton et al., 2009).

The network-as-structure perspective does not ignore the attributes of actors, however. An important assumption of network science is that agents matter as well in analysing a phenomenon. We should therefore always look at the dependence of the nodes as well as at their individual characteristics. Investigating networks is a way to look at both the agents inside the structure and the structure itself. It goes beyond purely structural explanations of phenomena by acknowledging the fact that the structure may constrain or free agents who in turn transform the structure through their decisions and actions (Maoz, 2012). In this regard, Goddard underlines the significance of agency in networks, looking at ‘agency not as opposed to structure but as inhering within network structures.’ (2009: 257)

It is important to mention the possibility of a network being part of a wider network. Analysing power logics inside intergovernmental networks, Slaughter (2004) shows that intergovernmental networks can be part of greater policy networks. When this happens, we can wonder whether the smallest network is a subnetwork or an actor of the widest network. Choosing the latter interpretation over the former leads to a different set of research questions and theories in the discipline. This is an important consideration in the context of the present study. Indeed, TMNs might appear as networks of cities and non-city actors. Yet, they might also be subnetworks or actors of wider networks such as transnational climate governance or global climate governance. If we see them as actors, we might look at their strategies to achieve their goals rather than their structure of interactions.

2.1.1.2 Networks as actors

The network-as-actor perspective has become common in International Relations. Scholars have identified various transnational networks as actors. Examples include studies on epistemic communities (Haas, 1992; 1989), or on transnational advocacy networks (Keck and Sikkink, 1999; 1998). Many scholars have also started to broadly refer to networked governance (Gordon, 2016a; 2016b; Bouteligier, 2013a; Khan, 2013; Juhola and Westerhoff, 2011; Bäckstrand, 2008). Authors using the network-as-actor perspective tend to focus more on the network as a whole, its behaviour and its actions, than on looking at its relational characteristics. They see the network as an actor, an agent or an institution that may impact a broader system, and oftentimes ignore the structure of the entity they are examining. They also underline the capacity of networks to push for change.

It is important to elaborate on the terminology of the network-as-actor approach. Just as the notion of structure, the idea of actor is very commonly used in International Relations. It is often used interchangeably with the term agent (Nijman, 2016), even though the two concepts have different meanings. To make clear what is implied by the network-as-actor perspective as understood in this study, it is useful to clarify their definitions.¹⁶ While different fields have taken interest in this issue, it seems relevant, in the context of the present study, to focus on environmental studies in order to clarify the distinction between actor and agent. Some scholars from this field define agency as ‘the capacity of individuals or organizations (‘agents’) to act independently and autonomously towards achieving desired outcomes.’ (van der Heijden et al., 2019: 239) Others consider that ‘While *actors* refer to the individuals, organizations, and networks that participate in decision-making processes, *agents* are actors who have the ability to prescribe behavior’ (Dellas et al., 2011: 87). Likewise, Gordon argues that ‘[a]gents, in other words, must be distinguished from actors; the latter are simply participants in the play of world politics whereas the former have the capacity to shape the plot and narrative itself.’ (in van der Heijden et al., 2019: 23)

In this perspective, both actors and agents are intentional. Agents, however, are more than actors; they are actors who can influence others. Agents may also affect processes and the system in which they are embedded. Their system constrains them, but their agency gives them the capacity to influence it in return. Following this distinction, Bouteligier (2013a) insists on the Weberian concept of authority, understood as the ‘power to command or rule and the duty to obey’ (Mol 2008: 34, cited Bouteligier, 2013a: 61).¹⁷ She thus argues that ‘Actors that have obtained authority transform into agents. The distinction between actors and agents in global environmental governance is a key analytical problem that addressed “the questions of *who* governs for *whom* and *how*.”’ (Bouteligier, 2013a: 62)¹⁸ Drawing from

¹⁶ Defining the concepts of actor and agent is part of an important general question on actorhood in International Relations. It is not the purpose of this work to go into the details of this debate. However, it seems important to mention it as a basis for specifying the definitions that will be used for these key concepts.

¹⁷ Other forms of authority exist, such as intellectual authority, or the ability to convince by using reason and knowledge.

¹⁸ Some might argue agents are not necessarily actors, in that they might influence others while not being purposeful entities. For instance, Latour (2005) sees non-living entities as ‘actants’, i.e. entities that have the ability to make human actors act differently although they lack intentionality (see also Mayer, 2012). While this is not the position this study adopts, Latour’s propositions and, more broadly, Actor-Network Theory, of which Latour is one of the main voices, have influenced International Relations. We should also note that posthuman

these works, this study agrees with Dellas and collaborators' distinction and builds on it to argue that networks can be considered actors, and in some cases also agents.¹⁹

The network-as-actor analysis brings valuable benefits to the study of global politics. Kahler (2009) explains that it primarily sees networks as organizational forms that contrast with markets or hierarchies. This perspective is therefore interested in examining its advantages and limits compared to those of other forms. Scholars often argue that networks are flexible and efficient (Bouteligier, 2013a; Gore, 2010), characteristics international actors are commonly said to lack. More specifically, for Powell, who originated the distinction among networks, markets and hierarchies, networks are based on the complementary strengths of their elements, have a medium degree of flexibility, create a medium to high level of commitment among the elements, offer open-ended and mutual benefits, and make actor preferences and choices interdependent (1990: 300-305). Drawing from Powell's work, Barnett and Sikkink mention that states and IGOs have a hierarchical and bureaucratic structure, whereas networks are voluntary, reciprocal and horizontal (2008: 72; also Keck and Sikkink, 1999: 91). Overall, the network-as-actor perspective has led to innovative studies on terrorist organizations or global corporations, among others (Kahler, 2009).

The vision of network-as-actor often encompasses the vision of network-as-institution. Powell's research (1990) comes from organisational studies. The study of international institutions has also used organisational theories on many occasions (e.g. Barnett and Finnemore, 1999). Many works on institutions consider them to have a certain degree of autonomy. For example, theories of delegation see IGOs as 'strategic actors with agency' (Hawkins et al., 2006). Other research studies international regimes as networks of institutions (Böhmelt and Spilker, 2016). Therefore, there are visible links between the perspectives of network-as-actor and network-as-institution. Nevertheless, they differ in their research goals. Whereas a network-as-institution perspective might focus more on the internal organisational logics and how they impact the behaviour of the network, a network-as-actor perspective might look more generally at the agency of networks and how they affect

International Relations has started to incorporate non-human systems to analyses of global politics, but it remains so far marginal. See Youatt (2017, 2014), or Cudworth and Hobden (2011).

¹⁹ To remain concise, however, the phrase 'network-as-actor' will be used to refer to networks as actors and as agents.

the wider system. It is sometimes hard to determine whether authors consider the network they study to be an actor or an institution. For instance, even though it highlights the power logics underlying government networks, Slaughter's work on intergovernmental networks (2004) seems to see them as institutions designed to foster cooperation. Because they are governed to a great extent by structural logics, they should be reformed in order to accomplish their functions better. Slaughter thus seems to envision networks as institutions. Overall, these strong links underline the relevance of considering the network-as-institution approach within the network-as perspective.

These considerations show the differences between the network-as-structure and the network-as-actor and network-as-institution perspectives. Envisioning TMNs as structures or as actors leads to different assumptions regarding networks (e.g. dependence of actors, or flexibility of the network), and different areas of focus (e.g. centrality of actors, or strategies of the network). It also leads to different hypotheses regarding the emergence of novelty (e.g. structural, or agentic causes). Yet, choosing between one of the two perspectives is not always necessary. As the next subsection argues, using an integrated perspective might benefit our understanding of networks.

2.1.2 Reconciling structure and agency in the network

Seeing networks as both structures and actors might bring distinct benefits to our analysis thereof. It might especially enhance our understanding of TMNs regarding their capacity to generate novelty. This dual perspective is thus part of the theoretical framework presented in this chapter.

2.1.2.1 Two mutually exclusive perceptions?

International Relations scholars tend to use either the network-as-structure or the network-as-actor perspective. They seldom use both simultaneously and explicitly (Kahler, 2009).²⁰ Keck and Sikkink claim their approach on transnational advocacy networks is both structural and actor-centred (1999: 91). Furthermore, Sikkink (2009) argues that the network-as-actor perspective always includes a network-as-structure vision of networks. However, Keck and Sikkink do favour the network-as-actor perspective in their main study of transnational

²⁰ A few exceptions include Elkins' work on transnational human rights networks, in Kahler (2009). We should also mention some studies on transnational municipal networks. See Acuto (2013).

advocacy networks (Ward et al., 2011). Scholars seem uncomfortable with the idea of a network being both a structure and an agent. They tend to see these approaches as mutually exclusive and to favour one over the other. The network-as-structure perspective does not consider networks as conscious and intentional entities capable of unified decision-making. It actually argues against that vision since it maintains that networks are structures made of a variety of processes that influence outcomes but that they have no intentionality. This lack of intentionality is precisely what the advocates of the network-as-actor perspective negate when they study transnational actors as networks.

These contradictions seem to impede any reconciliation of the structure and the agent in a sole entity, which leads us to the agent-structure problem. This debate focuses on the relationship between conscious agents and the structure in which they act (Wight, 2013: 30). It envisions structure and agents as distinct elements that may influence the system and its processes, and therefore help analyse outcomes. The structure is external to the purposeful agents. It represents the conditions that agents face and to which they seek to adapt in their choices and actions. Agents have intentions and strategies, the structure does not. Many scholars agree that both structures and agents help account for phenomena of interest to social scientists. For Wight (2006), the agent-structure debate is about building theories that may orient empirical research towards observations accounting for one or the other element.

This debate is not specific to International Relations. It has indeed been a prominent question across social sciences. For Wendt, all social sciences theories illustrate at least implicitly a specific answer to the agent-structure debate (1987: 337). Wendt himself owes much of his theory to Giddens, who developed the concept of structuration in the late 1970s. Rather than see structures and agents as reflections of one another, Giddens sought to unite the two elements (Wight, 2006). He argued in favour of a duality of the structure, which refers to ‘the essential recursiveness of social life, as constituted in social practices: structure is both the medium and outcome of the reproduction of practices. Structure enters simultaneously into the constitution of the agent and social practices, and “exists” in the generating moments of this constitution.’ (Giddens 1979: 5, cited Archer, 2010: 227)

The dialectic of structure and action is thus more precise than the preceding social theories on structures and agents. Structures may constrain but also enable agents, and thus lead to

unintended outcomes. According to Archer, structuration theory does not allow a distinction between structure and agent, especially regarding the synchronic and diachronic effects of both elements (Wight, 2006). There is an analytical dualism of structure and action that should be theorised. Archer thus advocates in favour of a morphogenetic approach, where morphogenesis is defined as a process that includes all the complex exchanges leading to change in a system (2010: 228). Morphogenesis has an ‘end-product’, i.e. structural elaboration (Archer, 2010). Giddens and Archer's approaches concur in that action presupposes structure, and structure presupposes action. Furthermore, agents act under conditions of which they are unaware although they impact their actions. The latter might also have unintended and unforeseen consequences which influence subsequent action.

The above comments underline the idea that the agent-structure debate has had a crucial influence on our understanding of the relationship between structures and agents in social sciences. International Relations and global environmental governance or earth system governance (Biermann et al. 2009) are no exception. If we follow the agent-structure debate, uniting the structure and the agent into one entity is incongruous. As Wendt argues, agents and structures are ‘mutually constitutive yet ontologically distinct entities’ (1987: 360). Seeing a network as both a structure and an actor (or an agent) seems inconsistent, which explains why most International Relations studies favour one element over the other, and do not integrate them.

This argument of inconsistency is not entirely convincing, however. First, the need to analytically distinguish structure and agent in order to improve our understanding of how they influence each other does not preclude their integration to pursue other goals. For instance, integrating structure and agent into one entity could help us answer the question of their combined influence. As mentioned earlier, scholars have analysed networks either as structures or as actors. For instance, Slaughter (2004) seems to analyse intergovernmental networks as agents that seek to influence other actors, but the attention she pays to power logics within these networks shows she does not ignore their structural dimension. Furthermore, while some researchers have used network analysis to analyse the C40, a well-known TMN engaged in climate issues, as a structure (Lee and van de Meene, 2012), others have seen it as an agent of experimental climate governance (Hoffmann, 2011).

Envisioning the network as a structure or as an actor seems to depend on the research question. Scholars may indeed want to focus on the internal organisation of the network, and thus see it as a network. In contrast, they may observe its influence on the wider environment, and therefore picture it as an agent. Moreover, choosing between structure and agency regarding networks might be linked to the timeframe used. More specifically, Padgett and Powell argue that ‘in the short run, actors make relations; in the long run, relations make actors’ (2012: 291). With this mantra in mind, the authors claim that the agency perspective may appear more significant at first, but the structure perspective becomes prominent later on. Consequently, interrogating the broad influence of the network, both from the inside and from the outside, may imply picturing it as both structure and actor. Some studies using Actor-Network theory do that. Looking at them might be interesting to see how a dual perspective might be used.

2.1.2.2 The contributions of Actor-Network Theory to International Relations

Acuto shows the double nature of the C40, describing it as a ‘hybrid collectif’, made of cities that, together, produce an emergent effect capable of influencing world politics (2013: 838). According to Acuto, changes inside the network may imply changes in the network’s interactions with other elements of global governance. He connects the networking within C40 with the networking of C40. Therefore, Acuto’s study is in line with this study’s argument on the coherence of studying networks as both structures and actors and the potential benefits of an integrated perspective of networks.

Acuto's 2013 study uses an Actor-Network Theory (ANT) perspective. ANT, as originated by Latour, Callon and Law within Science and Technology Studies, conceives of agency as a relational effect (Braun et al., 2018; Mayer, 2012). Actors are thus the outcome of a web of relations with other actors. They are the constantly evolving product of interactions. Indeed, ‘every entity, including the self, society, nature, every relation, every action, can be understood as “choices” or “selection” of finer and finer embranchments going from abstract structure -actants- to concrete ones - actors.’ (Latour, 1996: 375) In that sense, ANT helps International Relations go beyond the agent-structure divide (Acuto, 2013). Observing and describing the ties that make actors is crucial in order to understand these actors, their behaviour and their influence on larger networks. Actors are the result of a network and an element of another one. As Latour explains, ‘An actor-network is traced whenever, in the

course of a study, the decision is made to replace actors of whatever size by local and connected sites instead of ranking them into micro and macro.’ (2005: 179)

ANT has offered several valuable insights to International Relations. It has especially been used in security studies and by scholars of the practice turn (Braun et al., 2018). For Nexon and Pouliot, ANT offers a different understanding of phenomena when circumstances, such as a breakdown or a conflict, allow to look at them as systems of elements that can be disaggregated (2013: 343). It can help impede the reification of these phenomena. As Acuto (2013) argues, ANT has been very useful in analysing power strategies through the observation of actors as assemblages. These are made of a variety of elements that give them agency. Agency is not a given attribute of actors. Actors become agents through their interactions with their environment.²¹

ANT nonetheless has limitations that it is important to underline. Since it focuses on the micro level, ANT tends to forget about broader structural conditions, which is a part of a International Relations perspective (Nexon and Pouliot, 2013). Everything seems to be a question of networks and appears to be decomposable. Assuming global governance is complex, interactions and interdependence matter to a great extent in order to understand its structure and processes. Nonetheless, the ability to decompose an entity into distinct elements shows its complicatedness, not its complexity. As I will later discuss, complexity implies the emergence of properties that cannot be inferred from agents. ANT does not account for emergence understood this way. It lacks a systemic approach that can deal with the complexity of global governance, one that would also consider nonlinearity and feedback loops. Used on its own, ANT does not have explanatory power. Like social network analysis, ANT appears to be a method more than a theory. As Latour explains: ‘ANT is a method, and mostly a negative one at that; it says nothing about the shape of what is being described with it’ (2005: 142). ANT’s understanding of networks, which is less truncated than the two mutually exclusive perspectives of networks of International Relations, is fundamental to this

²¹ Another important input of ANT is related to the claim that non-living entities can be actors too. Norms, natural elements, or objects can influence the course of a phenomenon. Although this is one of ANT’s most famous arguments, notably examined by the practice turn in International Relations (see for instance Pouliot, 2010), it is not the most important here. As intentionality remains essential to being an actor, and non-living entities are not assumed to have intentionality, this work does not consider them as actors. The most important input from ANT here is thus the relational argument.

work. However, neither ANT nor the two perspectives presented above introduce enough complexity in their analysis. Yet, in the study of networks in global governance, it is crucial to consider the variety of interactions between structure and agents, as well as the possibility of changing roles. We thus need to incorporate network science in a wider complexity framework, which we can do through an integrated perspective.

2.1.2.3 The network as structure, agent and actor of a complex world

A few authors have underlined the dual perspective of networks as structures and actors (Widerberg, 2016; Acuto, 2013; Bouteligier, 2013a; Elkins, 2009), arguing, for example, that a network can be a structure and simultaneously an element or actor of a larger structure (Widerberg, 2016). More work in this direction might help enhance our understanding of networks in world politics.

The greater use of multilevel analysis and the concept of scale in global environmental governance (Johnson et al., 2015; Toly, 2008; Betsill and Bulkeley, 2004) may help recognise the dual perspective of networks in the discipline. Both the literature on scale and the literature on multilevel governance are related to the complexity of world politics. The diversity of scales and levels are indeed constituent of this complexity (Termeer et al., 2010). Indeed, multilevel analysis encourages considering networks as both structures and agents because it seeks to look at distinct levels of action in order to explain or understand global phenomena. In that perspective, cities may appear as local actors, but also global ones, if they belong to a network of local actors across borders. Scales represent diverse dimensions, (e.g. spatial, temporal, quantitative, or analytical), used to measure and study phenomena and levels located at different positions along these dimensions (Termeer et al., 2010). Global environmental governance has gone through a vertical and horizontal rescaling of global environmental governance and politics, which corresponds to a shift regarding the places and agents of interest and the scope of global environmental governance across different scales (Andonova and Mitchell, 2010: 257). Both studies on scale and on multilevel governance imply the recognition of a variety of actors, locations and levels in a phenomenon. This can help envision networks as structures of one part of a scale or a level and actors of another. It may reveal how a network of local actors can both be a structure of interacting cities, and an actor and possibly agent of global governance. Defining a certain network as both structure and actor might also help precise the contours of a scale.

This research posits that such an approach might benefit the study of TMNs. A few studies have used this dual approach on TMNs (e.g. Acuto, 2013), yet more efforts are needed. As mentioned in Chapter 1, TMNs are both formalised structures of interactions among mostly cities but also non-city actors, and actors of urban, transnational, and global climate governance. Seeing them as structures underlines their dimension of networks of cities and non-city actors. In these networks, cities interact, exchange information and best practices, and sometimes collaborate on climate-related projects (Betsill and Bulkeley, 2006; 2004). Since they use the same tools provided by the TMNs to which they belong, they may increase or deepen their interactions. TMNs often have partners to whom cities are also connected. The network thus goes beyond its member cities. By focusing on the structure of interactions, we may be able to identify the most important and most influential entities within the network. In addition, the network also involves the TMNs' staff, who often greatly interact with member cities. These interactions may have an impact on the decisions cities take. However, considering all the diverse elements previously mentioned, we might argue that cities are not influenced only by TMN staff. We cannot just look at the organisation or the institution. TMNs are large structures of interactions that include their staff, their members, and their partners. They influence the decisions of their member cities in the creation or implementation of climate actions (Busch, 2015; Reckien et al., 2015; Hakelberg, 2014), and those of other actors within their networks. But they may also influence actors outside of their networks as well as the system of global climate governance (Gordon, 2013).

Therefore, TMNs are more than structures. A network such as a TMN is also a group composed of its members, internal institutions, norms, and practices, one that takes decision, implements strategies to achieve goals, and influences other actors in a specific environment. As mentioned earlier, Acuto (2013) describes the C40 as a 'hybrid collectif'. We must consider all its different constituents in order to observe the nature and behaviour of the entire network. Decisions come from the interactions of these different actors: cities share and argue among themselves and with partners; these interactions are interpreted and used by the staff to act, in addition to their own interactions with members and partners. The decisions that are taken are a product of these dynamics. They illustrate the intentionality of the TMN. Consequently, we may see it as an actor that is not limited to its staff or its organisation, but that encompasses other constituents. We may thus study its strategy and seek to understand

its goals. Furthermore, when looking at the multiple levels of action within TMNs, we see that TMNs are actors of greater networks. One of them is the system of climate-related TMNs, to which the C40 and other TMNs belong. In this network, they seem to be actors interacting with and influencing other actors. Some TMNs also enjoy recognition from international actors. For instance, ICLEI, another prominent TMN, represents the focal point of the Local Governments and Municipal Authorities (LGMA) constituency to the UNFCCC.

Overall, applying an integrated perspective of networks on TMNs leads us to analysing distinct aspects of the same entity. Envisioning them as structures enables us to see how they constrain their members or create opportunities for them. In addition, it underlines the significance of the relations of the elements that constitute them, i.e. the staff, cities, IGOs, and many diverse private actors. Thus, such a perspective may improve our knowledge of networks. Furthermore, the integrated perspective of networks helps understand the power of and the power within the network. From the inside, a network analysis may reveal the power of certain nodes in shaping the rules and norms of the structure. From the outside, a focus on the agency of the network may help account for its strategy and influence on other actors of the global system. It may also highlight the power of some elements over others. Considering them as actors allows us to look at their purposes and their influence inside and outside the network. The literature review presented in Chapter 1 highlights the fact that scholars have used the network-as-structure and the network-as-actor perspectives. Yet, they have seldom integrated both into a sole analysis. Such an effort, however, would enhance our understanding of the influence of TMNs in climate governance.

More importantly, observing TMNs as both structures and actors might enable us to perceive more enabling conditions for the emergence of novelty. As structures, TMNs comprise certain interactions which might help or hinder their access to information. As actors, TMNs create strategies which might seek to transform that information into learning for the emergence of novel practices. A dual perspective of networks, albeit time and resource-intensive, allows us to gain a broader understanding of TMNs as generating novelty.

In that context, the hypotheses that will be presented at the end of this chapter build on the dual perspective of networks as structures and actors of climate governance. They highlight the notion that we need to look at both structures and agents to explain the rise of novelty in

the TMNs system. Some of them also imply that we look deeper at some concepts of network theory, on which we build to draw hypotheses. This is the goal of the next subsection.

2.1.3 Explaining the emergence of novelty using network theory

Network theory, which we presented earlier, is a heterogenous set of propositions coming from various disciplines and research questions. It encompasses numerous concepts. The following paragraphs focus on specific network theory contributions that are useful to this study, i.e. the concepts of centrality and diversity, and the weak links, structural holes, and complex networks arguments. These arguments revolve around novelty and how it might emerge. They also deal with the diffusion of information which leads to the rise of novelty. They are thus relevant to this study. Then, the concept of interactions, central to a study of networks, is further clarified.

2.1.3.1 Concepts related to novelty and diffusion in network theory

Even though this study looks at complex networks and the diffusion of information as well, it here focuses on two concepts which appear particularly important to the study of novelty in network theory, i.e. centrality and diversity. Both concepts show the importance of interactions in the emergence of novelty.

Centrality generally refers to the extent to which a focal node is connected to the other nodes of a network. Being the most central node thus means being connected to more actors than the other nodes of the network. Centrality is a crucial concept of network theory. Having many interactions matters in many ways. Many analysts argue that centrality might give actors power and influence in a network (Borgatti et al., 2009). Indeed, centrality gives actors greater access to and control over resources (Brass, 1984). As argued in this study, a prominent resource exchanged in interactions is information. By being connected to the most actors, focal nodes might control information flows. Some scholars claim that central actors play a crucial part in the diffusion of information (Saito et al., 2016). Others argue that centrality might play a part in the innovation performance of actors (Tan et al., 2015). Centrality enhances cooperation because of the norms that actors share in the network (Powell et al., 1996). Bonding ties between actors of a network might participate in explaining the rise and diffusion of novelty in a network (Rogers, 2003; Coleman, 1988). The present study refers to the concept of centrality because it provides greater access to information, and it is

related to cooperation. Central TMNs have more partners, which might lead to more collaborations. They also have access to more information than other TMNs. This information might help them generate novel governance instruments.

Centrality can be measured in several ways. Degree centrality, which measures the number of nodes to which an actor is connected, is probably the most common way to define centrality. Another example is betweenness centrality calculates the length of the paths between a focal node and every other node. Closeness centrality measures the average length of all the shortest paths between a focal node and every other node in a network. Eigenvector centrality is more complex, as it considers the degree of a node, the strength of its ties, and the degree of the nodes to which it is connected to measure its centrality. While those are the most common measurements of centrality, others exist (e.g. information centrality, see Hafner-Burton et al., 2009). As I will discuss in Chapter 3, this study focuses on degree centrality, which, with its assumption of homogeneity (i.e. all contacts are equal) conveys the idea that information might come from anyone.

Diversity is another crucial concept for explaining the rise of novelty.²² Yet, it is often operationalised using more specific variables. Granovetter (1973) and Burt (1995) thus refer to bridging edges to convey the idea that some links connect different nodes or subnetworks. Similarly, they and other authors also often resort to the concept of brokerage, that is, the idea that one node may be an intermediary between groups that otherwise would not be connected (Everett and Valente, 2016; Valente and Fujimoto, 2010; Burt, 1995; Granovetter, 1973). Burt's constraint is a measure of the degree to which a focal node has many contacts that do not interact with each other within the focal node's ego-network (Burt, 2004).²³ Granovetter and Burt consider that it is through the diversity of contacts that a node might innovate, hence the importance of diversity in the study of novelty emergence.

Although the underlying idea of diversity as paramount to the rise of novelty underpins both Granovetter's and Burt's arguments, they bear noteworthy differences. The weak link argument states that innovation in a network usually comes from the nodes that are most

²² Environmental governance scholars have also underlined the importance of diversity in networks. Recent works include Burch et al. (2018).

²³ Burt's constraint is denominated as such in the R igraph package, often used for network analysis (see (Ognyanova 2016).

central but have weak relations to marginal nodes (Granovetter, 1973). Indeed, strong ties usually replicate among diverse nodes. A same set of ideas thus diffuses among them. Bridging edges, that is, edges that create contacts between nodes connected to other nodes in the network and nodes that are not connected to them, help explain the emergence of new ideas. To be sure, central nodes use the ideas of marginal ones, which are usually not widespread in the network, to generate novelty. In Granovetter's theory, the strength of links is essential to understand where novelty comes from. Burt's theory of structural holes (2008; 1995) is interested in the same phenomenon but explains it in a different way. It focuses on the way an actor who is positioned between two different networks or subsystems may combine ideas coming from them to generate an innovative arrangement thanks to a bridging tie. Both theories thus argue in favour of non-redundancy as a cause for the emergence of innovation. In other words, they argue that, to be innovative, a focal node needs to be connected to nodes that hold a marginal position in the focal node's network. These links will enable the focal node to have access to information to which its other contacts might not receive. The focal node might then use this different information to generate new ideas.

Yet, while the theory of weak links favours the distal cause (i.e. the presence of weak links among a focal node's edges indicates the connection to nodes which are poorly connected to the focal node's ego-network),²⁴ the theory of structural holes prefers the proximal one (i.e. the presence of one or several structural holes around a focal node indicates the connection to nodes which are poorly connected to the focal node's ego-network) (Scott and Carrington, 2011).

This study posits that the proximal argument is stronger than the distal one to explain the rise of novelty. Indeed, as Burt argues, although it confirms it, Granovetter's weak link concept is not necessary to observe the rise of novelty. What matters is to detect bridging ties. Granovetter uses the presence of weak links to indicate indirectly the existence of bridging ties. Burt's analysis reveals the presence of bridging ties directly, through the observation of structural holes (which contain bridging ties). Burt's analysis being more straightforward, this study favours it to observe diversity. Yet, since it wonders why some networks are more

²⁴ As will be explained in Chapter 3, ego-networks can be understood as all the direct connections (or one-step paths) of a focal node.

innovative than others rather than how networks generate novelty, it prefers to compare the diversity scores of TMNs rather than look at diversity in each TMN's ego-network. As will be further explained in Chapter 3, the present work thus builds on Burt's work to create its own measurement of diversity.

As in the case of centrality, there are many ways to measure diversity. Brokerage and Burt's constraint are two of them. Other measurements of diversity include measures of the categorical attributes of a focal node's contacts, or heterogeneity, which can describe patterns of interactions favouring or undermining social integration and an equality (Perry et al., 2018). As we will see in Chapter 3, this study focuses on a structural measurement of diversity close to the concept of Burt's constraint and a substantial measurement close to the study of alter's categorical attributes.

This study also draws on Barabási's work on complex networks (2002). Barabási shows that many real complex networks do not behave in the same way as do random networks, which have traditionally been used to represent complex networks. Whereas random networks are often visualised as being static, real networks witness some growth and follow the preferential attachment rule. Also known as 'the rich get richer' rule, this phenomenon shows that those nodes that are already rich in links are likely to get richer as time goes by. However, some nodes that are not rich can become richer if they are fit, that is, if they have the ability 'to compete for links at the expense of other nodes' (Bianconi and Barabási, 2001: 437). Real networks indeed also often respond to fitness, that is, those nodes that have an ability to make friends survive or even thrive in the network. Furthermore, most real complex networks are scale-free. No node is characteristic of all the other nodes in these networks (Barabási, 2002). Scale-free networks have a power-law distribution, whereas random networks usually have a bell curve. For Barabási (2002), the growth and preferential attachment characteristics of real complex networks lead to power laws and the emergence of hubs. These in turn show the self-organisation of real complex networks. Indeed, it is only when one or more nodes of a hub disappear that the order in the network is threatened.

Barabási's findings are more useful to the study of diffusion, another important area of investigation in network theory, than to the study of the emergence of novelty. Here, it is still valuable to this research as a reference to get a better understanding of the behaviour of

complex networks or nodes in complex networks. Barabási's research might help us explain the behaviour of nodes with a centrality degree that is a lot higher than that of most of the other nodes. Power laws and self-organisation, properties of complex networks, are also properties of complex systems. The possibility of hubs and clusters is also visible in complex systems. Referring to Barabási's study thus also highlights the strong links between complex networks and complex systems, which we will present in Section 2.2.

The previous comments underline that network theory has enabled a greater understanding of the emergence of novelty in networks, especially through the concepts of centrality and diversity. They also show that the study of interactions appears crucial to any study of networks. Thus, it is important to clarify the way this research uses the concept of interactions.

2.1.3.2 Interactions in the TMNs system

While I already defined the concept of interactions in Chapter 1 and presented arguments that refer to it above, it is important to clarify how I will use it in this study. This research looks mainly at the interactions of TMNs as the independent variable explaining the emergence of novelty. It is based on the idea that interactions bring information to TMNs, and that a lot of diverse information facilitates the emergence of novelty.

While network theory might only consider the structure of the network and focus on network attributes such as density, it often pays attention to the interactions among actors of the network, looking, for instance, at brokerage or clusters. The concept of interaction is so common in network theory that it is rarely defined. The same goes for the discipline of International Relations, although its refinements sometimes are. For instance, Lake and Powell define a strategic interaction as 'a situation in which an actor's ability to further its ends depends on the actions others take' (1999: 3). The concept of interactions can refer to a variety of processes. Some are confident that interactions refer to the influence mechanisms of the international realm and domestic politics: 'We all know about interaction; we all understand that international politics and domestic structures affect each other.' (Gourevitch, 1978: 882) Others consider that interactions between state and non-state actors are 'what constitutes [International Relations]' (Charountaki, 2018: 529) Interactions also often mean interdependence among actors or even systems. In an International Relations network

perspective, interactions refer to specific visible exchanges among actors or other entities. They can also imply interdependence.

This research defines interactions specifically as the membership and partnership relationships that unite TMNs and other actors. It measures TMNs' centrality and diversity looking at their membership and partnership interactions. This study considers that among the resources that interactions bring, information is the most important. Drawing from some studies which argue that collaboration brings learning (e.g. Powell, 1998), this study posits that all interactions may bring information to networks, although it focuses on memberships and partnerships. Memberships and partnerships evolve over time. Some cities opt out of TMNs after a while, because they no longer wish to pay membership fees or because they do not agree with TMN rules. Partnerships can be instituted only for a specific project, and not go further along after the end of that project. Here, interactions are reciprocal: when a TMN lists an actor as a partner, I consider that this actor also has said TMN as partner. As will be underlined later, the network studied in this work is undirected.

Most of the time, members are cities and local governments joining a TMN, or signing its charter and commitments. In a few cases, associations can be members. TMNs recognise their members as such or as signatories of their charter. All members are mentioned on TMN membership lists.

In contrast, partners work with TMNs to bring a variety of benefits to specific members or to the TMN in general. Partners are sometimes cities or local governments, but most of the time, they are non-city actors. Partners are harder to identify than are members. TMNs do not always display a partnership list, and when they do, it is most often not complete and up to date. Besides, it seems that they do not all mean the same by partnerships. Thus, this research identifies partners with actors explicitly designated as such by TMNs, as well as actors funding TMN activities or collaborating with them on specific projects.

Overall, network theory is crucial to help explain the role of interactions in the emergence of novelty. Envisioning networks as structures and actors helps pay attention to structural and agentic enabling conditions for the emergence of novelty. Besides, concepts of centrality and diversity seem particularly relevant to explaining this phenomenon because of the diverse

information they bring TMNs. Yet, as Kim explains, ‘While the knowledge about the underlying structure of a system is essential to understand its complexity, it should be noted that “network theory is not a proxy for a theory of complexity” (Barabási 2005, 70). In other words, a network approach will not reveal everything we need to know about [complexity].’ (2019: 17) Besides, network theory does not say much about the nature and content of the interactions at play in networks. While it hints at the importance of the information exchanged in interactions, it does not tell us specifically how interactions lead to the emergence of novelty. It also mostly ignores the context surrounding networks and their environment. A complex systems approach might help us better account for these issues.

2.2 The embeddedness of networks in a complex system

Using complexity approaches to explain the rise of novelty is a fruitful way to consider structure and agent in a single theoretical framework and pay greater attention to the nature and content of the interactions at play in the system under study, as well as the context in which the system and its environment evolve. This study thus uses it to complement its network approach.

There are important links between complexity approaches and network theory.²⁵ First, both approaches, which are relevant to the study of change, consider the interactions between actors within a system. For instance, studies that apply seminal network theory found that actors’ capacity to innovate may depend on the strength of their interactions with others or their position in a network (Burt, 1995; Granovetter, 1973). Likewise, complexity approaches, which show that in complex systems, change is the norm, not the exception, have revealed some of the trade regime’s internal dynamics (Morin et al., 2017). Furthermore, complexity approaches and network theory are complementary. Some networks are complex systems, and all complex systems can be considered networks (McGee and Jones, 2019; Morçöl, 2012). Network theory can be applied to the study of change, but focuses mainly on the stability of structures of interactions (Morçöl and Wachhaus, 2009). By contrast, complexity approaches explain change by examining the nature of interactions between complex systems entities. For instance, interactions might allow social learning processes to

²⁵ It is important to note that this paragraph was drawn from an article recently accepted with minor revisions. See Papin (2020).

develop and facilitate change in the system. Network theory looks at the backbone of a system; it is largely a structural theory. Complexity theory considers a system in a wider perspective in order to observe and model change (Kim, 2019; Morçöl and Wachhaus, 2009). It pays more attention to the content of interactions and the context in which lie the system and its environment than does network theory. According to Barabási, network theory is crucial to the development of complexity approaches: ‘Should a theory of complexity ever be completed, it must incorporate the newly discovered fundamental laws governing the architecture of complex systems’ (2007: 41).

The use of a complexity approach implies going beyond complexity as a buzzword. There is more to complexity than a substantial number of entities (Morçöl, 2012; Cudworth and Hobden, 2011; Axelrod and Cohen, 1999). Underlining the diversity of institutions in an issue-area of global governance, or even their interdependence, does not enable us to call it a complex system either. It is important to define more precisely what complexity entails and understand the relevance of that concept when applied to the system of TMNs.

The next subsections show that, despite the reluctance of International Relations to resort to complexity approaches, these prove fruitful to analyse the emergence of novelty. Complexity approaches encompass a great number of concepts and ideas, some of which might help us provide an explanation for the emergence of novelty. They nonetheless rely on a specific epistemology that must be laid out.

2.2.1 The relevance of complexity approaches

Complexity approaches, to which some refer as complexity sciences,²⁶ represent a set of theories interested in the nonlinearity of the structures and processes they study (Duit and Galaz, 2008; Mathews et al., 1999). They consider that traditional reductionist and linear methods and epistemologies are inappropriate for the analysis of the objects of study on which they focus, to which they generically refer as complex systems. They contend that many phenomena are hard or even impossible to predict because their multiple causes have non-proportional effects on the structure and its actors, hence the occurrence of catastrophes

²⁶ This study refers to complexity approaches rather than complexity sciences as the latter notion is sometimes contested given the heterogeneity of the set of theories it embraces. The former one is broader and thus less contested.

or the state of chaos in which some systems seem to be. Complexity approaches seek to account for sudden or unpredictable change.

Before discussing the details of complexity approaches, it is important to briefly describe their emergence in natural and social sciences, and International Relations.

For a long time, social sciences were dominated by a positivist and reductionist philosophy (Morçöl, 2001). This philosophy saw entities and events as connected by linear causal relationships. Newton viewed the world as a 'clockwork universe', which, according to Laplace, could be predicted (Mitchell, 2009). In the post-1945 period, several voices started to strongly oppose that dogmatic view of science in favour of the acknowledgement and study of complexity as such (Lee, 2006). For instance, Heisenberg's uncertainty principle, which states that it is impossible to simultaneously measure the position and momentum of a particle, participated in weakening the significance of predictions. General systems theory developed an interest in the irreducibility of wholes. It stressed the nonlinearity of systems, and their properties of emergence and self-organisation (Bousquet and Curtis, 2011). Cybernetics, with the idea of feedback, also played a part in the emergence of complexity approaches (Gadinger and Peters, 2016). In that context, Steinbruner (1974) highlighted the role of feedback cycles in political decision processes, arguing that decisions affect outcomes, which in turn return information.

Complexity approaches include diverse theories. One example lies in chaos theory and catastrophe theories, which are interested in the behaviour of nonlinear, unstable systems (Bousquet and Curtis, 2011). Dissipative structure ideas come from Ilya Prigogine's interest in open, non-equilibrium thermodynamic systems. Self-organised criticality focuses on the critical point of transition of dynamical systems.²⁷ The disciplines from which these perspectives depart vary, going from chemistry to meteorology, mathematics, physics or biology. They study a vast variety of natural and social complex systems, such as human brains, ant colonies, world or national economies, or the World Wide Web (Mitchell, 2009). Several disciplines of social sciences have participated in the development of complexity approaches. In economics, Arthur developed the notion of increasing returns (Waldrop,

²⁷ For some scholars, complexity sciences even go beyond the aforementioned perspectives, as they also encompass systems theory or cybernetics (see Duit and Galaz, 2008).

1992). This notion, based on the idea of positive feedbacks, challenges the classical view of negative feedbacks drawing a system back to equilibrium after a disturbance. Change happens in the system through positive feedbacks. In political science, Baumgartner and Jones (2002), while not referring explicitly to them, have used the ideas of nonlinearity and positive feedback. Through the notion of punctuated equilibrium, they have shown how change in a policy sometimes might not be linear and incremental but rather abrupt.

Few International Relations scholars have tried to use a comprehensive understanding of complexity and complex system. There are links between dominant International Relations theories and complexity approaches, however. Like complexity scientists, various International Relations scientists have favoured a systemic vision of the world. Neorealist theories, several social constructivist theories such as Wendt's (1992), or international political economy theories such as Gilpin's theory of cycles (1983), or Wallerstein's world-system theory (2004), use a systemic perspective in strikingly contrasting ways. While criticising Kaplan's general systems theory work, Waltz has built his own systemic theory of international politics (Bousquet and Curtis, 2011). Against many reductionist studies breaking the system into smaller pieces to explain international phenomena, Waltz advocates in favour of systemic approaches in order to build explanations of the whole (Waltz, 1979; see also Gunitsky, 2013). Harrison and Singer argue that 'Complexity is more than systems theory', however (2006: 25). Complexity thinking goes beyond systemic theorising, particularly in its understanding of emergence and of causes and effects. Complexity approaches do not contradict all the scientific principles on which classical system approaches are based, but claim they do not account for important fragments of reality (Duit and Galaz, 2008). They seek to complement other systemic theories. Talking about systems does not necessarily mean talking about complex systems. Therefore, neither Waltz nor the other scholars mentioned above fully integrate complexity, as understood by complexity approaches, to their theories.

Some International Relations studies, especially those studying regime and institutional complexes, have used the concept of complexity outside of a complexity approach theoretical framework (Orsini et al., 2013; Keohane and Victor, 2011; Raustiala and Victor, 2004). Alter and Meunier define regime complexity as 'the presence of nested, partially overlapping, and

parallel international regimes that are not hierarchically ordered' (2009: 13). Using ideas of interactions and overlapping of elements, and of feedback effects, they show a more complex understanding of global governance. Others focus on the notion of punctuated equilibrium, showing the discontinuity of change in some regime complexes (Colgan et al., 2012).²⁸ Likewise, some scientists describe institutional complexes in global governance as situations of complex interaction between several international institutions which interact to address issue areas and constitute interlocking structures (Oberthür and Stokke, 2011). These studies make significant efforts at considering aspects of the complexity of global governance. Nevertheless, they ignore fundamental principles of complexity approaches that rely on a less mechanistic understanding of the global governance social system.²⁹ The notions of nonlinearity and unpredictability appear particularly undertheorised. Nonlinearity is partly implied in the notion of punctuated equilibrium, as it shows the discontinuity of the process of change. It nevertheless lacks elaboration regarding the disproportion between causes and consequences, a crucial element of complexity approaches.

A few International Relations scholars have used more comprehensive complexity frameworks in their analyses of international politics. Jervis (1997) emphasises the importance of studying different kinds of interactions and considers that interactions and emerging properties define systems. They are what makes the whole 'different' from the sum of its parts (1997: 12-13). He also claims that prediction is difficult, although he does not consider it to be impossible. Jervis's understanding of complex systems, which he often described simply as systems in his 1997 monograph, is one of the earliest efforts in the integration of complexity approaches to International Relations. Another important contribution is Rosenau's 1995 essay on governance, which integrated notions of emergence and self-organisation. For this scholar, most researchers today consider complexity when studying world politics.

Although it is true that many works today stress the complexity of international politics and global governance, most of them overlook the epistemological implications of such an

²⁸ Colgan and colleagues draw on Krasner's work, in which he underlines that institutional change, rather than being incremental, is often sudden and follows periods of stasis. Krasner (1984) uses the idea of punctuated equilibrium as a metaphor to understand change.

²⁹ Several scholars have used an analogy for social phenomena based on evolutionary biology rather than Newtonian physics, thus using the idea of a biological rather than mechanical approach (Bernstein et al., 2000).

ontology. Rosenau himself, a decade after his 1995 essay, is sceptical of the possibility of using a comprehensive complexity framework for the study of world politics. With Earnest, he argues that complexity approaches have in fact led to very few results, if not none at all (Earnest and Rosenau, 2006; see also Gunitsky, 2013). Earnest and Rosenau also claim that there is no epistemology of complex systems in global politics and thus use a positivist one. While this study disagrees with this statement (as underlined in Section 2.2.2.2), Earnest and Rosenau's critique shows that, at least until 15 years ago, complexity approaches in International Relations were still sparse and heterogenous.³⁰

Recently, several scholars have started to promote the use of complexity approaches in the study of global governance, either generally or in the analysis of specific issue-areas (Orsini et al., 2019; Pattberg and Widerberg, 2019; Le Prestre, 2017; Young, 2017; Kavalski, 2015; 2007; Hill, 2011). Some authors have also used the concept of complex adaptive systems to theorise posthuman International Relations, which seeks to integrate non-human actors to the study of world politics (Cudworth and Hobden, 2011). These different studies build on diverse theories and ontologies. Several of them would probably oppose Cudworth and Hobden's post-human worldview. Using complexity approaches as an analytical framework analytically implies overcoming some ontological, epistemological, and methodological challenges with which scholars interested in complexity approaches are still struggling. For Waldrop, however, '[i]f the field seems poorly defined at the moment, it's because complexity research is trying to grapple with questions that defy all the conventional categories.' (1992: 9) Another reason explaining why complexity approaches remain seldom used is because they contradict many concepts and ideas embedded in the way we produce scientific knowledge.

The wider use of complexity approaches could benefit the discipline, however. Waldrop's comment points to a crucial reason why we should use complexity approaches: the questions with which they deal are distinct; they may thus ultimately give use new answers to the challenges of complex world politics. The Newtonian and mechanistic thinking which has

³⁰ This goes against Kavalski's claim of a fifth debate in International Relations based on complexity (2007). Kavalski argues that there is currently a discussion between a linear vision of the world embedded in traditional International Relations, and a nonlinear vision that is part of complex International Relations. Although research using complexity approaches has certainly gained ground in the discipline, it still seems too marginal to be called a complexity turn.

historically underpinned International Relations in order to reflect on world affairs has revealed its limits. This is especially visible regarding the notions of linearity and negative feedback enabling a return to equilibrium after a shock. A complexity turn, underlining the emergence of positive feedback loops and nonlinearity, may facilitate the production of new theories to explain some unpredicted changes of world politics over the last decades. This study posits it might also be useful to explain the emergence of novelty in TMNs.

2.2.2 Complexity approaches for the study of the TMNs complex system

The following paragraphs describe the concepts of complexity approaches that might help us explain why some TMNs generate more novel governance instruments than others.

2.2.2.1 *An understanding of complex systems*

A complex system has been defined as ‘a system in which large networks of components with no central control and simple rules of operation give rise to complex collective behavior, sophisticated information processing, and adaptation via learning or evolution’ (Mitchell, 2009: 13). Although it helps visualise the different features of complex systems, this definition lacks a clear distinction between the characteristics or attributes of systems and their properties, or what results from their characteristics (Le Prestre, 2017). Accordingly, this study understands a complex system as being made of a multiplicity of interdependent actors whose actions and interactions may go through distinct levels of action. The system is open, i.e. it interacts with its environment, which influences it and is influenced by it. Furthermore, it behaves in a nonlinear way, and might be affected by positive and feedback loops. Central properties of a complex system are its adaptability, self-organisation, and undetermined emergence of new characteristics (Orsini et al., 2019).

It is important to note that this study focuses on complex adaptive systems, considered by Rosenau as the core of complexity theory (2003; see also Hill, 2011). As Duit and Galaz explain, ‘While “complexity” defined in a general sense implies change, uncertainty, and limited predictability, complex adaptive systems have common features that result from their emergent properties.’ (2008: 317). A key notion is that of adaptive cycles, which explains long-term changes in complex adaptive systems (Allen and Holling, 2010).

Following several complexity theorists, I acknowledge interconnectedness, nonlinearity and openness on the one hand, and adaptability, self-organisation, and emergence on the other

hand, as features and properties of complex adaptive systems (Pattberg and Widerberg, 2019; Bousquet and Curtis, 2011).

A crucial characteristic of complex systems is the interconnectedness of their multiple elements. As argued before, the number of elements does not matter as much as their diversity and the diversity of their links (e.g. kinship, partnership, or competition). This idea echoes the question of diversity mentioned among the important concepts of network theory. These elements interact at multiple levels. Furthermore, complex systems are hierarchical:³¹ they are elements of complex systems and are simultaneously composed of several subsystems which themselves include subsystems (Simon, 1962).³²

The strong interconnectedness of the elements of complex systems leads to nonlinear behaviours. Nonlinearity is one of the most well-known principles of complex systems, and is also present in networks (Capra, cited Pattberg and Widerberg, 2019). It illustrates a disproportion between input and output, or what has been popularly described as the butterfly effect. In a regular system, one small action has small consequences because of linearity, which guarantees proportionality between actions. In a complex system, one small action might lead to large-scale phenomena. Quoting Duit and Galaz, ‘Small changes do not necessarily produce small effects in other particular aspects of the system nor in the characteristics of the system as a whole.’ (2008: 312). A small action might have important consequences because of its many interconnections with other elements of the system. Because of the many interconnections among the actors of the system, simple causality, i.e. one cause leading to a proportional consequence, is highly unlikely. For Capra, the relationships in a network pattern are nonlinear relationships. Information may go through a cyclical path which might turn into a feedback loop. Feedbacks and networks are firmly connected (cited Pattberg and Widerberg, 2019). Strange loops, that is, cycles going through different levels in hierarchical systems, might also occur (Hofstadter, 2007).

Another important concept of complex systems is openness. Openness stands for the notion that complex systems exchange information with their environment and are thus influenced

³¹ As in Simon’s work, hierarchy in complexity approaches is used in a wide understanding, which excludes the idea of a subordination of inferior levels to superior ones.

³² Hierarchy in complex systems is similar to the dual perspective of networks detailed in the former section.

by it. Openness participates in the possibility of contingency and evolution of complex systems. For Bousquet and Curtis (2011), this highlights the importance of paying attention to history in complexity approaches. What happens in the environment of complex systems and when it happens matters and helps account for change in complex systems. It also reveals the greater instability of complex systems than of closed regular systems.

Adaptation is one of complex systems' possible properties, in the sense that it derives from their characteristics. Many complex systems are indeed adaptive, meaning that they either learn to survive changes in their environment, or they evolve in a way that enables their survival. For Holling, complex adaptive systems evolve over time through transformational cycles of 'growth, accumulation, restructuring, and renewal' happening at different scales (2001: 392). The adaptive capacity of complex systems has been understood as reflecting learning, flexibility to experiment and adopt new solutions, and response to distinct challenges (Walker et al., 2002, cited McCarthy et al., 2011). Related to adaptive capacity, social learning refers to the learning of an individual based on the observations and interactions of the learner in and with their environment (Bandura, 1977, cited Pahl-Wostl, 2007). Social learning matters to a great extent, since it partly highlights the content of interactions. Interactions bring entities information from which they learn and might evolve and help their system adapt.

Related to that, another property of complex systems is self-organisation. To fulfil certain tasks and survive, complex systems form structures and patterns in specific ways. In Duit and Galaz's words, self-organisation 'occurs when agents are acting on locally available information about the behavior of other nearby agents.' (2008: 313)

Self-organisation leads to the concept of emergence. Emergence is the rise of properties of the system out of the behaviour of its individual elements but without prints leading back to those individual behaviours. In other words, it is an accumulation of local behaviours that is disconnected from its origins and is therefore undetermined (Morçöl, 2012: 68-69; Miller and Page, 2007).

All these aspects highlight the idea of change, which is fundamental in complex systems. This justifies the use of a complex systems approach against that of general systemic

approaches. Several rational systemic approaches have been accused of being too static and ignoring process (Ruggie, 1993; Wendt, 1992). Whereas classical systemic approaches seek to explain equilibrium, complex systems approaches stand for a theory of change useful to explain discontinuities in certain systems. They might also be fruitful to analyse the emergence of TMN novel governance instruments. Yet, this implies accepting distinct epistemological foundations.

2.2.2.2 A distinct epistemological concern

Since it differs from other dominant social sciences epistemological concerns, it is important to elaborate on the epistemology of complexity approaches. Kavalski argues that the discipline of International Relations needs new forms of knowledge that may help answer today's complex world politics issues (2015: 3). These new forms of knowledge imply different ontologies, epistemologies and ethics. Likewise, other authors note that 'If you take on board what it means to say the world is complex, this will change the way you think, feel, and act.' (Boulton et al., 2015: 1) Acknowledging and embracing the complexity of world politics implies revisiting one's epistemological assumptions. Some scholars have made efforts in that direction, yet we need to put forward the distinct implications of using complexity approaches, such as accepting or expecting uncertainty, unintended consequences and surprises.

The still dominant epistemology of classical social sciences is based on the capacity to identify and explain causes, and then intend to predict consequences. Building on a Newtonian tradition, it assumes the existence of general laws. To elaborate systemic theories in line with this epistemology, ontological assumptions of linearity and the closed nature of the system are crucial (Bousquet and Curtis, 2011). However, complex systems do not abide by the same rules as regular systems. Nonlinearity and openness make it very hard to predict their future states because of the multiple causes with nonproportional effects and new conditions that might appear and make hypotheses obsolete. Once we contend that the international system is an open one, prediction becomes vain (Wight, 2006). Besides, nonlinearity increases the difficulty to predict by challenging the proportionality between causes and effects.

Another important issue related to these perspectives is the uncertainty of the validity of the research, and the difficulty or, in some cases, the impossibility to predict the future states of those systems. The assumption of a complex and complexifying world and the implications of that complexity lead to greater uncertainty regarding both the outcomes of the studied phenomenon and the validity of our scientific findings and conclusions. In complexity approaches, uncertainty is either too strong or present in too many aspects to eliminate. Therefore, we must acknowledge and accept it. Accepting uncertainty implies reflecting on what this uncertainty is and where it lies. Gerrits distinguishes different degrees of uncertainty (2012: 111). Although there can be certainty in determined sequences of events, uncertainty integrates the possibility of change. Stochastic uncertainty, then, refers to uncertainty in which some probability can be assigned to the uncertain event. Regarding non-stochastic uncertainty, there is no way to determine the likelihood of an event.

Acknowledging uncertainty as such entails integrating an epistemology that considers the unpredictability of the system. The uncertainty related to complex systems goes beyond the amount of information to which we have access. In other words, even if there were perfect information regarding a complex system, there would still be uncertainty. Indeed, in a linear system, outcomes can be explained by studying and assembling the actions of individual entities; in a nonlinear system, outcomes are impossible to predict. The openness of complex systems also affects the capacity to predict. Prediction models are based on the idea of closed systems in which one assumes empirical invariance under specific known conditions (Bernstein et al., 2000). In Kavalski's understanding of a nonlinear world (2007), scholars need to admit to the existence of different realities, based partly on impressions, constructions and experiences. Unpredictability is the norm and predictability the aberration. This is in line with Rosenau's argument that 'uncertainty is the norm and apprehension the mood' (2003: 208; cited Kavalski, 2007: 443).

Overall, accepting uncertainty in complexity approaches implies revisiting the classical goals of explaining and predicting of the positivist research philosophy. For Le Prestre (2017), prediction in a complex system is impossible because distinct causes may have one same effect and similar causes distinct effects. Consequently, we need to keep in mind that the causal links and processes we might detect in complex systems are possible states or plausible

scenarios of what might happen in a specific context rather than general laws.³³ Similarly, we need to move away from the will to produce parsimonious theories that explain much with few variables.

Complexity implies a certain vision of causality. As Earnest mentions, ‘the presence of complexity means that causality itself—its presence, intensity, and direction—is not stable over time, or even within parts of the same system’ (in Kavalski, 2015: 46). This drives us away from a perception of causes as general or universal laws, true at any time. Context matters to a great extent. When looking for causes, we must consider the time frame in which the studied event has occurred, and on which depends the validity of our inferences. In other words, when looking at the possible reasons explaining why some TMNs generate more novel governance instruments than others, we must keep in mind the evolution of the TMNs complex system. Because the number of TMNs has increased in the last decade and they thus cannot ignore each other and are bound to interact, looking at their interactions today is crucial. As some interviews underline, TMNs seem to need each other (Interviews 9 and 11). Interacting and exchanging ideas to innovate and adapt a constantly changing world seems crucial to their survival. This study does not consider interactions to be the sole cause for the emergence of novelty, but sees them as a significant variable in a period of strengthening of TMNs in global climate governance.

Complexity approaches involve different ontologies, epistemologies, and possibly methodologies. Using them might help us provide a new explanation for the emergence of novel governance instruments in TMNs. In that sense, the next paragraphs show how we can apply complexity approaches to the study of TMNs in global climate governance.

2.2.2.3 The system of climate-related TMNs as a complex system

A few authors have started to use complexity approaches to study global environmental governance (Le Prestre, 2017; Young, 2017; Bulkeley et al., 2014; Hoffmann, 2011; 2005). Drawing from their research, the following paragraphs show that we can study the system of TMNs as one single complex system comprising 15 TMNs, their members, and their partners, the selection of which will be explained in Chapter 3.

³³ Possible states and scenarios seek to reflect the implications of distinct possible pathways (Miller et al., 2014).

First, this system has a multiplicity of elements, namely the different TMNs involved in climate action, their member cities, and their various partners, including (but not limited to) states, IGOs, NGOs, or regions. This diversity of actors is significant, especially since the TMNs system, embedded in global climate governance, is multilevel (Jänicke, 2017; Betsill and Bulkeley, 2006). It is centred on transnational actors, i.e. TMNs, but includes a variety of actors present at other levels. International actors, either countries or IGOs, thus work more and more with both transnational and local actors, who have progressively gained prominence (Bulkeley et al., 2014). Transnational actors may be subnational actors acting on their own, not on behalf of their state, at the global level. As explained earlier, we may consider TMNs as both structures gathering transnational actors and transnational actors themselves. We may also envision them as a complex system, or as a subsystem of the global climate governance system. The Conferences of the Parties (COPs) to the UNFCCC, an international event, now comprises states and many nonstate actors who dialogue and negotiate, whether in the official negotiation zone or in the civil society zone.

The interconnectedness of actors is also visible looking at specific entities, such as the Covenant of Mayors for Climate and Energy (CoM, or Covenant of Mayors). CoM, which gathers more than 8,000 cities and local governments and thus represents the largest TMN in the European Union in terms of membership, was created by the European Commission. It depends on it for funding. The European Commission also needs the CoM, since it is a way for it to further its climate and energy policy among European cities (Kern, 2019). The CoM office is managed by several entities, among which the TMNs Energy Cities, Climate Alliance and Eurocities. The CoM has about 350 partners, such as other TMNs, European institutions, governmental agencies, and local and regional governments, which provide funding, technical assistance or strategic guidance to CoM members. These in turn gain influence and visibility from CoM's activism. This reveals the interconnectedness of an important part of the entities of the TMNs system.

The TMNs system is hierarchical. Its entities work from different levels which we need to consider for a complete analysis of the system. When describing global climate governance, Jänicke (2017) considers six levels, i.e. the global, the world regions, the national, the state or provincial, the local, and the micro levels. These are visible also in the TMNs system.

Actors might generate strange loops from the bottom to the top, when a city bypasses the transnational level to interact directly with international actors. This might happen, for instance, when a city directly reports its climate action on the NAZCA website, a platform operated by the UNFCCC to display the commitments of non-party stakeholders. Another relevant example lies in the interdependence of international and subnational actors regarding the elaboration and implementation of the Paris Agreement. The drawing of an international agreement on climate creating obligations for states must come from the international or regional level. However, its implementation implies action by subnational actors.

The TMNs system is also nonlinear. Cities started to act transnationally on climate issues as early as the 1990s, with the work of TMNs such as ICLEI or Climate Alliance, which now have the support of more than 1,500 cities and local governments each. Nevertheless, cities really started to be heard and gain visibility through the actions of TMNs that had fewer members but more political support, such as C40, funded by Bloomberg Philanthropies.

Finally, the TMNs system is open. It interacts with and influences actors coming from other systems, such as international actors who do not collaborate with TMNs but whose decisions might still impact them. For instance, the U.S. Federal Government's declaration to withdraw from the Paris Agreement, which was taken by an actor that does not belong to the TMNs system, influenced the behaviour of actors of the TMNs system (i.e. U.S. C40 member cities) which pledged to 'adopt, honor, and uphold the commitments to the goals enshrined in the Paris Agreement' (Climate Mayors, 2017). The behaviour of TMNs might also affect the environment of the TMNs system.

The system of climate-related TMNs meets all the aforementioned characteristics of a complex system, hence its characterisation as such in this study. Complexity approaches are both beneficial and relevant to the analysis of the emergence of novelty. Concepts of interconnectedness, nonlinearity, adaptation, and social learning are particularly useful to explaining the emergence of novel governance instruments. Yet, while complexity approaches do not refute the significance of actors and their attributes, they say few about their role in the emergence of novelty. Thus, using some insights from another perspective, such as organisational theories, might be beneficial.

2.3 A system made of networks and organisations

As mentioned earlier, this research focuses on the interactions of TMNs to explain the emergence of novelty. While seeing interaction variables as crucial, it does not ignore the possible significance of other variables. Actor attribute variables might also play a role in the emergence of novelty. To study these variables, this research uses organisational theories, which are interested in the functioning and evolution of, as well as the changes within organisations. Organisational theories also look at the interests of organisations. They show that organisations seek to survive; to do so, they must satisfy their needs in resources (Abbott et al., 2016b). The next subsections underline the relevance and benefits of using an organisational perspective, introduce the ideas that complement this study's theoretical framework, and show the imbrication of the three sets of theories presented in this chapter.

2.3.1 The relevance of organisational theories

Using organisational theories is relevant considering the dual perspective of networks that this study uses. Indeed, while seeing networks as structures of interactions, I also envision them as actors of global climate governance. As mentioned in Section 2.1.1.2, the perspective of networks as actors encompasses the vision of networks as organisations. Organisational theories picture organisations as ‘agentive and autonomous actors, despite their dependence on their constituent units for resources and personnel’ (Ellis, 2010). Seeing states as primary international actors, International Relations scholars have traditionally been reluctant to see international organisations as agentive. Some see the design of international organisations as rationally elaborated by states to serve their interests (Koremenos et al., 2001). Likewise, some researchers see international organisations as entities representing states to implement international norms and commitments (Abbott and Snidal, 1998).

Yet, several International Relations scholars have used organisational theories in their research. A few have resorted to them in order to analyse the relationship between organisations and their environment. For Rosenau (1990), organisations face turbulence, that is irregular or unpredictable changes, when their environments are complex and dynamic. These turbulences go beyond levels of analysis. Other scholars have used organisational theories for the study of internal organisational processes and of the autonomy and agency of international organisations. Barnett and Finnemore (2004; 1999) have identified the

pathologies of international organisations looking at the limits of bureaucracies. Hooghe and Marks (2015) argue that the authority of international organisations, visible in delegation by states and pooling of collective decision making entities, is related to their policy scope and the scale of their membership. Johnson (2014) has linked the emergence of some international organisations to the involvement of international bureaucrats. Some even argue in favour of an organisational turn regarding the study of international organisations in International Relations (Ellis, 2010).

These different studies on international organisations show that using insights from organisational theories might help us address issues related to the different levels of analysis of organisations. They highlight that organisations are made of individuals (such as international bureaucrats). They also represent a whole with inner dynamics. Furthermore, the variety of international organisations represent diverse populations, understood as 'sets of organizations engaged in similar activities and with similar patterns of resource utilization' (Baum and Rowley, 2002, cited Abbott et al., 2016b: 257). In addition, interconnected organisations might represent a network or a system or be part of one, as in regime complexes, which also encompass other kinds of international institutions (Raustiala and Victor, 2004). Therefore, as I will discuss later, there are links between organisations, networks, and systems. This makes possible an analysis combining network theory, complex systems approaches, and organisational theories.

It is important to note that, although the studies mentioned above look at international organisations, I contend that we can also apply organisational theories to the study of TMNs envisioned as organisations. As argued in Chapter 1, the city networks selected for this study are formal, meaning they have at least a staff and a website. This formalisation makes them easier to observe, and enables us to see TMNs as organisations.

We now need to see which insights from organisational theories are important to this study.

2.3.2 A few insights from organisational theories

While some have highlighted some barriers to change in organisations, few International Relations studies using organisational theories have looked at the drivers of novelty therein. Organisational theories have produced a lot of work on this issue, however. While analysing

relational variables such as the diversity of collaborators (Nieto and Santamaría, 2007), they have identified internal actor attribute variables. Among those, I consider two that are relevant to this research. I posit that TMNs need time and money to generate governance instruments. More specifically, I look at age and organisational resources as possible variables influencing the emergence of novelty in TMNs. A recent TMN interacting a lot with other actors of the TMNs complex system might not be able to generate novel governance instruments if it does not have as much time as other older TMNs. It might also need time to create membership and partnership interactions with others. We should note that age has been observed as a predictor of network behaviour in network studies (Powell et al., 1996). Furthermore, interactions provide resources in the form of information, but other resources might be necessary to generate novel governance instruments, i.e. staff members dedicated to helping their members achieve certain climate-related goals. Resources in general are also often discussed in network theory, although they might appear as an outcome of the centrality of actors.

The relationship between organisational age and resources on the one hand and the emergence of novelty on the other hand is ambiguous, however. Some organisational theory studies have pointed to a positive relationship between organisational resources and novelty emergence (Laosirihongthong et al., 2014; Crossan and Apaydin, 2010). Organisations that have more money, staff, or technical resources might be more likely to generate novelty. Large organisations, which might have more resources, are also thought to be more innovative (Strang and Soule, 1998). In contrast, other research has identified a negative relationship between them. In that context, some argue that a scarcity of resources forces actors to be creative, which in turn helps them generate novelty (Löfqvist, 2017). According to others, the younger the organisation, the greater the drive to innovate and generate tools that will match its goals, the more flexible, the fewer bureaucratic rules (Le Mens et al., 2015). Age is seldom positively correlated with novelty emergence in organisational theories research. Yet, we might assume that being in the TMNs complex system for longer might give TMNs time to generate more novel instruments.

This research posits a positive relationship between age and organisational resources on the one hand, and the emergence of novelty on the other hand, because of the way novelty is

measured. Age here refers to the number of years that have passed from the time of launch of each TMN until 2018.³⁴ The other attribute variable studied is the amount of TMN organisational resources. This study observes organisational resources looking at the number of staff per city member in each TMN. The organisational resources score gives us an idea of the budget of TMNs, an information that was difficult to find in the documentary observation process. Besides, I measure novelty looking at the number of novel governance instruments TMNs either generated or adopted after their emergence in other TMNs. The TMNs that generate the most novelties in the system are the ones that have generated most novel instruments. When some TMNs have the same number of novel instruments, the ones that rank higher in the novelty ranking are those that have more promptly adopted instruments generated by others. This measurement is therefore quantitative rather than qualitative. I assume that generating or adopting more instruments implies more time and resources, hence the positive relationship posited between age and organisational resources and the emergence of novelty.

Thus, interactions are the most important variable to which this study looks to explain the emergence of novel governance instruments, but it is not the only one. Indeed, as will be explained in greater detail in Chapter 5, interactions most likely are not the only variable at play in the emergence of novelty. Some variables related to the characteristics of the 15 TMNs must be considered. This study thus looks at age and organisational resources as other variables possibly influencing the emergence of novelty. As I will later discuss, three control variables are also considered: TMN geographical scope (i.e. the location of TMN members), thematic scope (i.e. the broad issue that TMNs address), and the nature of founders (i.e. the actors who launched the 15 TMNs).

Before specifying the hypotheses stemming from this study's theoretical framework, it is important to say a few words about the imbrication of the three sets of theories presented in this chapter.

³⁴ 2018 is the year chosen for the end of the governance tool data collection.

2.3.3 The imbrication of network theory, complexity approaches and organisational theories

A theoretical framework building on different sets of theories to explain the emergence of novelty needs to be coherent. The distinct arguments it uses must complement each other. The next paragraphs highlight the imbrication of networks, complex systems, and organisations, and of network theory, complexity approaches, and organisational theories. They also show that this framework is relevant to explain the emergence of novel governance instruments in TMNs.

Organisations are an important unit of analysis of this study's theoretical framework. This study does not analyse specifically each entity taking part in a TMN, but rather observes TMNs wholly, as organisations comprising a diversity of individual elements. As mentioned earlier, an important insight of organisational theories lies in the possible agency of organisations. Organisations are actors and agents with specific goals and strategies to achieve their goals, possibly influencing other actors. They develop and implement their strategies considering their attributes, which might hinder or facilitate their action. The variety of actors who are part of TMNs participate, at least indirectly, in the strategies TMNs develop to achieve their goals. This study focuses on two actor attributes that might play a role in the emergence of novel governance instruments, i.e. age and organisational resources.

TMNs are simultaneously networks of cities and non-city actors acting as their members or partners. Their main objective is most often to connect cities together, or connect them with other actors that might help them achieve their climate action goals. As networks, TMNs are both structures of interactions and actors of global climate governance.

Furthermore, organisations that are connected among themselves represent a network. Thus, interacting TMNs represent a network of networks. This study focuses on 15 TMNs, and a network encompassing these 15 TMNs, and their members and partners.

Besides, a network can be seen as the backbone of a system (Kim, 2019). Using a systemic approach enables us to pay attention not only to the interactions of the actors included in the network, but also to the nature thereof and to other processes that might be at play in the system of 15 TMNs, and their members and partners. These processes include interactions of the TMNs complex system and its environment.

This study thus posits an ontological imbrication of organisations in networks and systems. Theoretically, it sees network theory, complexity approaches, and organisational theories as forming a coherent theoretical framework. A network approach enables us to look at the structure of interactions of the system. It also pays attention to the agency of networks through its interactions with other actors. A systemic approach considers the nature and content of the interactions at play in the system. In the case of complex systems approaches, it also adopts a dynamic perspective which pays attention to the effects of time. Besides, it does not ignore the role that actors might play in the system. Lastly, an organisational perspective highlights the significance of agency in explaining change, a point with which the two other approaches agree but that they do not analyse. It complements them by looking more closely at the attributes of organisations that might help explain change.

Using complexity approaches in addition to network theory might seem redundant and unnecessary. Indeed, we might refer to several concepts of complexity approaches (e.g. interconnectedness, hierarchy, or nonlinearity) through network theory and thus avoid complexifying this study's argument. Yet, using complexity approaches leads to a holistic approach that integrates the idea of evolution of networks and the entire system. As argued above, while network theory looks at the backbone of a system, complexity approaches explain change by examining the nature and content of interactions among complex systems entities and also considering their context (Kim, 2019). Complexity approaches use a wider perspective to observe change. They thus appear as complementing the network approach described in Section 2.1. Therefore, I deem them useful to the present study that seeks to explain why some TMNs generate more novel governance instruments than others.

Likewise, the use of both network theory and organisational theories might appear redundant, since the network-as-organisation perspective already studies organisations. There are overlaps between the study of networks as organisations and organisational theories, but the latter are broader. They encompass analyses that do not specifically apply to networks, but to organisations in general. Thus, they might provide insights on organisations that the network-as-organisation perspective does not include.

While there are clear links between networks, systems, and organisations, it is also coherent to combine network theory, complexity approaches, and organisational theories in a single

theoretical framework. The imbrication of these three sets of theories is coherent, and each theory complements the other two with slightly different insights. This framework appears to be the best suited for the study of the novel governance instruments of TMNs. As I will discuss in the conclusion of this study, there are other ways to explain the emergence of novel governance instruments in TMNs. Theories on policy learning, multilevel and polycentric governance, or delegation and orchestration are some of them. Yet, each of them has flaws that make it unsuitable for this study. One limit is the fact that these theories focus either on agents or on the structure. They lack the dual perspective that this study deems crucial to the analysis of the enabling conditions for the emergence of novelty.

The imbrication of network theory, complexity approaches, and organisational theories highlights the relevance of this study's theoretical framework analysing the enabling conditions for the emergence of novelty. It is now necessary to present the specific hypotheses built from this framework and that the empirical analysis will test.

2.4 Hypotheses

The hypotheses drawn in this study build on network theory, complexity approaches, and a few insights from organisational theories. As suggested earlier, these can be used in a single theoretical framework without incoherences. This study's framework does not imply that only interactions matter for the rise of novelty, but rather that it is crucial to consider them when studying such a phenomenon. Complexity makes it difficult to detect the weight of interaction variables in the emergence of novelty in comparison to other types of variables (such as actor attribute ones). Context matters, and interactions might not be as significant as other variables depending on the timeframe. At a time of increased interactions between TMNs, those should be more significant than when the first TMNs emerged.

Drawing from the three sets of theories mentioned in the present chapter, this study sees the emergence of novel governance instruments as follows. In the complex system of TMNs, this study sees interactions as key enabling conditions for the emergence of novel governance instruments. TMNs that are *central* and have *diverse* contacts have access to important amounts of diverse information. They *learn* from this information and are thus able to generate novel governance instruments, or adopt the novel governance instruments of others. While interactions are key in explaining the emergence of novelty, *age* and *organisational*

resources must be considered as well. The *longer* a TMN has been in the system, the greater its chances to generate novel instruments. Likewise, the higher its *organisational resources*, the greater its chances. The *social learning process* through which TMNs go following their interactions helps them *evolve* in their governance practices. This *evolution* overall facilitates the *adaptation* of the system to changes in its environment such as new constraints of global climate governance. *Evolution* is paramount to the survival of TMNs and the *adaptation* of their system. TMNs act as *structures* of interactions which attract information. They also appear as *actors* that use this information to evolve and ensure their survival.

This theoretical framework helps answer the question ‘why do some TMNs generate more novel governance instruments than others?’ It focuses on a few important concepts and ideas of the three sets of theories mentioned in this chapter. The next paragraphs specify the link between these concepts and ideas and the hypotheses to which they lead.

2.4.1 Centrality and diversity

Centrality and diversity are two important concepts of network theory. As argued in Section 2.1.3.1, centrality appears crucial to power and influence of actors, and reveals numerous bonding ties. Centrality and diversity also appear more implicitly in complexity approaches. The nonlinearity element of complex systems suggests that the behaviour of an actor with apparently few resources might have great effects on the system. Its interconnectedness might be key. If this actor is connected to many actors, or to actors that are themselves connected to many actors, his or her actions may affect many people. This idea echoes the concept of centrality in network theory. Besides, complexity partly emerges through the diversity of actors and the diversity of interactions. Centrality and diversity are absent from organisational theories, however. This study uses insights from organisational theories because they offer valuable analyses of actor attribute variables. They are less useful to study interactions.

This hypothesis also draws on Burt’s structural argument that novelty comes from actors that represent bridging ties between two subnetworks or subsystems. It assumes that a diversity of information is key to the emergence of novelty. To receive diverse information and ideas, actors need to have contacts of distinct natures or working on different issues. They also need contacts to which no other actor in the network is connected. These contacts might indeed

provide information and ideas no one else has. Actors that are diverse in terms of contacts have access to information and ideas other actors might not have. They may turn these different ideas into new arrangements, i.e. novel governance instruments. The importance of diverse contacts for the emergence of novelty is not present only in network theory. Studying urban sustainability transformations, understood as a form of novelty, Burch and collaborators also see a diversity of actors as paramount (2018: 305).

Complexity approaches give us a better idea of what interactions enable. Bonding ties enable central actors to receive the most information, process it and thus have knowledge regarding key issues in and of the system, what has and has not been done, and what might and might not work. Ultimately, this greater knowledge helps actors generate new arrangements to evolve in a changing environment.

Building on network theory and complexity approaches, this study expects centrality and diversity to affect the emergence of novel governance instruments. It also expects them to go together. Having a lot of information, but information others have (i.e. being central but not having diverse contacts) may not enable actors to generate arrangements that have not been generated before in the TMNs system. Likewise, having few diverse contacts might give access to information others do not have, but this information will unlikely be sufficient to lead to a sufficient knowledge of the system and its environment enabling the emergence of novel instruments.

Thus, this study's first hypothesis is as follows:

H1: The TMNs generating the most novel governance instruments are likely to be central and have diverse contacts in the TMNs complex system.

2.4.2 Age and organisational resources

As pointed out earlier, while it seeks to show the significance of relational variables, this study contends that actor attribute variables might matter as well to explain the emergence of novelty. To consider the weight of actor attribute variables, it draws a hypothesis arguing in favour of the significance of actor attribute variables. To observe and measure actor attribute variables, this study uses organisational theories, which, among other aspects, look at the evolution of and change in organisations.

Network theory does not refute the significance of actor attribute variables. It sometimes sees age as a predictor of network behaviour (Powell et al., 1996). It also generally links resources to centrality. Yet, it does not provide detailed analyses of these variables, since it focuses on interaction variables.

Novelty is here understood as the number of governance instruments created by TMNs, although it also considers the early adoption of novel tools (see Chapter 3). It thus has a strong quantitative component. Being in the TMNs complex system for longer might give TMNs more time to generate novel instruments. Consequently, this study expects older TMNs to generate more novelties since they might have more novel instruments than younger ones. Furthermore, TMNs with more organisational resources (understood as the number of staff per TMN member) are deemed more likely to generate novel governance instruments. More resources might indeed lead to the creation of more tools, hence possibly more novel tools. More staff may also mean more attention given to the needs of city members, which might lead to more diverse instruments. Furthermore, more staff may mean more resources to analyse the information received and transform it into novel instruments.

Thus, this study expects that the older the TMN and the more organisational resources, the more novelties it might generate. It expects age and organisational resources to go together. Although having more time than newer TMNs might help generate novelty, it is unlikely to be sufficient for the emergence of novelty. Generating novel instruments does not depend only on having time to do so. Likewise, given the ambiguous interpretation of organisational resources in the emergence of novelty, I expect it not to be sufficient. Having a lot of staff might help generate novel instruments, but it is unlikely to be an enabling condition for the emergence of novelty on its own. Resources and time combined might represent a set of insufficient but necessary components of causal conditions that are unnecessary but sufficient for the outcome. Together, they might lead to the emergence of novelty, hence this study's second hypothesis:

H2: The TMNs generating the most novel governance instruments are likely to be among the oldest ones and the ones with most organisational resources.

2.4.3 Social learning and evolution

The last hypothesis of this study encompasses the preceding ones in order to explain the causal process in-between interactions, novelty and the evolution of TMNs. H3 differs from H1 and H2 in its nature. While the latter are interested in revealing causal relationships, the former seeks to uncover a causal process. More specifically, H3 envisions a chain of causal relationships between these elements. Doing so, it seeks to help explain why TMNs interact and generate novelties.

This study posits that not only do TMNs generate novel governance instruments, they themselves evolve over time. It builds on the dual perspective of TMNs as structures and actors, and on the social learning argument of complex adaptive systems theory. Interactions seem to be necessary for TMNs to learn from others, evolve and help the system adapt to a constantly changing environment. Through interactions, TMNs learn and use these learning to either generate novelties or adopt the novelties of others. Generating novel governance instruments might be a way, albeit not a unique one, for actors to evolve, which might help the system adapt to a changing environment and better confront unintended consequences and surprises. Adopting the novel governance instruments of others might be another way to evolve. TMNs might evolve in relation to their areas of interest, internal organisation, or practices. Interactions might help TMNs survive in a world with limited resources in which they must fit. Furthermore, their numerous diverse partners enable them to learn about norms and practices that may exist inside the TMNs system or even outside of it.

Social learning is an argument developed in complexity approaches, among other theories. It is linked to questions of adaptation. Organisational theories have worked on social learning as a process at play inside organisations (e.g. Chong et al., 2018; Harrison and McIntosh, 1992). They link learning to the diffusion of innovations and the adoption of decisions inside organisations (Chandler and Hwang, 2015).

The notion of social learning is not explicitly expressed in network theory because network theory focuses on interactions rather than the nature thereof. Yet, interactions clearly refer to the dual nature of networks. As structures, TMNs connect distinct actors together, enable information to flow and social learning to occur. They create opportunities and constraints which influence the behaviour of the actors inside the network. As actors, TMNs use the

information that led to social learnings to generate novel governance instruments or adopt the novel instruments of others. This enables them to evolve especially in their practices. This evolution, in turn, might facilitate the adaptation of the system to its changing environment. Even though it is not prominent in the explanation of novelty emergence, the intentionality of TMNs matters. Information does not automatically lead to the evolution of TMNs and the adaptation of the system. From the information they gather, TMNs learn about techniques or tools to evolve, which they choose to use to change and have a better chance of survival. The simultaneous evolutions of TMNs might lead to the adaptation of the system.

This study's last hypothesis posits a chain of causal relationships as follows:

H3: Social learning follows interactions, and precedes the emergence or adoption of novel governance instruments, and the evolution of TMNs.

2.5 Concluding remarks

To conclude this chapter, this study offers a new explanation of the emergence of novelty in climate-related TMNs. This explanation mostly builds on network theory and complexity approaches to focus on the interactions of TMNs as an independent variable. The use of network theory and complexity approaches underlines a systemic ontology that does not ignore the presence and possible influence of agents. The theoretical stance in network theory taken here is based on a dual understanding of networks as structures and actors. The use of network theory also allows us to emphasise the concepts of centrality and diversity as crucial enabling conditions for the emergence of novelty. Complexity approaches seem to support the significance of centrality and diversity. They also enable us to examine the nature and content of the interactions linking actors of a system. Social learning appears to be an important notion in clarifying the role of these interactions. Indeed, interactions might enable social learning processes facilitating the emergence of novelty.

This framework does not completely exclude the possible effects of actor attributes, however. To explain more specifically how the attributes of actors might help explain why some generate more novelties than others, adding insights from organisational theories to this study's framework is relevant. Age and organisational resources might be significant here. Altogether, network theory, complexity approaches, and organisational theories provide a

coherent framework for explaining why some TMNs generate more novel governance instruments than others.

This study is based on an epistemology which embraces uncertainty, and understands causality as context-specific. In other words, it asserts that the interactions of TMNs currently matter to a great extent to explain why some TMNs generate more novelties than others. Yet, it is possible that, at other times, such as the emergence of the TMNs complex system at the end of the 1980s and the beginning of the 1990s, actor attribute variables might have been more significant in explaining the rise of novelty.

The three hypotheses emerging out of this study's theoretical framework will be tested in Chapters 5 and 6, while Chapter 4 will focus on analysing the novel governance instruments of TMNs, i.e. this study's dependent variable. Beforehand, it is necessary to present the methods used for the empirical analysis. This is the goal of the next chapter.

Chapter 3 Analysing novelty and its roots

This research includes an empirical investigation seeking to test the hypotheses introduced in Chapter 2. This investigation is based on a mixed-methods design which the present chapter seeks to present.

The complex system of TMNs under study includes 15 TMNs, selected according to specific predetermined criteria. As TMNs, they are all formalised, they have a majority of cities among their members, and work across borders. Besides, this research only selected TMNs that: saw climate action as one of their priorities, had at least one city member in the European Union, and were operational at the time of the data collection. The complex system of TMNs comprises the 15 TMNs that corresponded to these criteria, as well as their 2018 members and partners.

The data collection, which consisted of a documentary observation, a literature survey, and interviews led to the gathering of quantitative and qualitative data. In line with a network theory and complex systems approach, this study used social network analysis to observe and analyse the interactions of TMNs with their members and their partners. The analysis was conducted on 15 cases only. It enabled me to run correlation tests and observe possible cases confirming or infirming the theory. Yet, a small number of cases could not allow the drawing of causal inferences. Supporting the social network analysis with other methods appeared crucial. In that sense, a qualitative analysis using cross-case analysis and synthesis strengthened the findings of the social network analysis. The purpose of the qualitative analysis was not to triangulate results, but to expand them by investigating the causal process at work between interactions and the emergence of novelty. A comparative case study considering the similarities of the independent variables and the differences on the dependent variable aimed to better explain anomalies found in the social network analysis and left unexplained by the cross-case analysis. Using the analytic technique of explanation building, it uncovered other aspects of the causal process between interactions and novelty emergence. Overall, these techniques complement each other, but also represent a coherent design enabling the testing of this study's hypotheses.

The next section clarifies the criteria used for the selection of the TMNs under study and identifies the TMNs complex system. Afterwards, I detail the data collection, looking first at the documentary observation process, then at the interviews, and at the literature survey. Finally, I present the data analysis is presented in three steps, i.e. the social network analysis, the cross-case analysis, and the comparative case study. Overall, this study is a qualitative analysis research that builds on diverse methods in line with the theoretical framework presented in Chapter 2, to enable results that consider the causal relationship and process between independent and dependent variables and anomalies.

3.1 The identification of the TMNs of the complex system

In order to start this research's empirical analysis, it was necessary to detect the TMNs complex system. This implied setting up criteria for the identification of the TMNs around which the analysis would revolve. Setting those criteria enabled me not only to identify the TMNs that are part of this study's empirical investigation, but also discern the borders of the complex system. This was all the more important as there is today a great variety of TMNs and city networks (Acuto and Rayner, 2016). To form a complete network and observe all the nodes and edges that are part of it, it was crucial to include all the TMNs that fall under the definition set by the selected criteria.

3.1.1 The criteria for the selection of the TMNs under study

It is important to recall that this study looks at TMNs understood here as a subcategory of city networks. As mentioned in Chapter 1, TMNs are formalised networks. Among the diverse city networks that evolve in global governance, many are informal, such as those gathering global cities (Sassen, 1991). They are made of cities that work together without being part of an association or formal alliance. These city networks may be quite numerous. Yet, they are also harder to detect, precisely because there is no organisation embodying them. Identifying their limits, their interactions with other actors, and their effects requires a great number of techniques of observation and of resources.³⁵ To facilitate the analysis, this study focuses on TMNs. Drawing from Busch (2015), this research only considers the

³⁵ Even though these networks are excluded from the present analysis and from many other works on TMNs, they are likely to be quite numerous and significant. Further research on city networks should certainly investigate their role and influence in global governance, especially in the climate realm. See Gordon, in van der Heijden J, Bulkeley H and Certomà C. (2019) *Urban Climate Politics: Agency and Empowerment*. Cambridge: Cambridge University Press.

networks that have a staff (even if it is just one individual acting as secretary general) and a functioning website. Headquarters can be hosted within a larger organisation.

Furthermore, TMNs are made mostly of cities. It is important to note that non-city actors may participate in these networks (Nielsen and Papin, 2020). Yet, cities remain the most important actors thereof. Self-determined city networks working for the promotion of the interests of cities while not including more than 50% of cities as members are not considered TMNs in the present study.

In addition, a crucial characteristic of TMNs is their transnational nature. A city network working in only one country, such as the *Mayors National Climate Action Agenda*, a U.S. based network, does not meet the selection criteria. This work indeed does not look at national or local city networks. It is interested in networks crossing national borders through actors that do not necessarily represent their country, making them transnational actors (Risse-Kappen, 1995).

Now that what sets TMNs and other city networks apart is clarified, it is important to detail the criteria that led to the selection of 15 TMNs for this study. Inside the TMN subcategory, this study has set several criteria in order to identify the TMNs that are part of the TMNs complex system under study. One is the focus of the work of TMNs. All TMNs that are part of the system have climate action as one of their priorities. It is sometimes their exclusive goal (e.g. C40 or CoM). In other cases, it is one of their explicit objectives (e.g. ICLEI). This study also considers the TMNs that work on specific climate-related issues, such as transportation, and explicitly refer to climate change or climate action as a priority (e.g. CIVITAS or Polis). Sometimes, TMNs tackle climate change in a specific project, to which the TMN gives special attention and visibility (e.g. Metropolis).

The second criterion contemplated lies in the presence of one or more member cities in the European Union. To consider a complete network, including all the TMNs that have the preceding characteristics while not facing too big a network for a qualitative empirical analysis, it is best to look at a specific geographical region. In that sense, this study focuses on the TMNs that are present in the European Union (EU), meaning that they have at least one member located there. The TMNs complex system under study therefore includes TMNs

that operate only inside the EU (e.g. CIVITAS or Climate Alliance), and TMNs that have a global scope and include one or more cities located in the EU (e.g. 100 Resilient Cities or the Milan Urban Food Policy Pact). It excludes TMNs that are only present in other geographic areas, such as the Asian Cities Climate Change Resilience Network. The EU, compared to other regional spaces, has a strong climate policy and institutional structure, that, as seen in Chapter 1, may encourage the rise of TMNs (Giest and Howlett, 2013). Indeed, other areas, such as North or Latin America, have not experienced such a rise of TMNs on their territory. For instance, a preliminary research led for this study only identified three TMNs working specifically in Latin America, whereas it discerned at least seven in the EU. Asia is also an interesting region regarding the presence of initiatives dealing with climate change and urban settlements (UNFCCC Secretariat, 2017). However, conducting an empirical study focusing on Asia would be difficult for technical reasons (i.e. the languages spoken). Knowledge of English, French, and Spanish facilitates the study of TMNs inside the EU for the documentary observation and interviews.³⁶ Furthermore, there have been many studies on European TMNs. Although the study of the novelty TMNs generate has not been done in such details so far, its results might be easier to test and compare to other research if it focuses on a well-known area. Consequently, working on this geographical area may complete the flourishing literature on TMNs in the EU.

The last criterion is the activity status of TMNs. At the time of starting the empirical analysis, all the TMNs considered must be in operations.³⁷ The observation of the interactions of TMNs that are no longer active would require the use of other techniques. It is thus best to exclude them from this study.

Now that the criteria set to select the TMNs analysed in this investigation, we need to identify the TMNs that were selected.

3.1.2 The TMNs of the complex system under study

To ensure the compatibility of the theoretical framework and the empirical investigation, identifying and studying a complete complex system appeared crucial. This involved

³⁶ A research assistant working on this project for a few months has some proficiency in German, which was also helpful to further the documentary observation.

³⁷ The 100 Resilient Cities initiative ended its activities in July 2019, that is, after the end of the empirical research. It is thus part of the TMNs complex system under study.

identifying all the TMNs that followed the criteria set above. To do so, I first relied on the survey of the literature presented in Chapter 1 to define the unit of analysis. Several publications provide detailed studies of the most well-known TMNs (e.g. C40 or ICLEI). This made easy the comparison of their characteristics to the list of selection criteria. Furthermore, several studies were particularly helpful in identifying city networks that overall appear to be poorly known because of their narrow scope or lack of visibility (e.g. Labaeye and Sauer, 2013; Keiner and Kim, 2007). In several cases, an Internet research was necessary to obtain more information on these networks and identify their compatibility with the list of predetermined criteria. Finally, a wider Internet research using keywords such as ‘cities’, ‘networks’, ‘climate change’, or ‘climate action’ enabled the discovery of recent TMNs that scholars have not had time to study in depth yet (e.g. the Carbon Neutral Cities Alliance or the Milan Urban Food Policy Pact).

Name	Launch	Scope	Number of members in 2018	Main area of focus
Carbon Neutral Cities Alliance (CNCA)	2015	Global	20	Carbon neutrality
Milan Urban Food Policy Pact (MUFPP)	2015	Global	165	Food security
100 Resilient Cities (100RC)	2013	Global	98	Resilience
Covenant of Mayors for Climate and Energy (CoM)	2008	European	8,827	Climate change
C40 Cities Climate Leadership Group (C40)	2005	Global	96	Climate change
Global Compact Cities Programme (GCCP)	2003	Global	95	Sustainability
CIVITAS	2002	European	299	Transportation
Alliance in the Alps (AllAlps)	1997	Alpine region	265	Sustainability
ICLEI Local Governments for Sustainability (ICLEI)	1991	Global	818	Sustainability
Union of the Baltic Cities (UBC)	1991	Baltic region	82	Sustainability
Energy Cities (EnCit)	1990	European	177	Energy
Climate Alliance (ClimA)	1990	European	1,719	Climate change
Polis	1989	European	68	Transportation
Eurocities (EuCit)	1986	European	130	Urban issues
Metropolis (Metrop)	1985	Global	138	Urban issues

Table 3.1 List of the TMNs under study in the TMNs complex system

These different steps facilitated the identification of a complete system. They led to the detection of 15 TMNs (Table 3.1). The TMNs complex system comprises these 15 TMNs, as well as their members and partners, the identification of which is explained below (Section 3.2.1). Among the members and partners of TMNs, there are sometimes other TMNs. Yet,

because they did not fit the criteria mentioned above, they appear as members or partners, but not as cases that this research studies in detail.

Although this study focuses on 15 TMNs only, it is likely to offer a relatively fair representation of current TMNs in global climate governance thanks to the selection criteria presented above. The first and third criteria clearly highlight characteristics that TMNs in operation in global climate governance share, i.e. a great concern for climate issues, and current activity. The second criterion creates a bias in the TMNs complex system, since it excludes non-European regional TMNs. As mentioned above, Asian TMNs, for instance, are not part of this study. Yet, this selection criterion enabled the inclusion of all the global TMNs that might have European city members. Since TMNs of current global environmental and climate governance seem to witness a concentration of European cities (Bansard et al., 2017) and European TMNs (Betsill and Bulkeley, 2004), this research's TMNs system is likely to reflect that concentration. This system may thus echo the dominant trends of current TMNs in global climate governance, while leaving aside more marginal (albeit not unimportant) tendencies.

The next section details the distinct steps of the data collection enabled by the identification of the TMNs complex system.

3.2. Data collection

This section describes the process through which all the data used in this study was collected. As we will see in this section and the one following, a mixed-methods design appeared to be the most adequate choice for this study's empirical investigation. Indeed, this research seeks to uncover the nature of the relationship between interactions and the emergence of novelty, as well as the process at play between these variables. To identify this relationship, social network analysis and cross-case analysis seemed to be the best option. Yet, to detect the process in-between, a comparative case study was favoured. In the spirit of mixed methods designs, this research sought to investigate diverse sources, i.e. documentation, interviews, and scholarly literature on TMNs. It thus contains data-set observations as well as causal process ones (Brady and Collier, 2010). As we will see below, using diverse sources of information was also crucial to ensure the compatibility of the theoretical framework and the hypotheses on the one hand, and the empirical investigation on the other hand.

3.2.1 Documentary observation and literature survey

Political scientists often use documentary observation as a way to extract factual information (Mace and Pétry, 2000). This data collection tool includes a great variety of documents, including governmental documents, scientific reports, newspaper articles, or websites. This study looks at primary, secondary, and tertiary sources (including grey literature). The documentation was mostly found on the Internet, through the TMNs', TMN partners' and various newspapers' websites. Some documentation, such as Bloomberg's publications, was accessed through libraries. The goal of the documentary observation is to use documents' immediate content, but also possibly changing content over time and the values associated with these changes (Chadderton and Torrance, in Somekh and Lewin, 2011).

Documentary observation proved essential to collect information on different key concepts (e.g. TMNs complex system, novel governance instruments, and interactions with TMN members and partners). First, as the previous subsection already started to mention, it enabled the identification of the TMNs complex system. It was indeed necessary to go through a variety of documents to detect the TMNs fitting the criteria enumerated for the analysis of the complex system. The literature survey preceding the delimitation of the complex system was crucial in that matter. Yet, the use of documentation was also necessary to make sure no TMN was left apart in this study due to a possible lack of visibility.

Besides delineating the contours of the TMNs complex system, the documentary observation was crucial in identifying the dependent variable, i.e. novelty in the form of novel TMN governance instruments. To assess the degree of novelty of the governance instruments of 15 TMNs and compare them, it was necessary to list all the climate-related governance tools they generated since they started operating until the end of 2018 (date chosen for the end of the data collection period). For purposes of efficiency, the analysis of TMN governance instruments using the analytical framework presented in Chapter 1 (Section 1.2.1.3) was simultaneous to the data collection. A scan of the latest versions of the 15 TMNs' websites and the annual activity report published on their websites enabled the identification of a vast number of governance tools. In the case that too little information would be found through

the scanning of a TMN's website, its Twitter account and most important partners' websites would be scanned as well to enhance the level of data collected for that TMN.³⁸

Furthermore, many TMNs published information on their actions on earlier versions of their websites, and ignored that information on more recent versions. Disregarding those would possibly lead to overlook a large amount of data. Considering the ephemeral nature of Internet data, this study's documentary observation also relied on the use of the Internet Archive Wayback Machine (Internet Archive, 2019). The Internet Archive is an organisation seeking to create a digital library of Internet sites, among other documentary sources. The Wayback Machine is an Internet Archive tool designed to go through its digital web library. It currently stores over 396 billion web pages captured since 1996. As the software tends to capture more widely accessed web pages, TMNs with more visibility, such as C40, have more captures of their earlier websites. Like the documentary observation in general, this method thus created a bias against the TMNs that did not dedicate as many resources as others to digital visibility, although they might have produced as many novelties, or more. Nevertheless, it was overall useful to ensure that most of TMN tools would be listed, using the saturation method. This extra step partly mitigated this method's visibility bias.

Once all the climate-related tools generated by the 15 TMNs in the period under study were detected, it was necessary to compute the novelty ranking of the 15 TMNs. I chose to calculate the novelty ranking looking first at the number of novel governance instruments generated by each TMN. When two or more TMNs generated the same number of novel instruments, I ranked them according to the number of early adoption points they each had. I computed the number of early adoption points giving each TMN a certain number of points for generating tools that already existed in the system, but that other TMNs still had not generated. The first TMN to generate a certain instrument would obtain 15 points for that instrument. The second TMN to generate that same instrument would have 14 points, the third 13 points, etc. Each tool thus offered its TMN a certain number of points. I called the total 'early adoption points'. TMNs' novelty ranking is thus based on TMNs' capacity to

³⁸ See Appendix B.

generate novel governance instruments and, to a lesser degree, their capacity to learn from others and quickly adopt their novel instruments.

Documentary observation was considered to be the most adequate method for the observation and analysis of TMN governance tools. Indeed, documentary observation enables the gathering of factual information in a systematic way. I deemed other data collection methods, e.g. surveys or interviews, to be less valuable options to collect this kind of information. In the case of surveys, the usually low response rate might lead to overlook some instruments. Besides, surveys are best used for collecting opinions of individuals or testing their level of knowledge of a specific issue (Coman et al., 2016). Regarding interviews, they are best used in qualitative data collection. Yet, the high number of governance tools generated by TMNs between 1985 and 2018 represented quantitative data.

Documentary observation was also a crucial data collection instrument for the identification of TMN members and partners. The identification of TMN members and partners was paramount to the social network analysis conducted for this research, which was necessary to test H1. Those represent all the nodes (TMNs excluded) and edges on which the social network analysis builds. To detect all the members and partners, I conducted another scan of the 15 TMNs' websites. The goal of this operation was to find the members and partners' lists of each TMN. Because not all TMNs publish their lists of partners,³⁹ it was necessary to go through distinct sections of their websites (e.g. the 'activities', 'news', or 'about' sections) to find this information. Once again, the use of the Wayback Machine proved useful to get information on earlier web page versions. Yet, because the Wayback Machine captures are generally conducted at random moments, some information was sometimes found missing. The Wayback Machine did not allow for a systematic tracing of TMN memberships and partnerships over time. Therefore, although the Wayback Machine was useful to give more precision to the data collected, it could hardly be the only source of data for the identification of TMN membership and partnership interactions. Yet, it was the only source found for the detection of past interactions. Besides, we should note that the information displayed on websites today is much greater than it used to be. Consequently, it was not possible to trace

³⁹ Almost all TMNs publish their lists of members. When they do not, or the list is not easy to extract from the website, contacts within the TMNs may provide an official list.

these interactions back to when the 15 TMNs launched their websites. Only the 2018 TMN membership lists could be found. Regarding TMN partnerships, documentary observation enabled to find the lists of 2016, 2017, and 2018. Ultimately, a complex system comprising the 15 TMNs, and their 2018 members and partners was identified. This study represented it as a network of 12,703 nodes and 14,057 edges.

The requirements of this study's theoretical framework and use of social network analysis demanded the most complete information possible regarding nodes and links of the system or network under study. In that context, documentary observation appeared to be the most reliable data collection method. Indeed, while conducting surveys to collect information on the interactions of TMNs might unveil the existence of less publicly visible interactions, an important limit of surveys lies in their low response rate, which could lead to a lack of information on the interactions of some TMNs. Besides, conducting surveys would also run the risk of the respondents not being systematic in their identification of TMN memberships and partnerships. For this reason, the option of conducting interviews for the identification of TMN interactions was also dismissed.

The documentary observation of TMN governance tools and interactions provided data-set observations as well as causal-process observations. Data-set observation are most often used in quantitative analysis (Brady, in Brady and Collier, 2010). Yet, as Brady and Collier argue, 'Data-set observations play a central role not only in quantitative research, but also in qualitative research that is based on cross-case analysis' (2010: 24). The cross-case analysis enabled an analysis of each case and a synthesis that strengthened former findings and gave information on the causal process between interactions and the emergence of novelty. It looked at 15 TMNs through data-set observations on their memberships and partnerships, and their governance tools, in order to observe the interactions leading to the emergence of novelty. The social network analysis indicated seeming tendencies. The cross-case analysis then deepened the analysis looking across the 15 cases, using qualitative data.

Documentary observation was also critical for the cross-case analysis, since it provided information on the attribute variables studied in this work. Age, organisational resources, geographical scope, thematic scope, and the nature of founders, as well as the other descriptive elements regarding funding, all appeared thanks to the documentation found in

the publications displayed in the 15 TMN websites. The Wayback Machine and TMN partner websites sometimes helped find information that was absent from the TMN website current versions. As in the case of governance tools, this was factual information that was easier to collect through documentary observation than surveys or interviews.

Documentary observation was an important source of data for the comparative case study. Documentary observation here appeared to be a first step in the construction of the comparative case study. It helped define the two cases, their similarities, and their differences. Nevertheless, it needed to be supplemented by interviews.

It is important to also mention the literature survey which was conducted as part of the documentary observation. To complement the information gathered through documentary observation, academic articles and book chapters presenting case studies of one or several of the 15 studied TMNs were scanned to obtain missing information as secondary and tertiary sources of information. The literature survey was therefore useful to the cross-case analysis. It also provided useful information for the comparative case study, especially regarding the C40 case. Indeed, the C40 is one of the most famous climate-related TMNs (Rashidi and Patt, 2018). There has been a lot of studies on this TMN, its functioning and its effects (e.g. Davidson and Gleeson, 2015; Lee and Koski, 2014; Acuto, 2013; Bouteligier, 2013a; Gordon, 2013; Lee and van de Meene, 2012; Román, 2010).

We should note the accepted limits of documentary observation, especially regarding data that was no longer available on the current versions of TMN websites. This made it impossible to identify all TMN interactions since they started generating governance instruments. In other words, I could not study the correspondence over time of, on the one hand, centrality and diversity measurements, and, on the other hand, the emergence of novel governance tools. Consequently, this research relied on the surmise that the centrality and diversity scores of the different TMNs evolved similarly over time. This surmise was based on the findings of a documentary observation, which enabled the study of TMN interactions between 2016 and 2018, a period for which data on TMN websites was still available. It suggested that the number of contacts of TMNs (i.e. members and partners) tended to grow homogeneously for all TMNs over time. An observation of the 2007 interactions of the TMNs that had the most visibility in the Wayback Machine (i.e. ICLEI, C40, UBC, Metropolis, and

Climate Alliance) confirmed the idea that the centrality ranks of TMNs evolved in the same way.⁴⁰ These elements led me to the surmise that the comparison of 2018 TMN interaction scores and TMN novelty ranks based on the number and nature of instruments TMNs generated from their launch until 2018 was a valid way of observing the link between interactions and the emergence of novelty.

Regarding documentary observation in general, it is important to keep in mind that ‘the analytical potential of documents as social data is in also understanding the circumstances of production and the receiving (reading) of the document as an artefact of the setting under study’ (Coffey, in Flick, 2014: 371). When looking at documentation as source of data, we should thus keep in mind that it was written by an actor with specific goals. It is important to distinguish between factual and normative content as much as possible. For instance, looking at Bloomberg’s strategy as C40 chair, it is crucial to acknowledge that his statements are driven by his goal to promote the TMN he leads (see Chapter 6). The numerical data as well as qualitative data relating to the occurrence of an event contained in these statements may be considered neutral information, but we should refrain from using the information about his or C40’s successes as factual data. Thus, when observing documents, this study pays particular attention to what they look like, what they do, and how they are related (Coffey, in Flick, 2014).

Overall, the preceding paragraphs have shown the importance of the documentary observation in this research’s data collection. Yet, to ensure the external validity of the findings and gather information unavailable through documentary observation, this study also relied on another data collection instrument, i.e. interviews.

3.2.2 Interviews

This research also used the data collected during 18 semi-structured interviews⁴¹ and several informal talks with staff members of TMNs’, TMN members’, and TMN partners’. These informal talks occurred during events such as COP23 in Bonn (Germany) in November 2017 and COP24 in Katowice (Poland) in December 2018.

⁴⁰ 2007 appears to be the oldest year in which enough information could be found regarding the interactions of several TMNs.

⁴¹ See Appendix A for information regarding interviewees.

Conducting interviews had three main goals. First, interviews provided a third source of information to this research. Building on Yin (2009), it is crucial to rely on several sources of evidence in qualitative analysis. Each information source has advantages and drawbacks. Some sources might be less reliable. By using several of them, we ensure complementarity of data and external validity of the research. It is important to note that interviews often emphasise the effects of agents and undermine those of the structure. In this study, they were particularly useful to gather more information on some agents and processes occurring inside TMNs. Yet, they could not represent this study's sole source of information, even though they also provided information on the content of the interactions of TMNs.

Second, and in line with the former comment, interviews aimed at receiving more information regarding the process between TMN interactions and the emergence of novelty, completing the work done in the documentary observation. More specifically, interviews provided information regarding the reasons for interacting and the nature and content of the interactions of TMNs. This was important to confirm or infirm H3, which states that '*social learning follows interactions, and precedes the emergence or adoption of novel governance instruments, and the evolution of TMNs*'. While crucial to detect interactions, documentary observation could not enable to capture the nature and content of interactions and their benefits. Conducting surveys might have provided more information, yet their brief answers would probably have appeared insufficient to detect the process at play between interactions and the emergence of novelty. Lengthy discussions with respondents working in TMNs, or TMN members or partners, appeared more useful to fulfil this goal. The information extracted from interviews was analysed through an explanation building exercise based on a cross-case analysis.

Third, conducting interviews was important to obtain more information on the cases that appeared to diverge from this study's theory. This was thus particularly useful to the comparative case study, in order to detect other potential enabling conditions for the emergence of novel governance instruments.

Looking at 15 TMNs, this research sought to interview staff members of TMNs', TMN members' and TMN partners'. These all have different headquarters locations (e.g. Brussels, New York, London). Since it was too costly and time-intensive to go to all those locations, a

preliminary data collection strategy favoured online interviews. Nevertheless, when it was possible to conduct face-to-face interviews, I favoured this option.

It appears that this preliminary strategy did not lead to many responses from interviewees. One problem was that the email addresses of the potential respondents were hard to find online and that the standard request form on their organisation's website did not generate any response from potential interviewees. Thus, a new data collection strategy was used, involving participation in COPs. Previous informal talks with a TMN partner staff member revealed that many city and city-related actors are present in those events, especially in the side-event part. They use this space to promote the interests and actions of cities. Some also appear in the official negotiation zone as representatives of the LGMA of the UNFCCC (i.e. ICLEI). Because many COP participants carry crowded agenda during these events, few potential respondents agreed to an on-site interview. Yet, several individuals agreed to being interviewed after the event.

Ultimately, this strategy led to conducting 18 interviews. This number of interviews facilitated the collection and triangulation of information regarding the reasons for TMNs interactions and the process between interactions and the emergence of novel governance instruments.⁴² I selected interviewees according to the organisation in which they worked, looking for both resemblance and diversity. Interviewing two or more members of the same organisation or partners to that organisation enabled me to confirm the validity of the statements of some respondents. It was also crucial to get access to more information on the two cases of the comparative case study (i.e C40 and 100RC). Interviewing members of different organisations also proved useful to compare information on different TMNs and highlight commonalities and differences. Combined with documentary observation, this enabled me to detect the causal process at play between interactions and the emergence of novelty.

Participation in two COPs also enabled the observation of some interactions between TMNs. These interactions were most visible at the Cities and Regions pavilion, operated by ICLEI

⁴² It is important to note that conducting a few more interviews might have helped shed light on some elements of the empirical investigation that remain obscure (e.g. the role of organisational resources). Yet, because of resource constraints (e.g. the time and financial cost of attending another international event), I rejected this possibility.

with the participation of other TMNs (such as C40, and Covenant of Mayors). The Cities and Regions pavilion acted as a sort of hub for city and city-related actor during the COP (ICLEI, 2018). Informal discussions during COP23 revealed that collaborations on side-events were irregular. Although it was quite prominent at COP21 and COP23, TMNs did not collaborate on such structure for COP24. COP24 nevertheless enabled observations of interactions as well through other pavilions' side-events, such as that of the European Union.

As the interviews were semi-structured, the questions changed depending of the nature of the respondent and their organisation. They also evolved with the research's progress. They first dealt with the reasons, benefits and drawbacks of interactions and with the characteristics of the tools TMNs created. As the research evolved, questions also tackled the differences among TMNs.

This research's intensive data collection enabled the gathering of a vast amount of data. To analyse it, several techniques were used, as detailed in the next subsection.

3.3 Data analysis

The data analysis section of this research relied on several tools used for 'bridging the qualitative-quantitative divide' by 'putting qualitative flesh on quantitative bones', that is, using quantitative data as starting point for qualitative analysis. (Brady and Collier, 2010: 106). I first conducted a social network analysis on 15 TMNs which enabled the drawing of correlations between the distinct independent variables and the dependent variable and the identification of noteworthy cases regarding the relationship between independent and dependent variables. Then, I conducted a qualitative analysis, including a cross-case analysis explanation building, and a comparative case study. It used both data-set and causal-process observations. Indeed, the goal was to use the relational data, insufficient to provide a causal explanation, to look deeper at the process between interactions and novelty emergence. In other words, it was necessary to look at the underlying causal process to make sure I had the right interpretation of the data-set observations and identify the process in-between (Brady, in Brady and Collier, 2010). The following paragraphs detail this research's use of social network analysis, cross-case analysis, and comparative case study.

3.3.1 Social network analysis

As mentioned in Chapter 1, few studies have looked at the interactions of TMNs. Because this research does, seeing interactions as an independent variable influencing the emergence of novelty, social network analysis seems relevant. As explained by Wasserman and Faust, social network analysis, as a network explanation, includes information and concepts on the relationships of units (1994: 6). Furthermore, following Maoz, 'Network analysis is eminently suited for capturing, analyzing, and modeling complexity.' (2012: 251) It has been used several times in the analysis of complexity in global governance (Kim, 2019). Indeed, complexity involves many interactions among diverse actors in an open system, interacting with its environment. Thus, since social network analysis focuses on the relationships and interactions of units, it is appropriate for this research. Social network analysis appears to be the most adequate method to test H1, which heavily relies on relational data analysis. Centrality and diversity of contacts are concepts to which this method often refers. It observes centrality through measurements of degree or closeness centrality, and diversity of contacts through brokerage or constraint, for instance.

The documentary observation presented above enabled the collection of data (i.e. memberships and partnerships of TMNs) appropriate to a social network analysis. It provided information regarding the nodes and edges in each of the 15 TMNs studied. Based on this information, 15 ego-networks, that is, sets of nodes and edges directly linked to a focal node (here, one of the 15 TMNs under study), were drawn. Each network includes the nodes to which the focal TMN is linked (through membership or partnership) and the edges linking that TMN to those nodes. Being an ego-network, it does not include the relationships among those nodes. The compilation of the 15 ego-networks led to the identification of the TMNs complex system. Nonetheless, the documentary observation did not provide information regarding the weight of the links. Although it provided information regarding the direction of the edges, the analysis did not consider it. No hypothesis was made regarding the position of receptor or sender of information. The network is considered undirected.

The social network analysis conducted in this study is part of a qualitative analysis rather than a quantitative one. Indeed, although the information gathered facilitated the identification of a network made of several thousand nodes and edges, the analysis focuses

on only 15 nodes, i.e. the TMNs first identified in Section 3.1.2, and of which the ego-networks were drawn. Thus, the social network analysis is used to detect tendencies regarding the possible relationship of interactions and novelty emergence. As argued before, it cannot lead alone to a causal explanation of the emergence of novelty, however. It needs to be backed up by other methods and data.

This study's first hypothesis (i.e. *H1: The TMNs generating the most novel governance instruments are likely to be central and have diverse contacts in the TMNs complex system*) involves an analysis of both centrality and novelty. Both variables can be measured in a variety of ways.

Centrality measures are among the most popular ways to analyse networks in social network analysis. Distinct measurements correspond to distinct aspects of centrality, according to diverse assumptions. It is thus important to identify what we are looking for to select the best measurement.

Degree centrality measures the number of nodes to which an actor is connected. It adds up all the identified contacts of a focal node without considering the direction of edges.⁴³ Degree makes several assumptions revealing a specific understanding of interactions. Degree centrality first assumes the homogeneity of nodes, meaning that all the nodes to which the focal node is connected are considered equal. They are assumed to give the same quantity and quality of information to the focal node. Degree centrality does not consider whom these nodes represent, their attributes and the extent thereof.

Among the common measures of centrality are also closeness and betweenness centrality. Closeness centrality measures the geodesic distance of a node from all other nodes. It is mostly interpreted in the literature as a measure of short distances, and therefore of either efficiency or access, or independence of actors. Betweenness centrality calculates the number of shortest paths that go through a node. It is mostly understood in the literature as a measure of the control or the dependence of a node over the other nodes of the network, or frequent brokerage (Brandes, 2016; Brandes et al., 2016). Because this research looks at the access of TMNs to information rather than their direct influence, closeness centrality seems to be here

⁴³ In-degree and out-degree are the measurements used to consider the direction of the edges.

more relevant than betweenness centrality. Closeness centrality also carries assumptions that we need to consider. Although closeness centrality is more complex than degree centrality, it is based on the same ideas of homogeneity, additivity, and the greater significance of quantity over quality.

As a matter of fact, for Brandes, all centrality measures make an assumption of homogeneity: ‘Quantitative representations are limiting because they impose a one-dimensional ranking structure and require a justifiable aggregation operator such as the sum or maximum to turn a vector into a scalar’ (2016: 11). Centrality measures indeed all focus on a unidimensional analysis of nodes that does not consider their various attributes.

It is important to discuss whether these assumptions create problematic incoherencies with this study’s ontology. In a complex systems framework, the assumptions of homogeneity, additivity, and quantity over quality are often absent. Not all interactions matter to the same extent, and quality can win over quantity in a nonlinear system. Yet, since the social network analysis does not rely only on centrality, but also on diversity, and is further supported by other measurements, these assumptions might not be problematic. Although centrality implies homogeneity, diversity tends to counterbalance this homogeneity with considerations regarding the role of diverse actors.⁴⁴

Diversity is the other variable at which this study’s social network analysis looks. More specifically, it focuses on what it coins structural and substantial diversity measurements. This study understands structural diversity in relation to non-redundancy. More specifically, a node is structurally diverse if it has a certain number of contacts that other nodes of the network do not have.

Among the popular ways to measure diversity is Burt’s constraint. However, it is not the most relevant here. Indeed, Burt’s constraint usually involves measuring weight which, as mentioned earlier, is not a piece of information that this work’s data contains. Besides, non-redundancy, in Burt’s constraint, focuses on each node’s neighbourhood rather than on the entire network. Constraint, as conceptualised by Burt, is based on the analysis of ego-networks, that is, all the direct connections (or one-step paths) of a focal node. It enables us

⁴⁴ This point is further emphasised in Chapter 5.

to understand whether a node A has many contacts that do not interact with each other inside A's ego-network, and whether A is investing energy in contacts in which other of A's contacts are investing energy. This is in line with Burt's structural hole argument which states that 'social capital is created by a network in which people can broker connections between otherwise disconnected segments' (Burt, 2008). Yet, Burt's constraint does not tell us whether A's contacts are contacts of other nodes outside of A's neighbourhood, but inside the identified network.⁴⁵ Two nodes that have no direct contact to each other but have similar contacts might end up with the same information and ultimately create the same instruments.

Burt also observes the distinct triads of networks in order to find brokerage positions (Burt, 2004; 1995). Brokerage can be understood as the position of a node B connecting two nodes A and C that are not directly connected to each other. B thus acts as an intermediary between A and C. The brokerage function measures the number of times a node B connects two other nodes considering the distinct communities they might come from. The distinct types may be computed as different communities. In that sense, brokerage considers better the attributes of nodes than Burt's constraint. Burt's constraint may tell us about the extent to which a TMN is connected to nodes to which other contacts (among which TMNs) are not linked, but it may not distinguish among those that are of a different type (i.e. non-TMNs).

Gould and Fernandez (1989) identify different brokerage positions: coordinator, itinerant broker, representative broker, gate-keeper, and liaison broker. A coordinator is a node that links other nodes from the same type together. An itinerant broker is a node from one type that links actors of a different type. A representative broker is a node from one type that connects actors of another type to actors of its own type. A gatekeeper acts similarly, but links actors of its own type to actors of another type.⁴⁶ Finally, a liaison broker is a node of a type A that connects nodes of a type B to nodes of a type C.

Nevertheless, brokerage does not identify nodes that are connected to a TMN and that TMN only. As in the case of Burt's constraint, brokerage applies non-redundancy to

⁴⁵ Ego-network and neighbourhood are here synonyms, as we consider the neighbourhood to include the focal node, its one-step away contacts and the ties between them.

⁴⁶ The distinction between representative and gatekeeper is most relevant in the case of directed networks. In the TMNs network, which is undirected, the values for representatives and gatekeepers would be the same.

neighbourhoods (here, the nodes around a node A to which A has a one-step connection) rather than to the entire network. In other words, brokerage looks at triads that are only connected through the focal node. The other nodes of the triad might however be connected to other nodes. Rather than understanding how a node B intermediates the relationship of A and C, we want to identify the nodes that are linked to only one TMN and thus have a degree of one in the whole network.

To analyse the structural diversity of the 15 selected TMNs, I choose to look at the degree of TMNs considering only their degree-of-one contacts (nodes which are thus being connected only to a TMN). These are non-redundant contacts in the entire TMNs system. Here, the structural diversity of TMNs thus measures the degree of each TMN according to their number of non-redundant members and partners. In contrast with the centrality measurements described above, this measurement does seek to treat all the nodes as equal. Indeed, what matters here is the number of unique contacts of TMNs, i.e. contacts TMNs do not share with anyone else and who might, therefore, bring new information to them. The importance of the contacts, in relation to the amount of information they might bring, is often ignored in diversity measurements.

Like Burt's constraint, structural diversity does not consider the types of the diverse contacts of the focal node or the issues with which they deal. It assumes that actors that are not connected to the same partners, whomever these partners may be, automatically have access to distinct information. In an undirected network, if A is connected to B, C and D, and B is connected to C, A might have access to different information because no one else is connected to D. However, D might have the same function as C and thus not provide different information to A (see Figure 3.1). In other words, non-redundancy in contacts does not necessarily equate non-redundancy in information. Brokerage starts highlighting the variety of types of partners of the distinct TMNs, yet it cannot go into the details of that diversity.

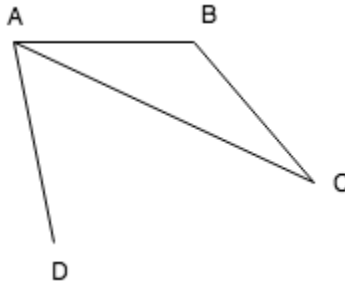


Figure 3.1 Representation of structural diversity in an undirected graph⁴⁷

To observe which TMNs are connected to most distinct actors (i.e. actors of different types or dealing with different issues), an analysis of substantial diversity is also necessary. It might indeed be a way to consider the attributes of actors, which might help better account for the diversity of information TMNs might get and transform into novel instruments. Using a measure of substantial diversity enables us to start countering the limits of centrality variables, which take all nodes as homogenous. This will also help us better consider the non-redundancy of the information to which TMNs might have access. In addition, considering substantial diversity in addition to structural diversity is a way to use an indicator that depends less on degree than structural diversity. Indeed, although it differs from degree centrality in several ways, structural diversity partly relies on it to build its measurements, looking at the number of non-redundant TMN contacts. Therefore, using only this indicator to observe diversity creates a bias against TMNs with less contacts. This is problematic because observing diversity is not meant to measure the amount of information TMNs receive, but how the information some TMNs get might be different from the one most get. Structural diversity helps achieve this goal that by underlining the number of potential sources of distinct information. Yet, an indicator that is less related to the quantity of contacts and considers more their distinct attributes is also necessary, hence the use of substantial diversity indicators.

This study's data collection enabled me to consider two types of substantial diversity, i.e. institutional diversity and topical diversity. Institutional diversity is related to the distinct types of actors to which a TMN might be linked (i.e. city, company, country, governmental agency, global partnership, IGO, local government, local government association, NGO,

⁴⁷ The focal node A has diverse partners, but those might not provide it with distinct information. Looking at other ways to measure diversity might offer a more comprehensive understanding of diversity.

private foundation, research, subnational government, selected TMN, other kind of TMN, or other). It is measured by adding the number of types of actors to which each TMN is connected. Topical diversity is related to the distinct issues on which partners of a TMN might work (i.e. climate change, energy, food security, health, resilience, sustainability, technology, transportation, urban issues, or other). It is based upon the number of overall issues with which the contacts of each TMN deal. The selection of the categories of types of actors and issues on which these actors work is based on the most common themes identified in the data. The two classifications both highlight some degree of diversity while seeking to synthesise the numerous themes found under rather broad categories. The number of categories of actors is higher than that of categories of issues because of the variety of levels (i.e. local, subnational, national, regional, or global) and of sectors (i.e. public, private or hybrid) of the actors of the identified system.

We should note that, since the purpose of the analysis is to observe the relationship between diversity and the emergence novel governance instruments, institutional diversity might seem to matter more than topical diversity. A company has governance practices that visibly differ from those of a city government. The nature of an actor, based on its mission, goals, sources of funding, among other elements, might affect its practices more than the issues with which this actor deals. Nonetheless, we should not ignore the issues on which actors work. The specificity of some issues might imply certain practices. For instance, several interviews suggest that resilience may imply more attention given to the local scale and its actors than climate mitigation (Interviews 16 and 18). Thus, both institutional diversity and topical diversity might provide TMNs with information enabling them to create novel governance instruments. I consider that the two indicators complement each other and can be combined into a single variable, namely, substantial diversity.

Looking at substantial diversity supplements this study's analysis of diversity. Structural diversity and substantial diversity measure different aspects of diversity that might be both significant in the creation of novelty. Structural diversity is close to, albeit different from the measurements of centrality. Since it provides a structural understanding about how information flows, it is crucial to this research which partly sees networks as structures. Substantial diversity is important as well. Indeed, it measures a distinct dimension of

diversity which pays more attention to the differentiation of the contacts of TMNs, a point that this research's centrality measurements do not address. I therefore give an equal weight to structural and substantial diversity but consider they cannot be combined into a single variable.

Considering the data gathered, one network made of TMNs, their 2018 members, and their 2018 partners could be drawn. Within this network, several subgraphs could be detected, i.e. a subgraph made of the 15 TMNs only, a subgraph made of the 15 TMNs linked to their members, and a subgraph made of the 15 TMNs linked to their partners. Looking at these different subgraphs is a way to look at possible variations in the centrality and diversity scores of TMNs depending on the kind of contacts (TMNs, members, or partners).

A first analysis of the measurements of the centrality of TMNs in the whole network and the members' and partners' subgraphs and of the diversity of TMNs' contacts was made through correlation tests. These tests used Spearman's method, which is useful to look at correlations of ordinal values (Dehon et al., 2008). Calculating the correlations of the distinct independent variables and the dependent variable can be here considered as creating plausibility probes. '[P]lausibility probes involve attempts to determine whether potential validity may reasonably be considered great enough to warrant the pains and costs of testing' (Eckstein, in Greenstein and Polsby, 1975). The correlation tests conducted in this study are insufficient to confirm the existence of a causal relationship between interactions and novelty emergence. As well-known in the statistics world, 'correlation is not causation'. Furthermore, although it relies on a large number of observations, this work's social network analysis is ultimately based on 15 cases only. This number is too small to enable a statistical analysis leading to causal inferences. This study is mostly qualitative. Yet, running correlation tests as part of the social network analysis remains helpful. It might suggest the existence of a causal relationship between interactions and novelty emergence, which a qualitative analysis will then need to confirm. Correlation tests thus act as plausibility probes showing the way towards other tests and analyses regarding the possible causal relationship between interactions and novelty emergence.

3.3.2 Cross-case analysis and synthesis

In order to go beyond a mere correlation between interactions and the emergence of novelty, the results of the social network analysis needed to be supported by a qualitative analysis. In that context, this study conducted a cross-case analysis and synthesis to strengthen the findings of the social network analysis. The other goal of the cross-case analysis was to test H2 (i.e. *the TMNs generating the most novel governance instruments are likely to be among the oldest ones and the ones with most organisational resources*). Cross-case analysis and synthesis appeared to be the most relevant method for testing causal relationships.

Cross-case analysis refers to ‘the systematic comparison of cases’ (Brady and Collier, 2010: 323). It can be either quantitative or qualitative. In this research, it is part of a qualitative analysis. It involves both dataset-observations (i.e. TMN membership and partnership interactions and TMN governance tools) and causal-process observations.

The study of 15 cases impedes individual in-depth analyses of each case or a comparative case study of all TMNs. Both types of analysis are inappropriate mostly because they would be too time-consuming. Furthermore, they would imply an enormous amount of data, which would be hard to process altogether. A qualitative cross-case analysis appears here more adequate. Indeed, by looking at specific variables and comparing them across cases, the data collected on 15 TMNs is more focused and easier to manage and process. Cross-case analysis proves adequate to test H2, which focuses on specific actor attribute variables, i.e. organisational age and resources. Thanks to documentary observation, observations of these variables across the 15 cases were collected, which made possible the analysis.

The analytic technique most used in this study’s cross-case analysis was cross-case synthesis (Yin, 2009: 156). Following Yin, each individual case was treated independently. Considering its independent and dependent variable scores (based on dataset observations and social network analysis), an analysis using causal-process observations (collected through documentary observations, a literature review, and interviews) then sought to make sense of them. Some preliminary conclusions were offered in each case and then synthesised (see Chapter 5, Section 5.4). The analysis underlined some similarities across a variety of cases and confirmed the significance of centrality and diversity in the rise of novelty. It also

pointed to some anomalies, or elements that the cross-case analysis could not explain. This led to the need for an in-depth analysis, through a comparative case study.

3.3.3 Comparative case study

Finally, this research conducted a comparative case study to further investigate the process at play between interactions and the emergence of novelty including the reasons for interacting (thus testing H3: *Social learning follows interactions, and precedes the emergence or adoption of novel governance instruments, and the evolution of TMNs*), as well as other possible enabling conditions for the emergence of novelty. According to Yin, a case study is an empirical in-depth examination of a phenomenon within its context (2009: 18). A comparative case study is a variant of the case study method, and thus follows the same broad principles. The phenomenon this study investigates is the emergence of novelty in TMNs. One of the methods it uses is the examination of two TMNs, i.e. C40 and 100RC.

As argued above, comparing in depth all 15 cases was a difficult task, for time and data management reasons. Another possible method considered might have been an ethnographic study of a TMN. Yet, while this might have helped uncover the process between interactions and the emergence of novelty, it would probably not have enabled the exploration of other enabling conditions for the emergence of novelty. For this goal, looking at two different cases was best. Besides, ethnographic studies are more in line with understanding research goals than explaining ones. Yet, this study focuses on explaining why some TMNs generate more novel governance instruments than others. In that context, a comparative case study of two cases appeared to be the most adequate method to both unravel the causal process at play between interactions and novelty (isolating some factors via the comparison of two cases), and look for other possible enabling conditions for the emergence of novelty for the cases that this study's theory did not explain (comparing a TMN with many novel governance instruments and one with few).

The results of the social network analysis and cross-case analysis pointed to several cases left unexplained. Among those, the study of C40 and 100RC looked more feasible because of the availability of data and their apparent points in common. The comparative case study sought to look at two cases with both similarities and differences. More specifically, it used a method based on the most similar design (also understood by Mill as the method of difference). The

cases were selected based on their variation on the dependent variable and their lack thereof on the independent variables. 100RC has centrality and diversity scores that seem to correspond to its level of novelty production. In contrast, C40 is the second most innovative TMN, yet its centrality and diversity scores are generally lower than those of 100RC. C40 and 100RC do have a few different independent variables. Their centrality and diversity scores diverge slightly. Yet, this is not problematic in that they still follow the tendency highlighted and accounted for by the social network analysis. There are other differences (e.g. nature of founders or thematic scope), but these are linked to a ‘technically distinctive situation in which there will be many more variables of interest than data points’ (Yin, 2009: 18). In other words, the comparative case study required that we distinguish between the differences that matter for the emergence of novelty and those that do not.

The analysis used documentary observation, the literature review, and interviews to detect the differences that might explain why there are many more C40 novelties than 100RC ones. Cross-cutting information on different documents (e.g. TMN press releases, annual reports, and secondary sources examining those processes) provided information on the similarities and differences between the two selected TMNs. It also offered information on the processes of emergence of novel governance instruments. The literature review helped find information that was absent in the documents. It also confirmed or infirmed certain ideas. Out of the 18 interviews conducted in this research, 10 dealt directly or indirectly with C40 or 100RC. Interviews provided more direct information on the processes at play in the emergence of novel governance instruments and on the role of interactions for TMNs.

The analytic technique mostly used in that part of the analysis was explanation building. To explain is to ‘stipulate a presumed set of causal links about [a phenomenon], or “how” or “why” something happened.’ (Yin, 2009: 141) In an explanation building exercise, general theoretical propositions are tested against one or more cases. The general propositions tend to fit the cases, but the information brought by more data helps refine the proposition. The scrutiny of the evidence enables the revision of the theoretical propositions. The evidence is then examined again in the light of the new theoretical proposition (Yin, 2009: 141-144). Explanation building appeared to be a relevant approach to support this work’s social network analysis and cross-case analysis. After a theoretical exercise drawing three

hypotheses (see Chapter 2), social network analysis pointed to possible tendencies regarding the relationship between centrality and diversity on the one hand, and the emergence of novelty on the other hand. Cross-case analysis then built on those efforts to precise the presumed causal link and detect the process between interactions and the rise of novelty. It detected some anomalies in the data, i.e. elements that did not fit the general tendencies and theoretical propositions. The comparative case study thus refined said propositions with a new one, focusing on the role of governance entrepreneurs in case of low centrality and diversity scores. This enabled the refinement of said propositions (see Chapter 5, Section 5.4.3.2), then tested in the comparative case study with the cases of C40 and 100RC.

Chapter 6 presents the comparative case study transversally, underlining the commonalities and differences of the two cases that seem to matter in explaining the emergence of social learning processes and novel governance instruments.

3.4 Concluding remarks

To conclude, this chapter has sought to present the methods used to conduct this research's empirical investigation. Considering this study's theoretical framework and hypotheses, which involved identifying a relationship between interactions and the emergence of novelty and the process in-between, a mixed-methods design appeared to be the most adequate option. This study seeks to be a qualitative research that relies on both dataset and causal-process observations. It focuses on a variety of data collection techniques that facilitate the gathering of these two types of data. It also uses distinct types of data analysis to optimise the information collected. Doing so, it hopes to show tendencies across 15 cases through a social network analysis and cross-case analysis that appear relevant to a research on networks. These two techniques enable the testing of H1 and H2 by focusing on the observation of causal relationships. It also seeks to then refine the analysis and offer an explanation for the emergence of novelty through a comparative case study asking questions about different outcomes for similar independent variables. This technique is best for testing H3, which includes a causal process.

It is important to note that these different methods represent a coherent design. While they are presented separately for the sake of clarity, the data collection and the data analysis techniques are intricately linked. The success of the latter depended on the achievements of

the former. For instance, a social network analysis demanded a complete documentary observation. Likewise, a well executed comparative case study required both documentary observation and interviews. Furthermore, all these methods are in line with this study's epistemological stance. Since they focus on explaining outcomes, they maintain the researcher as an outsider seeking to explaining the functioning of the social world, rather than involving him or her as an insider trying to understand its meaning (Hollis and Smith, 1990). Following many complexity science statements, they also avoid predictions. In that context, I refrained from using such methods as quantitative analysis using regression or qualitative analysis using ethnographic methods, which I believed were not coherent with my approach. I focused on using those that were congruent with a mixed-methods design.

Based on the work done to identify the TMNs complex system and TMN governance tools, the next chapter introduces the empirical study by presenting the novel governance instruments of TMNs. Although this chapter does not test any of the hypotheses presented in Chapter 2, it is a crucial part of the demonstration since it identifies and analyses what the novelty of TMNs, i.e. this study's dependent variable, looks like.

Chapter 4 The novel governance instruments of TMNs

TMNs generate governance tools to steer their member cities towards certain types of climate action. Most of these tools are imitations of older instruments generated by the same or by other TMNs. Some of them constitute novel governance instruments, understood as first-time combinations of governance characteristics constituting tools that TMNs generate to use on their member cities or for their member cities to use. Some TMNs generate more novel governance instruments than others. The main goal of this study is to explain why. In order to identify which variables or sets of variables might lead to the emergence of novel governance instruments, it is crucial to first analyse what this novelty looks like and how it might vary. It is also important to identify the TMNs that generate more novelty than others, which implies giving more details about these TMNs' characteristics. These are the goals of this chapter.

Identifying novel governance instruments implied enumerating all the governance tools generated by TMNs since their launch, to then detect which were the ones that were novel. This revealed distinct governance approaches among TMNs. As the literature argues, TMNs have rather soft approaches to governance. They do not completely neglect harder and more traditional approaches, however. The distinction between TMNs created at a time of municipal voluntarism and TMNs created during a period of strategic urbanism introduced in the literature appears relevant here. While voluntary municipalism, which started at the beginning of the 1990s, is a time in which a few cities decided to start acting on environmental and climate issues, the following strategic urbanism period (starting in the mid-2000s) refers to a time in which more cities have engaged with climate issues, seeing them as related to a variety of other municipal concerns, and have sought to mainstream their climate policies (Bulkeley, 2013). The analysis of the data collected for this study showed that the use of traditional governance approaches, which resort to rule-setting and obligation mechanisms, is more common among new-generation TMNs, that is, TMNs launched during strategic urbanism. These TMNs seem to have a novel governance style, using a mix of traditional and more recent approaches (i.e. using mostly information-sharing, norm-setting, and voluntary mechanisms) to orient the behaviour of their members. This might indicate a variation in the dependent variable among TMNs.

Yet, even though they have a different governance approach, new-generation TMNs do not appear to generate more novel governance instruments than older ones. The emergence of novel governance tools, both by older and by more recent TMNs, seems to be more intense in the period of strategic urbanism, which suggests that TMNs keep evolving over time in their practices.

This chapter's first section describes the 15 selected TMNs in terms of characteristics and novelty ranking. Scanning the variety of tools they created in the studied period (1985-2018), the second section shows their diverse practices. The third section then looks more specifically at the novel governance instruments TMNs generated in the period under study and highlights shows the novel practices the most recent TMNs might have. The last section concludes this chapter synthesising its main findings and introducing Chapter 5's empirical analysis.

4.1 Introducing TMNs and their novelty ranking

This section underlines the specificities of the 15 selected TMNs that make up the system under study, as well as their novelty ranking. As stated in Chapter 3, the TMNs included in the system under study were selected because of their great concern for climate action, the presence of one or more cities belonging to the European Union among their members, and their active status at the time of the data collection. Because of these criteria which define the TMNs system, the selected TMNs have common characteristics. They also have several differences that it is important to mention in order to start differentiating the diverse TMNs. This will be useful in Chapter 5 for the analysis of actor attribute and control variables. Presenting them now with their novelty ranking, which is a way to represent this study's variable, might also highlight noteworthy trends. Thus, the following subsections present several important attribute variables of TMNs and introduce their novelty ranking.

4.1.1 A thirty-year span for the launch date of the selected TMNs

A first important difference among the 15 TMNs lies in the year they were launched and started their operations (see Table 4.1). This information will be useful when testing H2 in Chapter 5.

TMN	Launch date	Geographical scope	Thematic scope	Founders
CNCA	2015	Global	Carbon neutrality	Cities
MUFPP	2015	Global	Urban food policy	Cities
100RC	2013	Global	Resilience	Rockefeller Foundation
CoM	2008	Europe	Climate change	European Commission
C40	2005	Global	Climate change	Cities
GCCP	2003	Global	Sustainability	City of Melbourne + UN
CIVITAS	2002	Europe	Transportation	European Commission
AllAlps	1997	Alps (Europe)	Sustainability	NGO
UBC	1991	Baltic region (Europe)	Urban issues	Cities
ICLEI	1991	Global	Sustainability	Cities
EnCit	1990	Europe	Energy	Cities
ClimA	1990	Europe	Climate change	City of Frankfurt
Polis	1989	Europe	Transportation	Cities
Eurocities	1986	Europe	Urban issues	Cities
Metropolis	1985	Global	Urban issues	Cities

Table 4.1 The 15 selected TMNs⁴⁸

As the data collected for this study shows, TMNs are no longer a new type of entity in global climate governance. Indeed, the oldest TMN of the identified TMNs system, i.e. Metropolis, dates back to 1985, at a time when climate change was barely acknowledged in global politics. Nevertheless, the newest TMNs (Carbon Neutral Cities Alliance and Milan Urban Food Policy Pact, i.e. CNCA and MUFPP) initiated their work only in 2015. The first one to be explicitly dedicated to climate action, i.e. Climate Alliance, was created in 1990, that is, before the creation of the UNFCCC. Thus, TMNs started to enter the global climate governance system even before some of its currently most important entities. Furthermore, the thirty-year span (1985-2015) in the launch and start of operations of the 15 TMNs hints

⁴⁸ Rather than their year of creation, Table 4.1 presents the year the selected TMNs started their operations. This date seems more relevant in the sense that this work focuses on the tools they produce to orient the behaviour of their members. In several cases, the date of creation and that of launch match.

at differences regarding their geographical scope. Out of 15 TMNs, eight initiated their work in the first 15 years of their overall period of creation and seven were created in the last 15 years. Among those that started their operations in the first period, six focus on cities in Europe or a European subregion, whereas two have a global scope. Out of those that initiated their activities in the last period, five have a global scope and two a European one. On average, European TMNs are thus older than global TMNs.

The evolution of the thirty year span of the TMNs system seems to correspond to what Bulkeley (2013) calls municipal voluntarism and strategic urbanism. For Bulkeley, the first wave of creation of TMNs, starting at the beginning of the 1990s, represented a period of municipal voluntarism.⁴⁹ Cities started to create or be part of networks ‘that would enable them to connect with one another, share information about the challenges and opportunities of responding to climate change, and mobilize politically on the issue’ (Bulkeley, 2013: 75). The second period, beginning by the mid-2000s, is one of strategic urbanism. It is distinct in that it answers growing climate-related commitments at different levels and relates climate change to other preoccupations. For Bulkeley, it shows the ‘growing alignment between addressing climate change and core municipal concerns, and the more direct, political approach that municipal authorities and other urban actors have begun to take to the issue’ (2013: 83). While municipal voluntarism focused on mitigation, strategic urbanism seeks to link climate issues to economic ones. Multilevel government partnerships have become crucial in that new period (Davidson and Gleeson, 2015).

It seems that municipal voluntarism is related to the beginning of global climate governance. The first TMNs of the TMNs system were launched before the creation of the UNFCCC in 1992, and at the time or after the Toronto conference on the changing atmosphere which was an important moment for international climate agenda-setting (Bodansky, 2001).⁵⁰ Yet, the first specialised TMNs, focusing on environmental and climate-related issues were launched around 1992. It was a time when global actors only started to discuss environmental and climate issues. Initiatives related to these problems were still scarce. The strategic urbanism

⁴⁹ Given the timespan of creation of TMNs identified in our population, we could argue that this period actually started in the second half of the 1980s. Nevertheless, we should keep in mind that climate action was not really part of the global agenda at the time, hence the few instruments that directly seek climate governance before the 1990s.

⁵⁰ With the exception of Metropolis, created in 1985.

period is very different. Many transnational climate experiments, including non-urban ones, were launched at that time (Bulkeley et al., 2012). For Stevenson (2018), the reasons for this increase in the number of transnational climate initiatives are related to the signing and ratification of the Kyoto Protocol. While some might have perceived opportunities in the carbon market mechanism launched by the Protocol, others might have sought to raise the ambition of global climate action (Stevenson, 2018: 161). It is likely that the second reason especially explains the launch of several TMNs in this second period of TMN emergence.

Table 4.1 also points to a hollow time from 1992 to 2001, with the creation of only one TMN, i.e. Alliance in the Alps in 1997. Between the two TMN launch periods of municipal voluntarism and strategic urbanism thus seems to occur a period coinciding with tumultuous international negotiation intents to operationalise the UNFCCC through the Kyoto Protocol, which was signed in 1997 and entered into force in 2005.

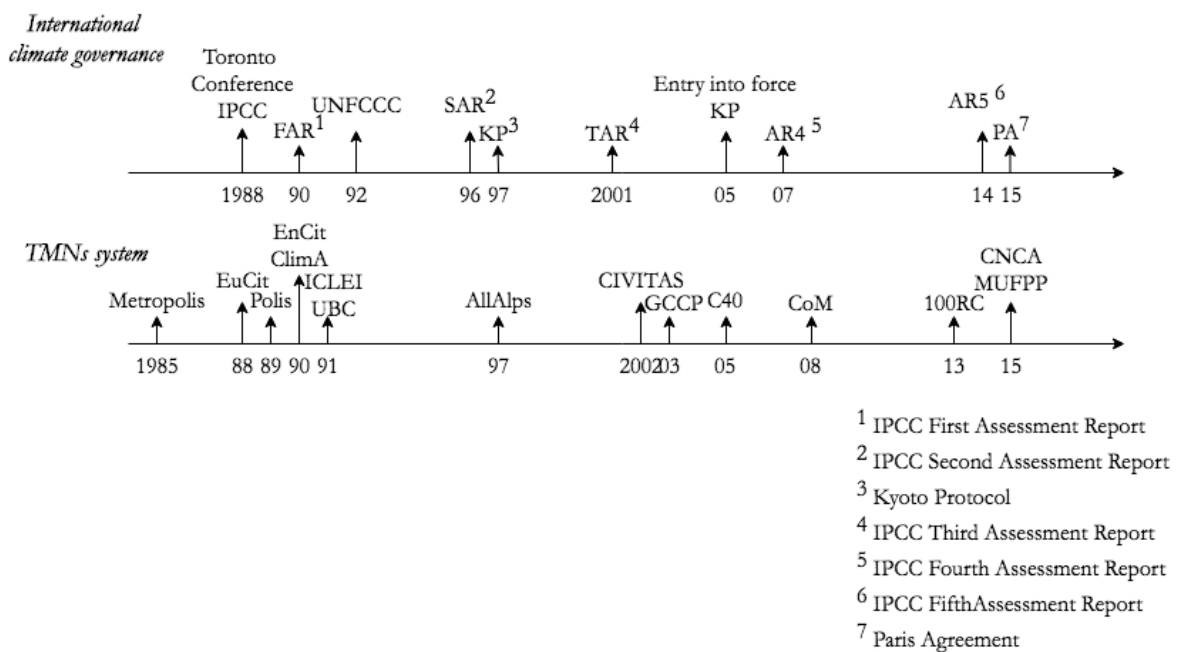


Figure 4.1 Comparative timeline of international climate governance and the TMNs system

Figure 4.1 illustrates how a variety of international climate governance events have occurred simultaneously with TMN launches. It suggests that the launch of TMNs has likely been a response to international climate negotiation outcomes. This is in line with the comments made above, and the statement of several scholars that important international events often

spur the rise of nonstate and sub-state action (Chan et al., 2015: 468). Several works have seen TMNs as climate governance experiments, that is, ‘process[es] of making rules outside well-established channels’ (Hoffmann, 2011: 18). As such, TMNs might start as a way for cities, NGOs or other actors to either enhance international efforts or look themselves for solutions in the face of either a paralysed or dysfunctional international climate governance (Bellinson and Chu, 2019; Bernstein and Hoffmann, 2018; Gordon, 2018; Smeds and Acuto, 2018; Hale and Roger, 2014).

The various dates of launch might also suggest a variation regarding the thematic scope of and the issues tackled by the distinct entities. Several older TMNs emerged with a broad scope, seeking to defend the interests of local governments in the global arena or to help them become more sustainable. A few TMNs still have a large scope, such as 100 Resilient Cities (100RC), which works on the broad phenomenon of resilience. Doing so, it includes climate-related issues, thus being an example of TMN created during strategic urbanism which tend to mainstream climate policies (Bulkeley, 2013).

With the exception of Climate Alliance, the TMNs working specifically on climate change or the related issue of carbon neutrality were launched rather recently, that is, from 2005 on. This might be related to the evolution of international politics. Indeed, climate change was not part of the international agenda at the beginning of the period. It was, and mostly remains, out of the prerogatives of cities, although there are in that regard great differences among cities worldwide. Like energy and transportation, which have been important city prerogatives for a long time, sustainability was soon acknowledged as a local issue. Sustainability, energy, and transportation are all linked to climate change, however. It is possible that, as climate change shifted from being ignored to becoming a pressing preoccupation with local roots, cities changed the framing of their actions in order to tackle the same traditional issues through a different wording including new climate concerns. Overall, this has led to the launch of more TMNs directly tackling climate change in the second half of the 1985-2015 period.

4.1.2 The diversity of actors behind the founding and funding of TMNs

A second variable underlining the diversity of the TMN population is the set of actors involved in their creation. As we will see in Chapter 5, this information will be useful when looking at control variables.

Scholars have often pictured TMNs as networks of cities by cities, often ignoring the presence of non-city actors in both their creation and their operations (Nielsen and Papin, 2020). Although the TMNs complex system surely contains a majority of TMNs created by cities, the creation of a third of these TMNs involved other actors, i.e. IGOs, NGOs or private foundations.

Both in TMNs created by cities and in TMNs created by non-city actors, it seems that founders have remained active participants. In the TMNs created by cities, it seems that the founding cities hold a different status or are more active than the other member cities. In Energy Cities and Climate Alliance, for instance, the founding cities also host the headquarters of the TMNs.⁵¹ The Global Compact Cities Programme (GCCP), which was created after Melbourne became the first city to sign the UN Global Compact, gave Melbourne a leading role in its management, making it the host of its international secretariat. Similarly, the recent Milan Food Urban Policy Pact (MUFPP), which was announced by the Mayor of Milan in 2014, has its secretariat in the Mayor of Milan's office. Furthermore, the City of Milan currently acts as chair of the TMN and has a permanent seat on its steering committee. The C40, created out of the initiative of the then London mayor Ken Livingstone, also seems to attribute its founding cities a specific role in its governing. This is perceivable in the history of C40 chairs, all mayors of C40 cities. Out of the five chairs that have led the TMN since 2005, four were mayors of C40 founding cities (i.e. London, Toronto, New York and Paris).⁵²

The TMNs founded by non-city actors also display a strong involvement from their founders. A relevant example lies in the 100RC initiative. Although the rest of the 100RC staff is hired by 100RC, the president of the initiative of 100RC is an employee of the Rockefeller Foundation, which founded the TMN and is still its main funder. The Rockefeller Foundation

⁵¹ Documentary observation suggests that headquarters rarely change cities.

⁵² For the list of the 18 C40 founding cities, see Chapter 6.

started to advance the global urban resilience agenda before creating 100RC, notably through the 2008 foundation of the Asian Cities Climate Change Resilience Network (ACCCRN). The Rockefeller Foundation also participated in fostering the Global Resilience Partnership and created, with the global consultancy ARUP, two urban resilience tools called the City Resilience Index and the Resilient City Framework. The Rockefeller Foundation is also the main funder of Rebuild by Design, an initiative aimed at designing projects in cities for the enhancement of urban resilience. Rebuild by Design has progressively become an important partner of 100RC's, while remaining an autonomous entity. An informal talk with a Rebuild by Design employee underlined the close relationship of the organisation and 100RC, mentioning the fact that the Rebuild by Design team attended 100RC staff meeting and that their director was on the 100RC executive team.

Urban resilience is thus clearly on the Rockefeller Foundation's agenda. The foundation has used the 100RC initiative as a tool to keep advancing its ideas on this issue, to the point where they sometimes seem to be two sides of the same coin. To wit, when describing the work of their member city with the TMN during informal talks, Montreal staff members seemed to confuse the 100RC initiative and the private foundation. The involvement of the Rockefeller Foundation in the functioning of the TMN it has founded and funded is hardly mistakable.

Information on the sources of funding was generally difficult to obtain. Data regarding the TMNs funded mostly by private foundations were more accessible. They show that 100RC sees its main funder as playing a significant role in its functioning, as explained above. As a matter of fact, because of the Rockefeller Foundation's decision to end 100RC's funding, 100RC recently announced it would end its operations and integrate the Foundation's resilience initiatives. C40 seems to be in a comparable situation in relation to the role of its funders. Among the three private foundations that fund it, Bloomberg Philanthropies is prominent.⁵³ Indeed, Bloomberg Philanthropies' founder, Michael Bloomberg, is currently president of the Board of directors of the C40, after being chair of the TMN between 2010 and 2013. He holds a prominent position regarding C40's functioning, since the board supervises the management and daily operations of the TMN. The situation of CNCA is less

⁵³ The two other main funders of C40 are Realdania, a Danish philanthropic association whose mission is to enhance the quality of life through the built environment, and the Children's Investment Fund Foundation, a British organisation dedicated to improving the future of children.

clear, since CNCA displays little information on its website. The role of its six funders is obscure.⁵⁴ The funders of other TMNs are often public and private. CIVITAS seems to rely mostly on EU funding. So does CoM, although information on the matter was particularly scarce.

These last comments on TMN funding highlight issues of transparency. Few TMNs openly display their budget, and information is often difficult to find on the websites of big funders. Yet, lack of transparency might be a sign of lack of accountability, which in turn might reveal problems of legitimacy (Bäckstrand, 2008). Bäckstrand (2008) has shown the need for more accountability mechanisms among governmental partnerships such as TMNs. Depending on the actor of focus, these mechanisms may vary. In the case of governmental partnerships, it seems that peer accountability and reputational accountability are dominant, but transparency and monitoring mechanisms might be lacking. Scholars have also shown that ICLEI, as focal point of the LGMA constituency of the UNFCCC, and the LGMA constituency itself, lacked accountability mechanisms in higher instances as well (Kuyper et al., 2017; Kuyper and Bäckstrand, 2016). Few studies have looked into details at these issues regarding TMNs. Although they cannot be examined here, looking into details at these questions will be crucial for future TMN studies, especially since, as we will see later, more and more private actors seem to be involved in and influencing TMNs.

4.1.3 Distinct organisational resources

A third attribute variable of interest is the size of TMNs' organisational resources. This information will be useful when testing H2 in Chapter 5.

Available information on TMN budget is again scarce. CIVITAS seems to be the TMN with the largest funding. Its corporate documents reveal that its estimated 2002-2020 funding from the EU project Horizon 2020 has been of 250 million euros, which equates to an annual budget of about 13 million euros, or 16.3 million dollars (Statista, 2020). Behind CIVITAS, 100RC stands out. Through the support of the Rockefeller Foundation, it has received about 164 million dollars since 2013, which equates to an annual budget of 11 million dollars.

⁵⁴ CNCA's main funders are the Kresge Foundation, the Barr Foundation, the V. Kann Rasmussen Foundation, the Rockefeller Brothers Fund, the Summit Foundation and the John D. and Catherine T. MacArthur Foundation.

ICLEI is another of the most funded TMNs. Its corporate and annual reports show that its funders are diverse, from national governmental agencies and member local governments, which pay a fee, to IGOs and private foundations. Its budget in 2012⁵⁵ is estimated at 12 million dollars (USD), or about 9.4 million euros at that time (Statista, 2020). As stated above, C40 is mostly funded by three private foundations. In 2016, this TMN received 27.9 million dollars from these organisations, which equates to an annual budget of about 9.3 million dollars. Unfortunately, information regarding the budget of the largest TMN of the TMNs system in terms of membership, the Covenant of Mayors, was unavailable. The other TMNs of the studied population have much lower budgets. CNCA, funded by six private foundations, has a budget of around 1.2 million dollars. The Union of the Baltic Cities (UBC) has currently an annual budget of around 0.45 million dollars.

Because information on TMN budget is too scarce, looking at TMNs' organisational resources is beneficial. TMNs have different organisational resources. C40 and 100RC stand out. With a staff of about 150 people in six offices and 100 people in four offices respectively, they have the biggest human resources of the 15 selected TMNs.⁵⁶ The size of their structure makes them hard to compare to the smallest TMNs of the system, CNCA, GCCP, or Alliance in the Alps, which have a team of five people for CNCA and six people for the other two TMNs. The size of the organisational resources and that of budget may be linked.

We might surmise that the wide differences of budget among the 15 TMNs are related to the TMN membership sizes. As mentioned in Chapter 3, the size of the membership of the 15 selected TMNs differs vastly (see also Figure 4.2). The largest TMN is the Covenant of Mayors, which has more than 8,800 members; the smallest is CNCA, with 20 members. Climate Alliance, the second largest TMN, has more than 1,700 members. The third one, ICLEI, has more than 800 members, and has worked with more than 1,700 cities and local governments. Most TMNs of the identified population have around 70 to 300 members. TMN membership evolves over time: it increases in the first years after the launch of the TMN, and then stabilises (Kern and Bulkeley, 2009).

⁵⁵ This is the latest information on budget found for ICLEI.

⁵⁶ This excludes ICLEI, which has a decentralised structure including numerous regional offices which can create their own governance tools. However, this study focuses on ICLEI's world secretariat, which has a staff of 55 people.

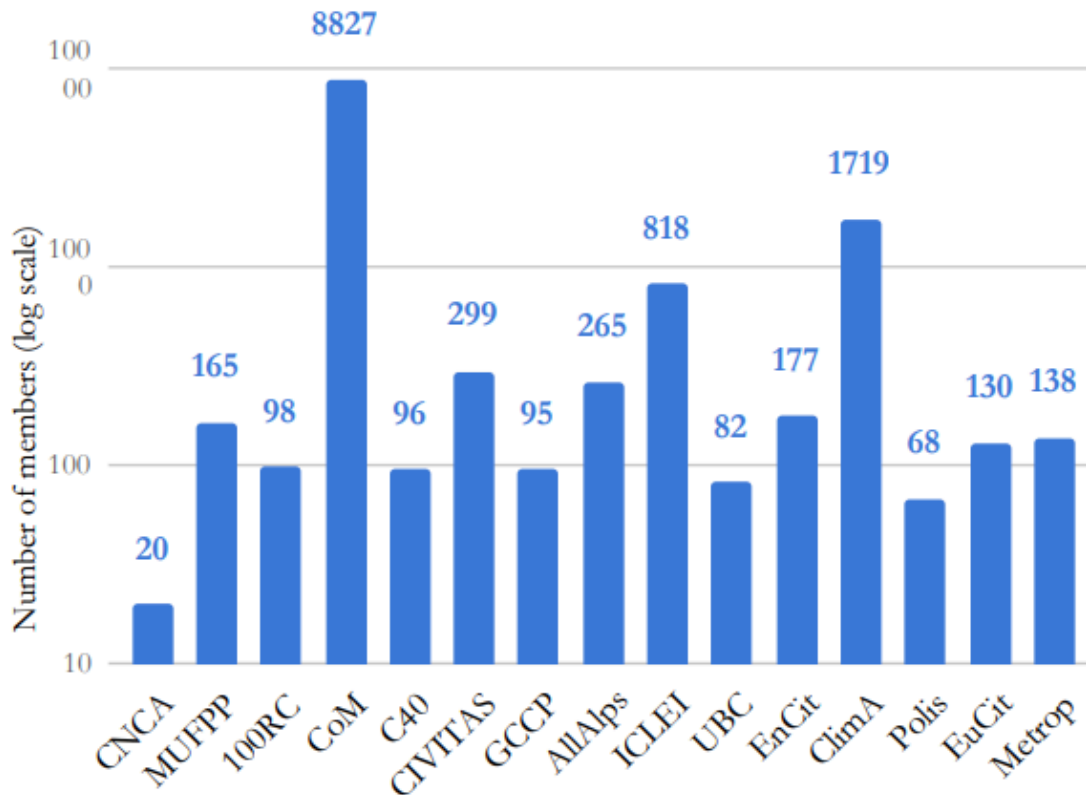


Figure 4.2 Membership of the 15 selected TMNs⁵⁷

Likewise, the size of the staff and the size of membership are not necessarily related. On the one hand, ICLEI has more than 800 full members and a considerable budget. On the other hand, C40 and 100RC have comparable budgets but only about 100 members. They nonetheless have between 100 and 150 employees and several regional offices. ICLEI also has a substantial organisational structure, of 22 decentralised offices and 55 employees just in its world secretariat. The Covenant of Mayors is a distinct case: its office of 24 people is indeed managed by six different networks, and funded by the EU.⁵⁸ At the time of creation of the initiative, the EU launched a bid among transnational networks offering them to take part in the management of Covenant of Mayors. Among the six networks that won the bid, three are part of this study (i.e. Energy Cities, Eurocities, and Climate Alliance).⁵⁹

⁵⁷ A logarithmic scale was used to better illustrate the differences between the TMNs of less than 500 members.

⁵⁸ Understanding what comes from the EU and what comes from the six networks managing this TMN, and what belongs to this TMN is difficult. As will be highlighted in Chapter 5, I consider that the organisational resources of the Covenant of Mayors lie in its 24 staff members. The six networks mentioned might nonetheless bring other kinds of resources of which we are unaware and therefore do not consider here.

⁵⁹ The three others are ICLEI-Europe (the European office of ICLEI), the European Federation of Agencies and Regions for Energy and the Environment (FEDARENE), and the Council of European Municipalities and Regions (CEMR).

We should note that the organisational resources of TMNs appear limited, including for TMNs with the highest funding such as C40. TMNs depend highly on external funding and funders (Haupt and Coppola, 2019). For several interviewees, TMNs seek to interact with others because they lack funding to achieve their mission (Interviews 3, 7, 12). The search for resources therefore leads them to either collaborate or compete (Interviews 1, 3, 4, 7, 8, 12). As we will see in Chapter 6, TMNs appear to be constantly struggling to find resources. Depending on the TMN, this need for resources might be linked to the large scope of their mission (such as sustainability, resilience, or urban issues) or their high number of members (as in the cases of the Covenant of Mayors or ICLEI).

Now that we observed important characteristics of TMNs, which help differentiate them and will be useful to test this study's hypothesis in Chapter 5, it is important to introduce TMNs' novelty ranks, which are a way to represent and analyse the variation of this study's dependent variable.

4.1.4 Distinct novelty ranks

A fundamental observation from which this research stems is that all TMNs do not generate the same number of novel governance instruments. The analysis of all the governance tools generated by TMNs in the period under study (1985-2018) reveals that a few TMNs generate a lot more novelties than others.

Figure 4.3 emphasises the distribution of novelties among the 15 TMNs. It indicates that, albeit not easy, generating novel instruments is by no means impossible. Apart from ICLEI, which has managed to generate on average slightly more than one new instrument every couple of years since its creation, most TMNs have generated few instruments. This is not surprising, especially considering this study's understanding of novelties as unprecedented combinations of specific governance characteristics. Since there is a finite number of governance characteristics (or resources) available to TMNs, there are only so many novelties they can generate. Nevertheless, because novelties are not necessarily disruptive, but often offer incremental changes only, they are not exceptional either. Among the 535 tools identified in this work, 62 (or about 11%) represent novelties.⁶⁰ Figure 4.3 also shows that

⁶⁰ Appendix C provides details on these novelties.

not all TMNs are equal in terms of novelty emergence. While ICLEI managed to generate 17 tools in 29 years, Eurocities did not create a single one in 33 years. This shows that not all TMNs have the same ability to generate governance instruments. The number of novel instruments generated by each TMN is useful to establish a ranking of the TMNs with the greatest capacity to create novelties.

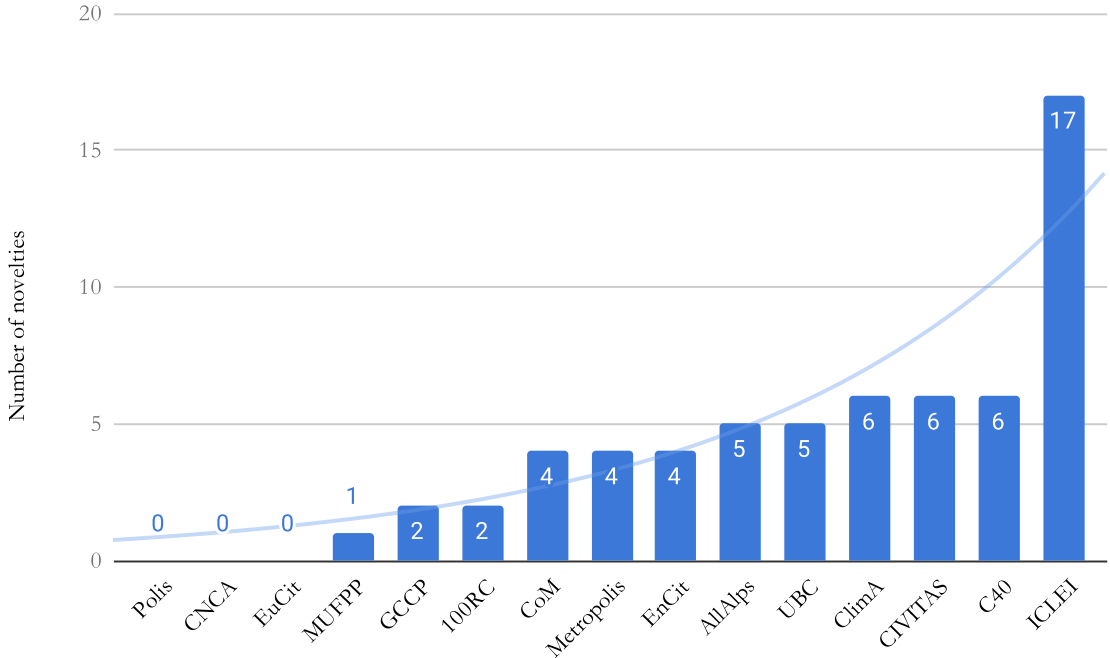


Figure 4.3 The distribution of novelties among the 15 TMNs⁶¹

As we will see in Chapter 5, ICLEI’s high number of novel instruments may be related to its high centrality and diversity scores, as well as its age. The relatively similar scores of many TMNs are also mainly related to their interaction variable results.

Table 4.2 presents the novelty ranking of the 15 TMNs. As mentioned in Chapter 3, the novelty ranking was calculated considering two scores, i.e. the number of novel instruments, and the number of early adoption points. The number of early adoption points was computed by summing up, for each TMN, the points granted for all the instruments that a TMN generated according to the number of times other TMNs had already generated these instruments (i.e. tools with the same combination of governance characteristics). For

⁶¹ The dark blue line illustrates the number of novelties per TMN, while the light-blue curve shows the tendency of the curve. The light-blue curve thus stresses the similarity of the TMNs system and scale-free networks, in which very few nodes create many novel instruments, and most create very few.

instance, an instrument generated for the first time ever in the system would give its initiator, TMN *a*, 15 points; a tool produced for the first time by TMN *b*, but already generated once by TMN *a* would give TMN *b* 14 points. Tools were only considered the first time they were produced by each TMN. In other words, a combination of governance characteristics used several times by TMN *a* would only be counted once for TMN *a*, that is, the first time it generated that instrument. The number of novelty points thus reflects to which extent a TMN is an early adopter of novel governance instruments. Most importantly, it highlights the capacity of TMNs to learn from others and use those learnings to evolve in their own practices.

TMN	Number of nov. instruments	Early adoption points	Novelty ranking
ICLEI	17	335	1
C40	6	317	2
CIVITAS	6	258	3
Climate Alliance	6	157	4
UBC	5	216	5
AllAlps	5	143	6
Energy Cities	4	223	7
Metropolis	4	218	8
CoM	4	151	9
100RC	2	145	10
GCCP	2	102	11
MUFPP	1	63	12
Eurocities	0	104	13
CNCA	0	82	14
Polis	0	80	15

Table 4.2 Ranking of the 15 identified TMNs in terms of novelty⁶²

⁶² The novelty ranking considers not only the number of novel instruments created by each TMN, but also, to distinguish among those that have created the same number of instruments, their ability to adopt novelties (by creating tools with the same combination as that of novelties) quickly.

The number of novelties matters more than the number of early adoption points in the novelty ranking. Indeed, this study is primarily interested in the emergence of instruments as defining novelty. The early adoption of tools is of lesser importance. It is nonetheless useful to rank the TMNs that have created the same number of instruments.

Table 4.2 reveals that ICLEI appears first both in the number of novel instruments generated and the number of early points. C40 ranks second because, although it has created as many novel instruments as CIVITAS and Climate Alliance, it has overall more early adoption points. Similarly, Polis ranks 15 because, although CNCA and Eurocities have not created any novel governance instrument either, Polis has a lower number of novelty points. The ability of TMNs to adopt the novelties of others generally follows the same tendency as their capacity to generate novel instruments. It is important to underline a few irregularities, however. Climate Alliance has generated a rather high number of novel instruments, but has a relatively low number of early adoption points, meaning its ability to adopt the novelties of others is weaker than its ability to generate novelties. The same goes for Alliance in the Alps. As we will see in Chapter 5, these are both TMNs with relatively low substantial diversity scores. MUFPP also has a rather low early adoption point score compared to its novelty rank. This may be related to its recent launch (only three years prior to the end of the studied period) which, while enabling it to generate one novel instrument, did not give it the opportunity to adopt the novel instruments of other TMNs. In contrast, Energy Cities and Metropolis, which, as we will see, have interaction variable scores that generally confirm this study's theory, have a number of early adoption points higher than expected considering their average novelty rank.

To conclude, this section has stressed the existence of several differences in the characteristics of the 15 TMNs of the system. It pointed to three main attribute variables which underline these differences, namely the date of launch of TMNs, the nature of their founders and funders, and their organisational resources. Chapter 5 will further analyse these variables. For now, these variables highlight valuable differences among TMNs. The last subsection presented the novelty ranking of TMNs, which shows another difference among TMNs, in terms of output. The next section looks more broadly at this output, analysing the

distinct governance practices in the variety of governance tools they generated in the period under study. It thus starts to analyse the variation of this study's dependent variable.

4.2 The governance practices of TMNs

This study posits that the novelty generated by TMNs lies in their governance practices, and more specifically, in the instruments they use to steer their members towards climate action. Looking into details at these instruments gives us a clue as to the governance practices of TMNs. In that context, this section presents the data collected for this work on the governance tools of the 15 selected TMNs. It reviews the 535 tools listed in the dataset and details their governance characteristics. Following the method discussed in Chapter 3, this section thus introduces part of the results of the data collection and analysis, i.e. the identification of the governance tools produced by TMNs, and the observation of tendencies regarding how TMNs govern their member cities in the climate action realm (see Table 4.3, Section 4.2.3.2). This broader picture of TMN tools and practices is necessary to better characterise what constitutes a novel instrument and show the variation thereof.

Contrary to what some scholars have argued, TMNs do not always resort to new, or soft and indirect governance techniques, to steer their members (Bulkeley and Newell, 2015; Hickmann, 2015). Indeed, the use of rule-setting, funding, and obligation governance characteristics, usually thought to belong to command-and-control approaches (Lascoumes and Le Galès, 2004), reveals that several TMNs, especially among the most recent (i.e. new-generation TMNs, those which were launched during strategic urbanism), have adopted a more diversified approach to steering. To describe these trends, the next subsections first underline how TMNs often intend to influence their members, what they tend to avoid, and some unexpected practices that they sometimes have.⁶³

4.2.1 What TMNs mostly do

4.2.1.1 Information sharing

The data collection and analysis show that, among the diverse governance functions identified, all the 15 TMNs greatly favour the sharing of information. It is indeed the most

⁶³ The analytical framework presented in Chapter 1 comprises 10 governance characteristics. Because some (i.e. directness and inclusion) did not appear to generate noteworthy results, this section only briefly mentions them.

visible function in the tools TMNs create (see Figure 4.4). In eight TMNs out of 15, all the tools identified seek to diffuse information or knowledge, among other goals. In the other seven TMNs, information sharing is present in about 90 to 98% of the tools. A vast number of tools created for purposes of information sharing take the form of events or publications. These tools are sometimes for members only, but they are most often open or accessible to other actors: 75% of all tools having information sharing as one of their functions are directed towards non-members as well as towards members. Information sharing is a characteristic of 53 instruments out of the 62 instruments identified in this study, i.e. the distinct combinations of governance characteristics (see Figure 4.4).

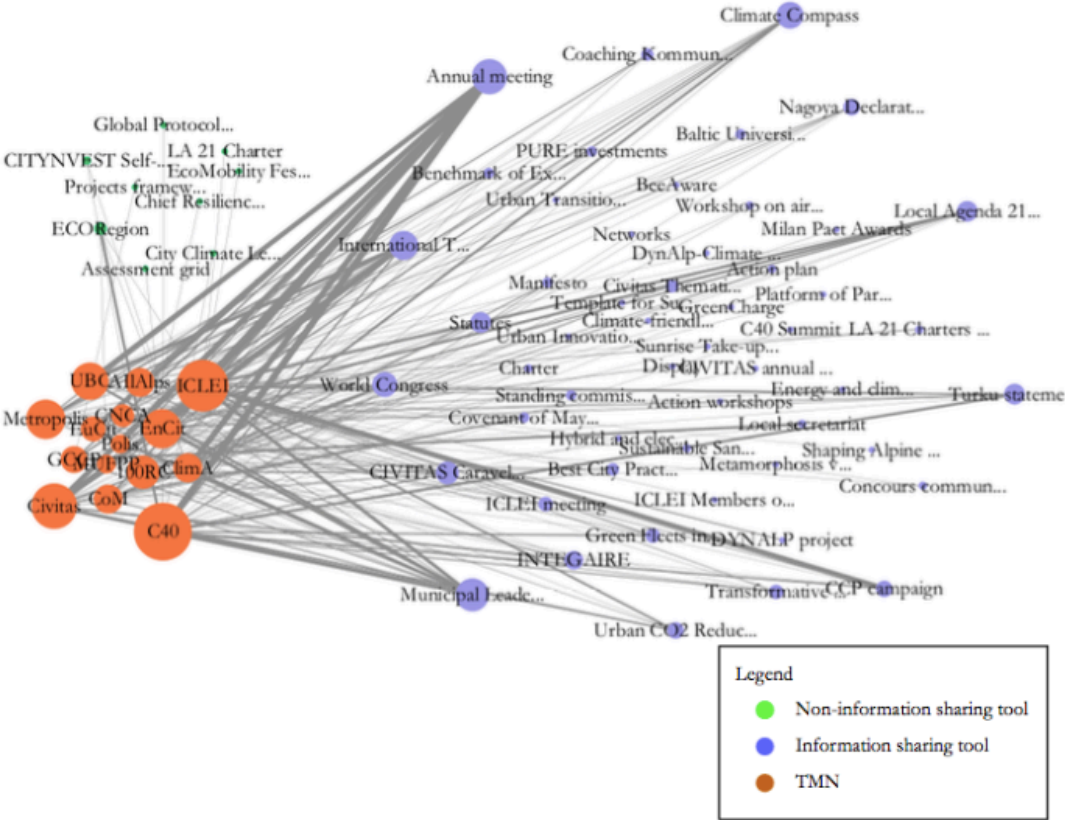


Figure 4.4 Information sharing instruments in the TMNs system⁶⁴

⁶⁴ This bipartite network illustrates the creation of information sharing instruments by the 15 TMNs. There is a link between a TMN and an instrument if that TMN created a tool that corresponded to that instrument (i.e. the specific combination of governance characteristics that instrument bears). The label of each instrument corresponds to the name of the novelty with which the instrument is associated, that is, the first-time occurrence of that instrument. The size of the nodes is proportional to their degree, that is, how many connections they have to other nodes (instruments if the case of TMNs, and vice-versa). The thicker the edge between a TMN and an instrument, the more tools created by the TMN corresponding to that instrument.

A bipartite network representation is here useful to highlight which TMNs have generated the most tools. ICLEI, C40 and CIVITAS clearly appear as having the largest degrees among the 15 TMNs, which means here that they have generated the most governance tools. Figure 4.4 also shows from which TMNs the very few non-information sharing tools come, i.e. mostly C40, but also ICLEI, and, to a lesser degree, Climate Alliance, 100RC, Energy Cities, GCCP, and MUFPP. The fact that C40 is by far the TMN that has created the most non-information sharing tools suggests that the distribution of non-information sharing tool does not strictly reflect the distribution of governance tools among TMNs. It also points to the idea that C40 might have overall distinct governance practices.

Information sharing is the most emblematic function of networks in general: interactions between nodes primarily enable communication and information flows. One of the great concerns of network theory is the diffusion of ideas. For Castells (2010), the current informational society is based on the network society. Scholars working on the functions of TMNs also often highlight the prominence of information sharing. TMNs indeed offer cities information and knowledge on climate change and climate action (Betsill and Bulkeley, 2004). As Kern and Bulkeley (2009) argue, ‘Networks are frequently established for the explicit purpose of creating and sharing “best” or “good” practice, and municipalities indicate that the opportunity to learn about “what works” from other places is a key motivation for their participation.’ Likewise, several interviewees see information sharing as one of the main benefits of joining a TMN (Interviews 6, 9, 16, and 17). One even mentions that ‘that’s the most important thing of the network, the sense of the network’ (Interview 9). The analysis of TMN governance tools therefore confirms other numerous findings in the literature on TMNs. It also confirms Busch’s general definition of TMNs as ‘institutionalised spaces where local governments from different countries come together as equitable partners in an exchange on climate change related issues.’ (2015: 215)

If all TMNs mainly seek to diffuse climate-related information, we may wonder why there are so many, and why stakeholders keep funding them. It might indeed look like unnecessary functional overlaps. One reason might be that TMNs, as actors, choose the information they diffuse to their members (Interviews 6 and 9). Not all TMNs diffuse the same information. Depending on their objectives or on the interests of those who lead the network, they might

decide which information is relevant and which is not. Another reason is that TMNs serve a variety of purposes, besides information sharing. Many TMN tools, yet not all, are notably used for norm-setting.

4.2.1.2 Norm-setting

The second most present function in TMN governance tools is norm-setting. As mentioned in Chapter 1, the definition of norm-setting used in this study is quite broad and includes best practices, recommendations for climate action, and discourses that might appear to favour some solutions over others regarding climate action. Norm-setting shows the volition of TMNs to diffuse certain normative ideas among their members, but also in many cases among other actors.

Norm-setting globally appears to be present in more than 75% of the 535 governance tools listed. TMNs organise many events for self-promotion and to give their members the visibility they seek. These events enable them to share information, but also, in many cases, to diffuse norms. Among all the information sharing tools of this study's list, about 75% also seek to set some norms. TMNs thus do not only seek to share information and knowledge, but also specific ideas that they deem important to climate action. Although some tools that have norm-setting as one of their functions are directed at members only, many are directed at other actors as well, whether or not the latter belong to the TMNs system. Out of the 410 tools that have norm-setting as one of their governance functions, 305 (or about 75%) are directed both at members and other actors. According to the data collected for this study, 75% of the tools TMNs have generated also seek to orient the behaviour of non-members. On average, TMN tools do not target only their members' behaviour.

Many norm-setting tools take the form of publications often called 'statements', 'declarations', or 'resolutions'. They also often include 'good practices'. Several European TMNs have their headquarters (e.g. Polis or Eurocities) or an office in Brussels (e.g. Climate Alliance or Energy Cities). This helps them lobby and promote the interests of cities before the EU. Global TMNs also tend to lobby in higher instances. Their presence and active participation at the COPs are a relevant example. At COP23, for example, ICLEI, in partnership with other TMNs such as C40 and the Global Covenant of Mayors, set up a Cities and Regions pavilion where a variety of side-events took place to promote the climate actions

of cities, and underline what they needed in order to keep increasing their efforts. Besides giving visibility to the mayors of city members, it was a way for TMNs to put forward certain ideas regarding the way urban climate governance should take place. One of the most important side-events organised at the pavilion was the Climate Summit of Local and Regional Leaders, which high-profile actors concerned with urban climate governance attended. The Summit led to the Bonn-Fiji commitment, a norm-setting tool which engaged cities in local Talanoa Dialogues.⁶⁵ Overall, the financing of city climate action and the use of renewable energy in cities were among the main themes discussed during these events. As were they a year later, at COP24, in the side-events organised by the TMNs. The discourse of TMNs during these events seemed to lean more towards advocacy than information sharing. Their practices were visibly presented as solutions rather than possible options to tackle climate change. Furthermore, we should note the role of ICLEI as a focal point of the LGMA constituency to the UNFCCC. The LGMA constituency aims to present and protect the interests of NGOs working for local entities in front of the UNFCCC. It is ultimately a lobbying force seeking to influence the UNFCCC decisions in a way that benefits its members.

Among TMN governance practices, norm-setting, therefore, seems to matter greatly. A few scholars have insisted on the importance of that governance function. Davidson and Gleeson (2015), proposing a political ecology of the C40, stress the neoliberal structural conditions in which it is embedded. They argue that this TMN supports a type of urban climate governance located in an economic development narrative that restricts its scope. In other words, TMNs such as C40 favour certain types of climate action over others.

Given the place of norm-setting in the governance functions of TMN tools, looking at the interactions of TMNs is particularly beneficial. Indeed, seeing how some TMNs are connected to distinct types of actors (e.g. businesses, private foundations, IGOs, governmental agencies, etc.) may help explain why they favour some types of policies or initiatives over others. For instance, the fact that Bloomberg Philanthropies is so involved in C40 may help explain why the TMN has given so much importance to data in its climate

⁶⁵ The Talanoa Dialogue was one of the most important initiatives of the Fiji Presidency at COP23. It carried the idea of an open, inclusive, and collaborative dialogue for enhanced commitments of the Parties in the Paris Agreement.

initiatives, as evidenced by an interviewee: ‘Bloomberg is very much focused, Bloomberg Philanthropies is very focused on data, measurement, so you know, you measure what you’re working on so that you can manage it and report your outcomes, it’s something that is really big in C40 now. And I think having that focus on outcomes allows us to be very effective.’ (Interview 13)

Data services are an important part of what Michael Bloomberg’s main company, Bloomberg LP, offers. Michael Bloomberg himself, who, as mentioned earlier, has been an important actor in the development of C40, tends to stress the importance of data. In his own words, ‘If you can’t measure it, you can’t manage it’.⁶⁶ Another one of his mottos, related by an interviewee, is: ‘In God we trust. Everyone else brings data’ (Interview 12).⁶⁷ While these mottos help understand why C40 gives so much importance to information sharing, it also reveals a norm that C40 has integrated since the involvement of Michael Bloomberg and Bloomberg Philanthropies in its development namely, the importance of measuring GHG emissions and outcomes of climate action.

These comments show that norm-setting is a crucial governance function to which scholars should pay more attention. Although information sharing remains the most important function of TMNs, norm-setting is in a close second position. Both functions are closely related: norm-setting depends on the information being shared by TMNs. For instance, it is because TMNs decide to diffuse a lot of information about renewable energy that they also promote electric public transportation as a good practice. Nevertheless, the two governance functions should not be confused. While information-sharing is related to the type, volume, and content of data shared with cities, norm-setting is mostly about how this information is presented.

4.2.1.3 Capacity building

The third most important function in TMN governance tools is capacity building, which is present in 25% of the identified tools. Like information sharing and norm-setting, capacity building is a soft governance function. It aims to give cities resources and empower them so

⁶⁶ This phrase is visibly one of Michael Bloomberg’s mottos. See his 2013 tweet: <https://twitter.com/MikeBloomberg/status/320250776431771648> (last accessed April 26, 2019).

⁶⁷ See also Bloomberg’s 2014 tweet: <https://twitter.com/MikeBloomberg/status/443753465488367617> (last accessed May 06, 2019).

that they can act on climate change themselves. Capacity building is visibly less important than information sharing or norm-setting. It remains an important function of TMNs (Haupt and Coppola, 2019; Busch, 2015; Andonova et al., 2009), albeit unevenly represented. A few TMNs, i.e. MUFPP and Climate Alliance, have generated very few capacity building tools, whereas others, such as CIVITAS, ICLEI and 100RC, include this function in about a third of their tools.

Indeed, several obstacles to local climate action seemingly lie in the lack of information, knowledge, and capacity of municipalities to develop climate plans (Reckien et al., 2015). In addition, TMNs have limited resources, and thus seem to constantly seek ways to multiply their effects. Consequently, it is not surprising that TMNs would make capacity building an important governance function. Capacity building implies a process of learning that goes beyond information sharing, which is only about the transmission of information and knowledge. It often requires from cities a greater commitment than merely reading a report or passively attending a conference. It also involves distinct resources from TMNs, as it occurs through real-life events or webinars and is therefore interactive. Rather than providing cities with information, whether or not this information is relatively neutral, capacity building implies helping them gain the skills to act. It is more oriented towards implementation than other functions. Capacity building may imply ‘negotiation over rights and responsibilities and struggles over the nature of the problem and its appropriate solutions’ (Andonova et al., 2009: 64). The engagement of actors is thus crucial and goes beyond information sharing.

Even though we may assume that the implementation of capacity-building is more resource-intensive than that of information sharing or norm-setting, 70% of them are directed at non-members as well as at members. TMNs thus use their limited resources also in favour of non-members. This suggests, once again, that they seek influence beyond their members.

The importance of information sharing, norm-setting, and capacity building among the governance functions of TMN governance tools reveals that, as other transnational actors, TMNs mostly use soft modes of governance (Green, 2017b; Bulkeley and Newell, 2015; Hickmann, 2015; Kern and Bulkeley, 2009). It is also in line with Busch’s theory that TMNs act as platforms, consultants, commitment brokers and advocates (2015). All these social

roles TMNs might have indeed correspond to the three governance functions that were just highlighted.

The study of TMN governance tools is pregnant since it offers a more detailed account of the governance characteristics to which TMNs resort to steer their members. It might also help us perceive where some TMNs appear to generate more novelties than others. Knowing precisely how TMNs work with cities is obviously crucial to the understanding of their possible effects on global climate governance. Knowing what they do not do is nonetheless as relevant to reach this research goal.

4.2.2 What TMNs mostly do not do

The list of TMN governance tools built for this study stresses some governance functions with which TMNs hardly ever engage. These are financing and direct action.

4.2.2.1 Funding

Among the reasons for which cities join TMNs is the possibility to receive funding for climate action (Betsill and Bulkeley, 2004). Cities most often lack financial resources to address this issue (Haupt and Coppola, 2019). This makes it harder for cities to include it to their agenda. Some economic factors, such as unemployment, act as barriers to climate action planning (Reckien et al., 2015). Receiving money for climate action may thus be a great incentive for cities to join TMNs.

Nevertheless, the present analysis reveals that TMNs actually rarely employ funding as a governance function in their tools. It also underscores the fact that, as for other actors, financing climate action has become an important issue. In the list of identified tools, there is a variety of workshops, events, and publications dedicated to financing urban climate action. TMNs seem to try to influence other actors to give cities money or to help cities get access to funding. They do not often provide financial resources themselves, however (Interviews 3 and 9). As underlined earlier, interviews suggest that resources are scarce, and TMNs often have to compete for them. It seems that they mostly use their money to manage the network, promote the point of view of their members, help cities receive information and knowledge and commit to certain norms, and empower them, rather than to directly finance their actions.

The tools that do have a funding function generally offer money to cities based on merit, in the form of grants or awards. Only two of them, both generated by 100RC, are automatically granted to cities. They nonetheless have specific purposes: they give cities access to some pro-bono services, and compel them to add a chief resilience officer (CRO) position to their organisational structure. As for capacity building, most funding tools are not limited to members.

On a final note on funding, seven TMNs out of the 15 studied have not used funding at all in their tools. These TMNs do not seem to correspond to a specific profile: they are European, global, old or more recent. However, among the four TMNs that use funding more than the others, three are global and the most recent of the analysed population, i.e. 100RC, CNCA, and MUFPP. As mentioned above, the two funding tools 100RC has created are open to all its members. This shows that 100RC has perceived the need of cities for more funding mechanisms for specific interventions. More evidence is needed, but these findings point to the idea that new-generation TMNs might see funding as a more important function than do older TMNs.

4.2.2.2 Direct action

The analysis of TMN governance tools underscores that direct action is almost absent from their functions. Indeed, very few TMNs directly act on climate change, and those that do do it through one or two of their tools only. TMNs act mostly as intermediaries. They connect actors together and interact with a lot of partners because they do not have the expertise to act on their own. Even with other actors, they help cities act more than they act themselves.

Drawing on Lascoumes and Le Galès (2004), both funding and direct action can be considered traditional governance approaches through which authorities become legitimate. Because TMNs have fewer financial resources than traditional state actors, it might be difficult for them to resort to these functions. Therefore, they mostly use functions that depend on informational and technical resources (e.g. information sharing, norm-setting and capacity building), easier to access through partnerships.

These findings are not surprising. Through a more detailed analysis, they confirm what the literature has underlined so far. The analysis also highlights unexpected aspects of TMN

governance practices, which might highlight the capacity of some TMNs to generate more novel instruments than others.

4.2.3 Some unexpected governance characteristics

As argued above, this research's analysis of TMN governance tools confirms several findings of the literature on TMNs. Yet, it also uncovers some characteristics of TMN governance practices that the literature has mostly ignored, i.e. rule-setting and obligation.

4.2.3.1 Rule-setting

As mentioned in Chapter 1, rule-setting is the elaboration of rules which guide or constrain members. These rules prescribe a behaviour that members should adopt, without necessarily being compulsory. Unlike norm-setting, rule-setting is systematically explicit. The implementation of rules requires that members acknowledge them. Furthermore, rule-setting implies a commitment from members. When members commit to a rule, they sometimes have to sign a document. By contrast, the elaboration of norms is subtler. Members might not be aware of them, or confuse them with information. Rule-setting is typically considered a traditional function, in which the authority prescribes a certain behaviour. Conversely, norm-setting is an example of recent, soft modes of governance, through which the authority tries to induce a certain behaviour. I see rule-setting as either compulsory or voluntary. Compulsory rules are prescriptions that members must follow, as failing to do so might threaten their membership status or result in other kinds of sanction. Voluntary rules are explicit rules to which TMNs suggest their members commit. Membership is never at stake when breaking voluntary rules. As an interviewee mentioned, cities nonetheless take voluntary rules seriously, since, when made public, they represent a commitment of cities to the world (Interview 17). Likewise, informal talks with Mexico City staff underline the fact that the 10% Pledge, a voluntary rule-setting tool through which member cities pledge to dedicate 10% of their budget to urban resilience, gives committing cities additional benefits. Cities are thus enthusiastically seeking to commit.

With the exception of the Covenant of Mayors, all the selected TMNs resort to rule-setting, although there is great variance in their use. Some, such as CIVITAS or Alliance in the Alps, use it quite sporadically. Others use it in about 10% of their tools or more. Among those, some are the oldest TMNs of this study, i.e. Metropolis and Eurocities. The others are among

the most recent, i.e. C40, 100RC, CNCA, and MUFPP. The last three of those most recent TMNs are also the ones that give more importance to the funding of their members, another traditional governance function. This suggests that recent TMNs might not use only soft approaches to governance, a point I will further discuss below.

Many rule-setting tools are political declarations on a variety of issues, such as clean transportation, greenhouse gas emission reductions, or food policy. These declarations often have strong norm-setting and information sharing dimensions along with their rule-setting function. Their role is indeed not only to create rules for members or non-members wishing to join the initiative, but also to show their climate action commitment to other actors, outside the TMN and even outside the TMNs system, as related by an interviewee (Interviews 9 and 17). They are also aimed at encouraging these external actors to sign them.

Rule-setting appears to be an understudied governance function of TMNs. A few scholars have identified it among other TMN governance functions (Bulkeley and Newell, 2015; Andonova et al., 2009). However, it remains largely overlooked. There seems to be few studies that look at the rule-setting TMN function and its impact in detail. The assumption of TMNs having a strictly soft governance approach is common (Hickmann, 2015). Yet, although rule-setting is surely not the most common governance function that TMNs use, we cannot ignore its presence when analysing TMN governance practices.

4.2.3.2 Obligation

Obligation expresses the idea that TMNs constrain their members to adopt certain behaviours. TMN tools may combine obligation with any of the governance functions discussed above. The possibility of obligation mechanisms in TMN practices in the supposedly democratic global climate governance context is unsettling. TMNs, as networks, are supposedly voluntary initiatives. They have no authority in the traditional sense of the concept as a characteristic of nation-states. They are not democratically elected entities and their legitimacy appears to be questionable (Bäckstrand, 2008). However, when defining obligation within the limits of TMN membership, it appears as one of the characteristics of governance tools. In other words, the use of some tools by members is compulsory; failing to use them might result in some form of sanctioning. Drawing from other works, TMNs might have an entrepreneurial form of hybrid or private authority (Hickmann, 2015; Green,

2013).⁶⁸ Outside of a delegation framework, cities choose to follow the rules of TMNs, here considered hybrid entities.

Compulsory tools are often those that set the network rules, that is, statutes, charters, or declarations, thus combining rule-setting and obligation governance characteristics. Sometimes, they are tools TMNs deem fundamental for the advancement of urban climate action. For instance, 100RC has, as a primary objective, the design and implementation of a resilience strategy in all its member cities.⁶⁹ Cities are in charge of writing that strategy, which is reviewed by the TMN before acceptance and publication. As explained by a 100RC staff member, ‘to be in our programme, you need to produce a resilience strategy, and if you no longer want to produce a resilience strategy, then it probably doesn’t make sense that you’re part of our programme.’ (Interview 15) Working towards the elaboration of a resilience strategy is an obligation of 100RC member cities. While not admitting to the possible expulsion of the cities that would not comply, the interviewee insisted on the need for member cities to elaborate the strategy. Although there has not been any case of expulsion from 100RC for failing to develop a resilience strategy. There has been at least one case of expulsion for not choosing an adequate CRO, a compulsory tool in the form of an administrative position created and funded for at least two years by 100RC (Nielsen and Papin, 2020). 100RC thus pressures its member cities into complying with its rules lest they face sanctions.

Like rule-setting, obligation is not a very common mechanism in TMN governance tools: it is a characteristic of only 7% of the tools identified in this research (see Figure 4.5). Nevertheless, TMNs, whether considered networks or transnational actors, are not expected to create obligations. Therefore, we cannot ignore the presence of obligation mechanisms.

⁶⁸ Hickmann (2015) claims that TMNs might have some form of authority over their members without admitting to their partly hard governance practices. According to him, their authority would rather come from their creation of norm-setting tools.

⁶⁹ Although not all 100RC cities’ resilience strategies directly tackle climate change, most of them do so at least indirectly.

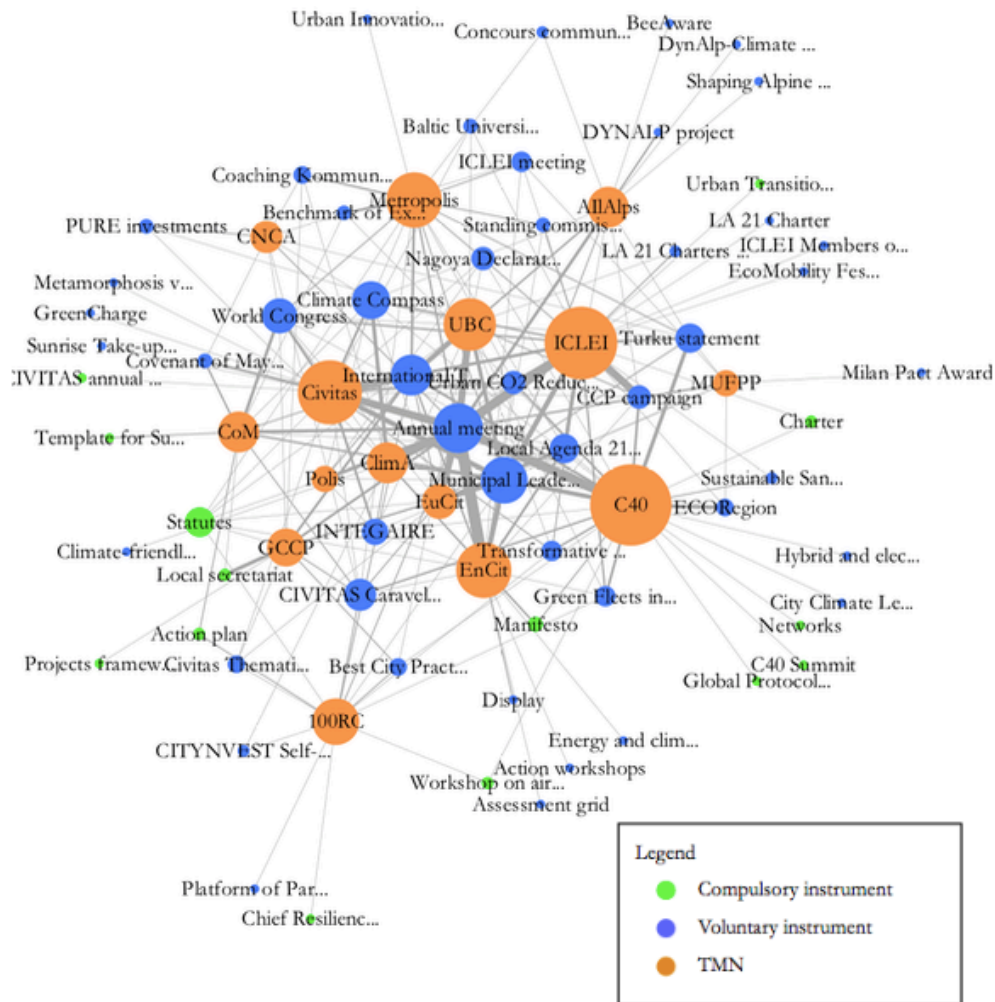


Figure 4.5 Compulsory and voluntary TMN governance instruments⁷⁰

The TMNs that most resort to obligation are often, once again, new-generation ones (i.e. GCCP, C40, CoM, and 100RC). Three out of the 15 TMNs studied do not use any obligation mechanisms. Two of those, i.e. CNCA and MUFPP, are the most recent TMNs of the network. Figure 4.5 shows that most TMN governance tools are voluntary. This bipartite network representation reveals how TMNs might be similar in their governance practices, and more specifically their use of voluntary and compulsory governance instruments. The TMNs that are closer together generally use the same instruments; those that are further apart tend to use different instruments. The instruments that are on the outskirts of the network are those that have rarely been generated. For instance, ICLEI and C40, which are the TMNs that

⁷⁰ The size of nodes is proportional to the degree of the nodes. The label of each instrument corresponds to the name of the novelty with which the instrument is associated, that is, the first tool that had such a combination of governance characteristics. Appendix C offers a list of all the novel instruments identified in this study. The biggest TMN nodes represent TMNs that have most created tools. The biggest instrument nodes are those from which TMNs have most created tools.

generated most tools in the period studied, share many tools and governance practices. Yet, the unique links between C40 and several tools reveal that C40 has practices that no other TMN has. The same can be said about ICLEI. 100RC appears slightly in the margins, which shows that several of its practices are not common among TMNs. Several European TMNs created during municipal voluntarism (i.e. Eurocities, Polis, Energy Cities, and Climate Alliance) seem to have similar practices. This might have to do with social learning processes in the TMNs complex system, both preventing too much duplication of efforts and differentiation among TMNs, and leading to their evolution and the adaptation of the complex system (a point to which I will return in Chapter 6).

Like rule-setting and the much less used funding governance function, the use of obligation mechanisms reveals a traditional vision of authority from TMNs. It is true that TMNs have mostly departed from this traditional use of coercion as a goal-attainment means. Indeed, their softer approach is in line with their network nature, often associated with voluntary mechanisms (Busch, 2015; Kern and Bulkeley, 2009; Barnett and Sikkink, 2008; Keck and Sikkink, 1999). The few occurrences in which TMNs use obligation seem to coincide with the time of their foundation, in order to establish network rules and norms, or when they decide to restructure their activities, targets, or goals, and change the rules and norms or establish new ones.

The description of the different governance characteristics of TMN tools reveals what TMNs do in order to orient the behaviour of cities (see Table 4.3 for a summary of the characteristics of the tools of the 15 TMNs). It also shows what they mostly do not do and some unexpected practices that they have. It highlights that some TMNs seem to have different practices from others, which might appear novel in the TMNs complex system. For instance, according to Table 4.3, ICLEI, C40, and CIVITAS are the only TMNs resorting to direct action. They are also the TMNs that generated the most novelties in the period under study, according to Table 4.2 (Section 4.1.4). Presenting broadly TMN governance It is now necessary to look more closely at these novelties. In that sense, the next section looks more specifically at the novel instruments TMNs generate and starts linking them to TMN attributes.

TMN	Rule-setting	Fund.	Direct action	Norm-setting	Capacity build.	Info. sharing	Oblig.	Direct.	Inclus.	# tools
MUFPP	11	11	0	67	0	89	0	78	78	9
CNCA	9	18	0	73	27	100	0	73	64	11
100RC	11	11	0	84	37	89	26	68	37	19
CoM	0	0	0	79	25	100	18	71	61	28
C40	12	0	1	86	29	89	10	63	72	73
GCCP	8	0	0	81	27	96	31	73	42	26
CIVITAS	3	0	3	69	34	100	3	72	82	65
AllAlps	5	29	0	67	24	100	0	62	95	21
UBC	5	5	0	77	33	100	3	77	90	39
ICLEI	7	2	1	81	32	96	2	52	80	81
EnCit	9	0	0	72	15	98	4	77	85	47
ClimA	8	3	0	75	6	94	8	67	81	36
Polis	8	0	0	77	15	100	8	85	92	13
EuCit	12	0	0	76	12	100	3	79	85	34
Metropolis	9	3	0	66	27	100	3	70	52	33
Average	8	3	1	77	25	97	7	68	75	

Table 4.3 Summary of the 15 TMNs' use of the distinct governance characteristics⁷¹

4.3 Novelty in governance instruments and styles

This section looks at the novelty of TMNs in terms of their specific novel instruments, but also more broadly in terms of some TMNs' novel governance styles. The preceding presentation of TMN governance practices, based on the analysis of all their tools (see Table 4.3) pointed to the presence of distinct governance styles. Beyond the expected soft approach of some TMNs, others, which belong to a period of strategic urbanism (Bulkeley, 2013), use a mix of soft and hard governance approaches, which appears to be novel in the TMNs system. After presenting TMN novelties, the next paragraphs address the question of the novelty in TMN governance styles.

⁷¹ The numbers in the table are percentages of the presence of the distinct governance characteristics in TMN tools (with the exception of the numbers of the last column, which correspond to the number of tools created by each TMN).

4.3.1 The increase and variety of novel TMN governance instruments

4.3.1.1 *A few examples of novelties*

Among the 535 tools identified between 1985 and 2018, the analysis of TMN governance tools recognised 62 novelties, i.e. tools whose combination of governance characteristics, or instrument, appeared for the first time in the TMNs system.⁷² Some of these novelties diffused in the system and were thus replicated by many TMNs after their emergence, while others did not recur. It is important to note that there is a great variety of novelties in the TMNs system. This variety mirrors that of the identified 535 governance tools. Each of these 535 tools corresponds or draws from one of the 62 novelties identified.

A common instrument is the TMN annual meeting to which members and non-members are invited and which is intended to disseminate information and norms. The first one, considered the first tool and novel instrument of the TMNs system, was generated by Metropolis, the oldest TMN of the system, the year of its launch. All the TMNs have since generated such an instrument, albeit under different forms and tool names. Many have favoured the publications of reports diffusing information and norms and accessible to members and non-members. The combination of governance characteristics being the same for the Metropolis annual meeting and the open-access publications that disseminate cases of best practices (i.e. norm-setting and information sharing functions, voluntary character, open to non-members), they represent the same instrument.

In contrast, a unique instrument is the global protocol for community-scale greenhouse gas emission inventories, co-generated by C40, ICLEI and the World Resources Institute. This instrument, generated in 2012, is based on norm-setting, open to members and non-members, and compulsory for C40 members. Its goal is to harmonise the way cities measure their greenhouse gas emissions. A former version of the Protocol, generated by ICLEI in 2009, differs in that it was not compulsory. Newer versions of the Protocol have since been released. A similar tool lies in the GCCP projects framework, a structure city members must use to promote their GCCP-related activities.⁷³ It resembles ICLEI and C40's protocol in that it is based on norm-setting and is compulsory. It is nonetheless not open to non-members.

⁷² See Appendix C for the list of the 62 novel TMN governance instruments.

⁷³ We should stress that, in this study, the similarity of tools is understood primarily in relation to their comparable combination of governance characteristics rather than their content or their form.

The specific combination of norm-setting, obligation, and openness to non-members, has not been identified among other TMNs.

Another interesting unique instrument is the 100RC chief resilience officer (CRO) position, created in 2013. After becoming a member of the 100RC network, each city must hire a CRO that will coordinate its resilience activities. 100RC finances the position for two to three years, after which cities take over or cancel the position. The CRO tool is thus a combination of funding, norm-setting, and obligation; it is reserved to members. Although this tool appears to represent a unique combination in the TMNs system, it has started to diffuse outside the system (Papin, 2019). Indeed, several non-100RC members, such as Tallahassee or Santa Monica, both United States cities, have started to create CRO positions in their jurisdictions. Explicit references to 100RC and some of their members on these cities' websites show the direct link between the 100RC CRO tool and the position they have created.

Furthermore, the CRO tool confirms the relevance of this research's definition of a novelty as not being an unprecedented invention, but rather as a new combination of existing elements, and sometimes a micro recombination of existing novelties. Indeed, an interviewee who used to work for the C40 pointed to the role of the interactions of the C40 and 100RC in the creation of novel tools (Interview 12). According to the interviewee, the 100RC business model and its CRO tool built on C40's business model and city adviser tool. In an encounter between some C40 and 100RC staff members, before the 100RC initiative was launched, a discussion around the city adviser model rose. It appears that 100RC used that discussion to build its CRO tool. The interactions between C40 and 100RC thus facilitated the creation of the novel 100RC CRO position. There are important similarities between the two tools. Indeed, the city adviser tool is a position C40 offers to implement in cities to help coordinate the climate-related activities. However, the CRO tool is not a mere replication of the C40 city adviser position. Whereas the former is compulsory and depends on the city's hiring (although 100RC closely oversees the hiring process), thus being a tool implemented by the city, the latter is voluntary and is a C40 staff member, making it a tool directly implemented by the TMN. The CRO tool has therefore built on the city adviser model but changed it in a way that makes it a novelty. This example thus follows the definition of

novelty used in this work. It also points to social learning processes which might help explain the evolution of TMNs and the adaptation of the TMNs complex system, a point to which we will return in Chapter 6. We should also note that the city adviser position has the same combination of governance characteristics as a former tool of the TMNs system, i.e. UBC's 2000 best practices workshops. Therefore, it is not a complete novelty in terms of governance instruments. The city adviser position was only the second tool to use that combination. Besides, the form it has taken, i.e. a position within the city, was unprecedented. We can thus consider it a micro-novelty that 100RC adapted and used for its own purposes.

The 62 novel instruments identified in the analysis reveal that, to steer their members, TMNs use a variety of combinations of governance characteristics. This was to be expected, since this diversity echoes the diversity of governance tools in general. Despite this variety, and as foreseen in the above presentation of governance functions, we observe that TMNs overall favour certain instruments, i.e. those that are voluntary, and seek information sharing and norm-setting. They seldom use other instruments, mostly those that are compulsory and offer funding or direct action.

An element to consider in the analysis of the novel instruments of TMNs is their year of emergence in the system. While this is necessary to detect the difference between a novelty and an imitation thereof, this might also help us perceive if there is a time in which TMNs generate more novel governance instruments in the system.

4.3.1.2 The more recent the TMN, the more novel instruments?

Looking at the time of emergence of the distinct novelties offers valuable insights. Using the median year of the 1985-2018 period (i.e. 2002), the analysis of the novelties generated by TMNs unveils the fact that TMNs generated 21 novel tools between 1985 and 2001, and 41 between 2002 and 2018 (see Figure 4.6). The second period, which more or less corresponds to the phase of strategic urbanism mentioned before, is thus a period of intensive tool creation.⁷⁴ ICLEI, created at a time of municipal voluntarism, is the TMN that generated the most novelties, i.e. 17, between 1990 and 2018. The second and third one, C40 and CIVITAS, were created during the strategic urbanism period, and are thus considered new-generation

⁷⁴ Although Bulkeley, in her 2013 book, sees the strategic urbanism period as starting in the mid-2000s, there is no triggering event launching that phase. Assuming the start of that period is thus fuzzy, we perceive in the analysis some changes announcing it as early as 2002, in the wake of the entry into force of the Kyoto Protocol.

TMNs. They have each generated six novel tools. The fourth to eighth TMNs in the novelty ranking were all created during the municipal voluntarism period. Therefore, new-generation TMNs do not generate more novel instruments than the TMNs launched during municipal voluntarism. This finding is valuable considering H2, which posits a positive relationship between the age of TMNs and their capacity to generate novel governance instruments. While it is certainly not sufficient to confirm its validity, this finding suggests there is no negative relationship between age and the emergence of novelty.

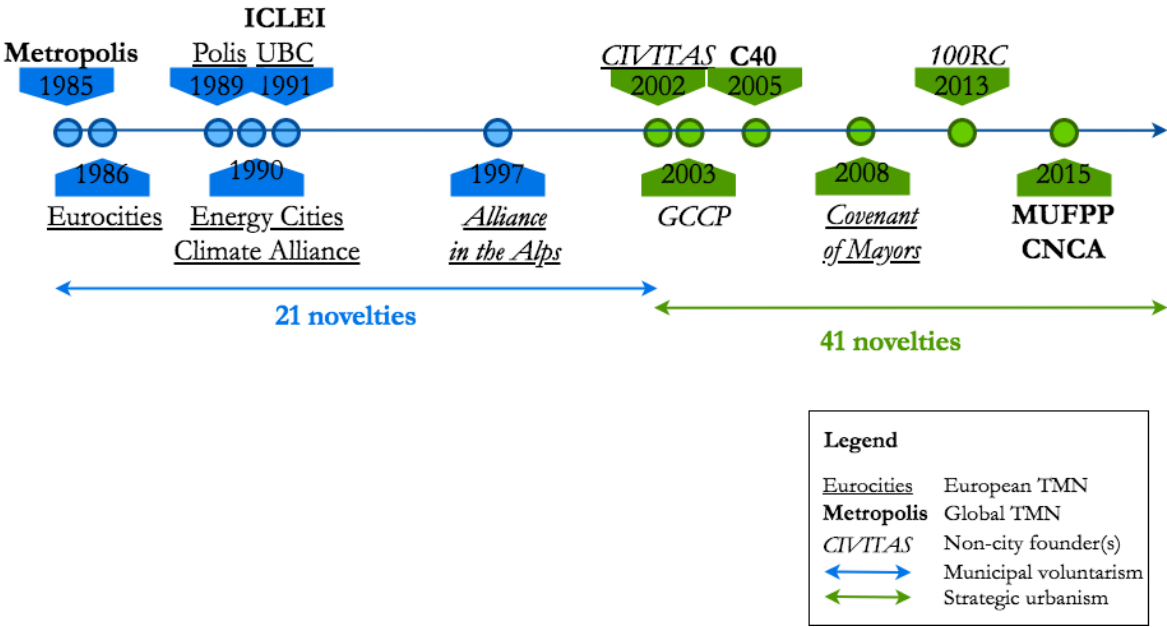


Figure 4.6 Timeline of the launch of the 15 selected TMNs and the production of novelty.⁷⁵

Strategic urbanism, nonetheless, is the period in which TMNs in general have created the most novel tools. Out of the 12 TMNs that have produced novelties, 10 have produced most of them between 2002 and 2018. Six of those TMNs were created before 2002 and six between 2002 and 2018. It is hard to say, at least for now, whether the reason for this surge in the number of novelties might in the characteristics of the strategic urbanism period (i.e. the mainstreaming of climate change and the higher diversity of actors involved in the creation and launch of TMNs) or, more generally speaking, the evolution of TMNs in their practices and the adaptation of the TMNs complex system.

⁷⁵ TMNs identified as having a non-city founder may also have one or more city founders.

While new-generation TMNs do not generally generate more novel governance instruments than older TMNs, they might nevertheless have a novel governance style.

4.3.2 A novel governance style for new-generation TMNs

New-generation TMNs seem to have an overall novel governance style, which is worth describing in the context of an investigation of TMN governance practices.

The identified use of rule-setting and obligation mechanisms by most TMNs, albeit discreet, is noteworthy. Discussing TMN instruments in general, Hickmann argues that ‘since networks cannot force their members to conform to a standard, follow a benchmark, or undertake performance-measuring programs, these instruments provide no more and no less than a specific incentive for cities and municipalities to tackle the problem of climate change’ (2015: 70).

While generally confirmed by this study, this statement might be over-simplifying some TMN governance practices that make rule-setting more than an incentive. Cities are aware there are rules in most TMNs before becoming members, although they might not know all of them. When they decide to opt in, despite any obligation to do so, they accept to submit themselves to the rules. Once in, cities can also refuse to follow or ignore some of the rules and goals promoted by their TMNs. In the absence of compliance verification mechanisms, consequences for that type of behaviour are unlikely. In that case, TMNs might provide no more than an incentive for those cities that want to act. City benefits might be low; so might be the effectiveness of the network (Green, 2017b). Even when there are ways for TMNs to assess members’ compliance with the rules or enforcement mechanisms, cities can also opt out of those networks if they do not want to follow their rules (Interview 17). However, there might be costs associated with exiting. As mentioned earlier, some TMNs, such as C40 or 100RC, are exclusive. Becoming a member implies going through a time and resource-intensive selection process (Nielsen and Papin, 2020). The benefits associated with being a member can be high, depending on the TMN (e.g. reputational benefits, capacity building, funding in the case of 100RC, etc.). The high entry costs and the membership benefits might make it hard for a city to decide to leave the TMN. Staying in and following the rules might be considered the best solution. In that context and in contrast with Hickmann’s claim, the rules and obligations set by TMNs might appear to provide more than just incentives to cities.

The argument of the significance of rule-setting is in line with Bulkeley and Newell's claim that 'Despite the supposedly voluntary nature of transnational climate change governance, the presence of regulation and (sometimes) sanctions suggest that networks are able to exert a degree of power over their members.' (2015: 72) The findings of this research confirm that there is a degree of rule-setting and obligation in TMN governance practices. They also show that cities overall tend to follow TMNs' rules. At the time of writing this research, more than 100RC 80 cities have hired a CRO and 68 have released their resilience strategy (100RC 2019a; 2019b). Several interviewees also claim that they have had to use several technical tools to answer 100RC's demands (Interviews 2 and 3). Through functions such as information sharing, norm-setting, capacity building or, for a few of them, funding, TMNs seek to shape ideas. Via rule-setting, they also seek to prescribe certain behaviours. Although their impact on city action or on cities' greenhouse gas emissions is not the subject of this study, documentary observation and interviews suggest that, to some degree at least, TMNs may help reinforce cities' willingness to implement climate actions.

It also appears that TMNs resort to hard governance approaches, although they do so in varying degrees. Although the number of TMNs studied is too small to lead to solid generalisations, the observations of governance tools point to the distinctiveness of the governance style of new-generation TMNs. As previously mentioned, recent TMNs, those created from the mid-2000s on, differ from older ones mostly in terms of the nature of their founders, and their steering practices. New-generation TMNs tend to resort to rule-setting, funding, and obligation mechanisms relatively more than the others. First, regarding rule-setting, the TMNs that most use this function are the two oldest (i.e. Metropolis and Eurocities), and four of the most recent ones of the studied population (i.e. C40, 100RC, MUFPP, and CNCA). One could argue that TMNs use more the rule-setting function at the time of their creation because they need to set some foundational rules for members, hence the high percentage of rule-setting tools for the most recent TMNs. The analysis shows that rule-setting tools emerge at all times, however. Eurocities and Metropolis have started to generate them at the time of their launch, but they have mostly generated them afterwards, from 2005 on. Furthermore, the most recent TMNs have not always generated their rule-setting tools in their first years. C40 started generating rule-setting tools at the time of its launch, and has kept doing it. 2017 and 2018 are the years when it was most active in this

regard. Second, regarding the obligation mechanism, although TMNs might generate more compulsory tools at the time of their launch or when restructuring their activities, recent TMNs have generated more compulsory tools than older ones both in relative and absolute terms. This hints at a greater importance given to obligation among recent TMNs. Finally, regarding the much less used funding governance function, the TMNs that have generated most funding-related tools are the most recent ones, with the exception of Alliance in the Alps (created in 1997).

The characteristics of some of the governance practices of recent TMNs suggest they have a novel governance style. To be sure, recent TMNs are not ignoring soft practices to go back to hard approaches to governance exclusively. Instead, the analysis suggests that the literature might have had a biased understanding of TMN practices, and that the governance practices of recent TMNs might be more diverse than those of older TMNs. Recent TMNs are more likely to have a hybrid governance style, using both hard and soft approaches. Because, as networks and transnational actors, TMNs are usually considered to use soft approaches only, their use of hard governance practices, while uncommon, is meaningful and cannot be ignored.

The likely connection between the governance style and the time of launch echoes the distinction between municipal voluntarism and strategic urbanism presented earlier (Bulkeley, 2013). In the system under study here, TMNs created during the period of strategic urbanism, to which we earlier referred as new-generation TMNs, have more often non-city founders than the others (see Table 4.1). Alliance in the Alps, launched in 1997, was created by an NGO. CIVITAS, founded in 2002, is an initiative of the European Commission. So is the Covenant of Mayors. The full denomination of 100RC (i.e. 100 Resilient Cities—Pioneered by The Rockefeller Foundation) highlights the TMN's creation by the renowned philanthropic foundation. The involvement of diverse types of actors in the conception of TMNs in the period of strategic urbanism suggests that those actors have had a growing interest in working with cities on climate issues. The overall interest in urban climate action seems to have grown since the period of municipal voluntarism. An interviewee working for ICLEI argued that 'the kind of importance that was given to the urban agenda in the 1990s is not comparable to the kind of importance the urban agenda gets now. There is a lot more

people talking about it, a lot more organisations working on it.’ (Interview 2) Like state actors have done with climate change and development (Gupta, 2014), it seems that new-generation TMNs, created during strategic urbanism, have mainstreamed climate issues into core municipal ones, such as economic growth. Doing so, they might have managed to connect more actors with diverse interests together. At the very least, they seem to receive a greater influence from private actors (Nielsen and Papin, 2020).

Because the concerns and the type of actors involved in their creation are different, new-generation TMNs, created during strategic urbanism, might have a new TMN governance style. More specifically, the diversity of actors involved in the launch of recent TMNs and their possibly distinct ideas may be related to the TMNs’ larger scope of governance practices. Although studies on a broader range of TMNs are needed to confirm this finding, this research suggests the presence of a link between the strategic urbanism vision of recent TMNs and their wider use of traditional functions in their governance style.

4.4 Concluding remarks

This chapter has shown part of the results of the data collection presented in Chapter 3. After briefly describing some of the characteristics of the TMNs under study, which allowed a more precise presentation of TMNs and introduced actor attribute variables that would be of use later, it presented their novelty ranking. Then, it focused on the governance tools generated by TMNs and emphasised the variety of governance practices that they reveal. Showing what TMNs do and do not do, and what unexpected practices they might have is crucial in an investigation of the governance practices of TMNs. It is also fundamental to characterise novel governance instruments and some possible variation in this study's dependent variable.

This chapter then analysed more specifically the novel governance instruments of TMNs. Doing so, it participated in addressing this study's research question by showing the novelty generated by TMNs. TMN novel governance instruments are diverse, mirroring the diversity of the numerous governance tools. Although many use the same governance functions, others are quite distinct, using uncommon rule-setting or obligation mechanisms. This finding led to the idea that some TMNs have a novel governance style. Some TMNs also generate more novel tools than others, but the reasons for this are unclear. While strategic urbanism seems

to have brought changes to the TMNs system, with new-generation TMNs emerging and influencing cities differently, the reason for the emergence of novel governance instruments, does not appear to be the period in which TMNs were launched. The possibility that more recent TMNs generate more novel governance instruments was also ruled out.

This chapter introduced several variables (i.e. age, geographical and thematic scope, nature of founders, and organisational resources) that will be of use in the analysis of the roots of novelty in Chapter 5. It also presented the novelty ranking of TMNs, which will be another crucial element of Chapter 5. It thus prepared the ground for the analysis of the relationship between actor attribute variables and the emergence of novelty. It is important to note that this chapter also alluded to the evolution of TMNs and the adaptation of the TMNs complex system. It thus introduced an important observation for the testing of H3 in Chapter 6.

To conclude, this chapter has introduced this study's empirical section. While presenting important variables of this study, it has also opened the door to more questionings on the sources of novelty and the evolution of TMNs. To start addressing these concerns, Chapter 5 analyses the roots of novelty.

Chapter 5 The roots of novelty

The roots of novelty envisioned here are mostly relational. This study posits that interactions facilitate the emergence of novel governance instruments. H1 states that *the TMNs generating the most novel governance instruments are likely to be central and have diverse contacts in the TMNs complex system*. This research does not ignore actor attributes, however. Indeed, it seeks to show that, in addition to studying diverse attribute variables as often done in the literature, we should look at interactions to improve our knowledge on the emergence of novelty in TMNs. It thus also posits that age and organisational resources might play a part in the emergence of novelty. More specifically, H2 states that *the TMNs generating the most novel governance instruments are likely to be among the oldest ones and the ones with most organisational resources*. This chapter focuses on testing these two hypotheses.

It is important to note that H1 and H2 are causal relationship propositions. They differ from H3 (i.e. *social learning follows interactions, and precedes the emergence or adoption of novel governance instruments, and the evolution of TMNs*), which seeks to uncover a causal process. Revealing causal relationships or causal processes involves different methods. While both might use qualitative methods, causal processes imply a deeper investigation on one or two cases. This study uses social network analysis and cross-case analysis to test the presence of causal relationships between relational and actor attributes variables and the emergence of novelty. It conducts a comparative case study to reveal the causal process at play between independent and dependent variables. Therefore, this chapter looks at H1 and H2, and Chapter 6 focuses on H3.

As posited in Chapter 2, the centrality and diversity of a TMN might help explain why it generates more novelties than others. Indeed, high centrality gives a TMN a higher chance of receiving a lot of information. Great diversity in the members and partners gives it the possibility to receive information that other TMNs, connected to less diverse actors, do not have. Findings show, however, that centrality and diversity, taken independently, are neither necessary nor sufficient conditions for the emergence of novelty. Combined with some actor attributes (i.e. age), they might nonetheless form insufficient but necessary components of causal conditions that are unnecessary but sufficient for the outcome (i.e. INUS conditions, see Mackie, 1974). The results of the empirical analysis presented in this chapter suggest that

centrality, diversity, and age might together explain the emergence of novel governance instruments.

This chapter looks at each identified set of variables and presents their results.⁷⁶ It starts by analysing relational variables. It then moves to observe actor attribute variables, and then control variables. In the penultimate section, it combines the results of the relational and actor attribute independent variable analyses with qualitative data. The conclusion synthesises the findings and highlights the need for a deeper study of a couple of cases to clarify the process at play between interactions and novelty, evolution, and adaptation of the system.

5.1 Is your network your net worth? Relational variables and the emergence of novelty

The literature has mostly ignored relational variables when studying TMNs and their effects. Yet, the theoretical framework presented in Chapter 2 posits they might be significant in the emergence of novel TMN governance instruments. Testing H1, this section focuses on two relational variables that might affect the emergence of novelty, i.e. centrality and diversity.

5.1.1 Centrality

Centrality is probably one of the most common variables studied in social network analysis. It is also an important relational variable for this research. Being central in a network means having more contacts than the other actors of the network. The assumptions lying behind centrality in this study are that having more contacts than others gives access to more information, and that information is key to the emergence of novel instruments.

There are several ways to measure centrality, e.g degree centrality, closeness centrality, or eigenvector centrality. As argued in Chapter 3, these distinct indicators carry different assumptions. An important assumption of centrality is the homogeneity of the contacts to which a focal node is linked. By simply adding up the contacts of a node, no difference is made among those contacts, especially regarding their possible influence. Considering contacts of TMNs as homogeneous is not an issue here. Indeed, this study is interested in the amount of information to which TMNs might have access, and not the influence of their contacts on their behaviour, or the kind of information these contacts might bring to TMNs.

⁷⁶ This chapter largely draws on a paper recently accepted with minor revisions (Papin, 2020).

When looking at diversity, the homogeneity assumption will be abandoned, considering TMNs need to be connected to diverse contacts to have distinct information.

The following paragraphs look at a normalised version of degree centrality, which adds all the contacts of a focal node on a zero-to-one scale. The TMNs system identified in this study can be divided into several subgraphs. While assuming homogeneity regarding the contacts of TMNs, looking at various subgraphs might underline relevant refinements in the analysis of centrality. More specifically, it might hint at stronger or weaker relationships between centrality and the emergence of novelty depending on the type of interactions (membership or partnership). Accordingly, the next paragraphs first look at the whole network, in which TMNs are connected to both members and partners (including other TMNs). They then observe the members' subgraph, in which TMNs are only linked to their members. Finally, they look at the partners' subgraph, in which TMNs are linked to their partners only.

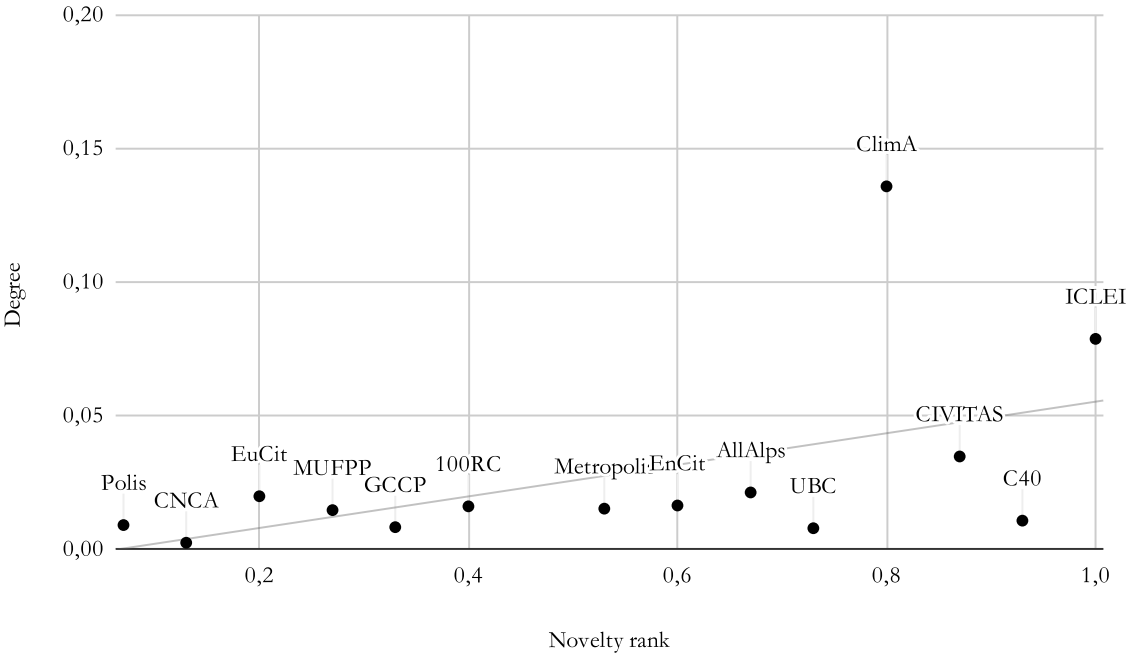


Figure 5.1 The degree of TMNs according to their novelty ranking in the entire network⁷⁷

Observing the centrality of TMNs in the whole network (Figure 5.1) reveals a highly skewed degree distribution, which is one of the characteristics of complex systems (Kim, 2019). The

⁷⁷ The Covenant of Mayors does not appear in the plot as it is far higher in terms of centrality. Excluding it enables us to better see the trend among the other TMNs. The novelty dimension on the graph inverts the novelty ranking on a zero-to-one scale, meaning that ICLEI, which ranks first, has a score of 1, and Polis, which ranks last, has a score of 0.07.

Covenant of Mayors has many more contacts than any other TMN, with 8,827 members, and 363 partners. The second most important TMN in terms of membership is Climate Alliance, with 1,719 members. After ICLEI, which has 818 members registered in this study and is the third largest TMN in terms of membership, all TMNs have below 300 members. In terms of partnership, the second most important TMN is ICLEI, with 254 identified partners. While Covenant of Mayors did not generate many novel instruments in the period under study, ICLEI and Climate Alliance are, together with C40 and CIVITAS, the TMNs that produced the most novelties. CNCA, which is at the bottom of the novelty ranking, has a very low centrality degree. Energy Cities, Metropolis, and 100RC appear to be average TMNs both in terms of novelty emergence and centrality. Several TMNs, especially the Covenant of Mayors, C40, Eurocities, and Polis, show a centrality value that deviates to a large degree from their novelty ranking. Overall, Figure 5.1 seems to indicate a mildly positive trend between centrality and novelty emergence.

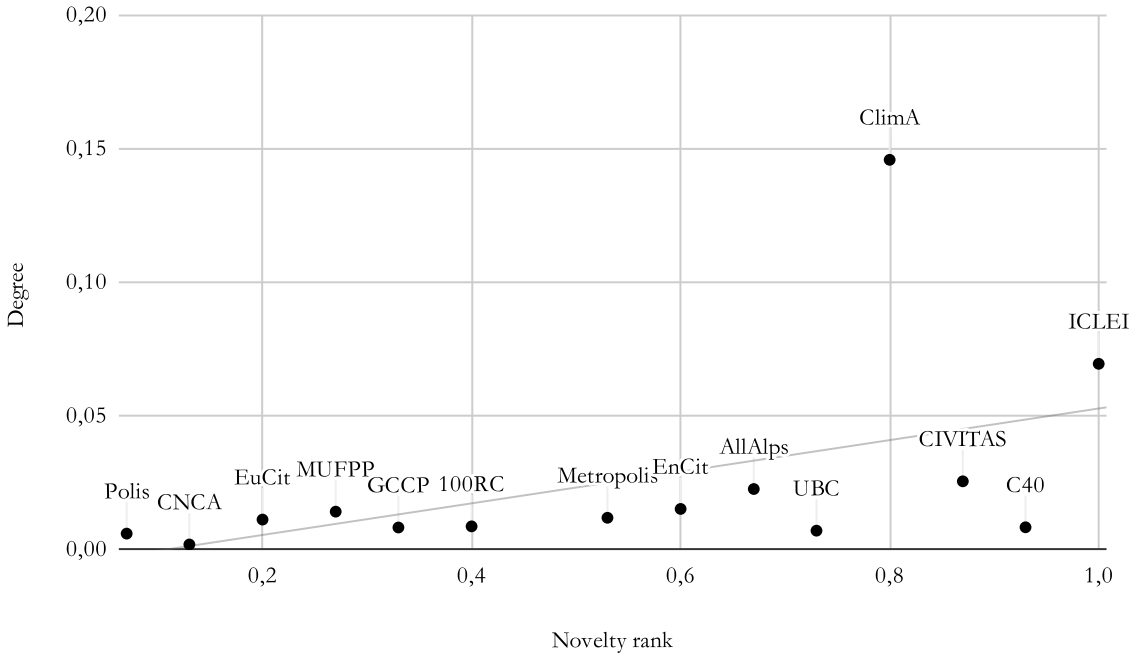


Figure 5.2 The degree of TMNs in the members subgraph⁷⁸

⁷⁸ Here again, the Covenant of Mayors does not appear in the plot because its centrality degree is a lot higher than that of the other TMNs.

Figure 5.2, which illustrates the degree of TMNs in the members subgraph, shows similar TMN positions. Once again, the Covenant of Mayors is above all the others, followed by Climate Alliance and ICLEI. CNCA is the least central TMN.

The partners subgraph diverges from the other two studied networks. Indeed, Figure 5.3 shows a plot in which TMNs are much more scattered. The Covenant of Mayors still appears at the top in terms of centrality, but Climate Alliance is here one of the least central TMNs. CNCA remains at the bottom of the centrality ranking, with Alliance in the Alps, which was among the five most central TMNs in the other plot. TMNs have fewer partners than they do members. Yet, the size of their partnership is not necessarily proportionate to that of their membership, hence the low centrality of TMNs such as Climate Alliance and Alliance in the Alps in the partners subgraph.

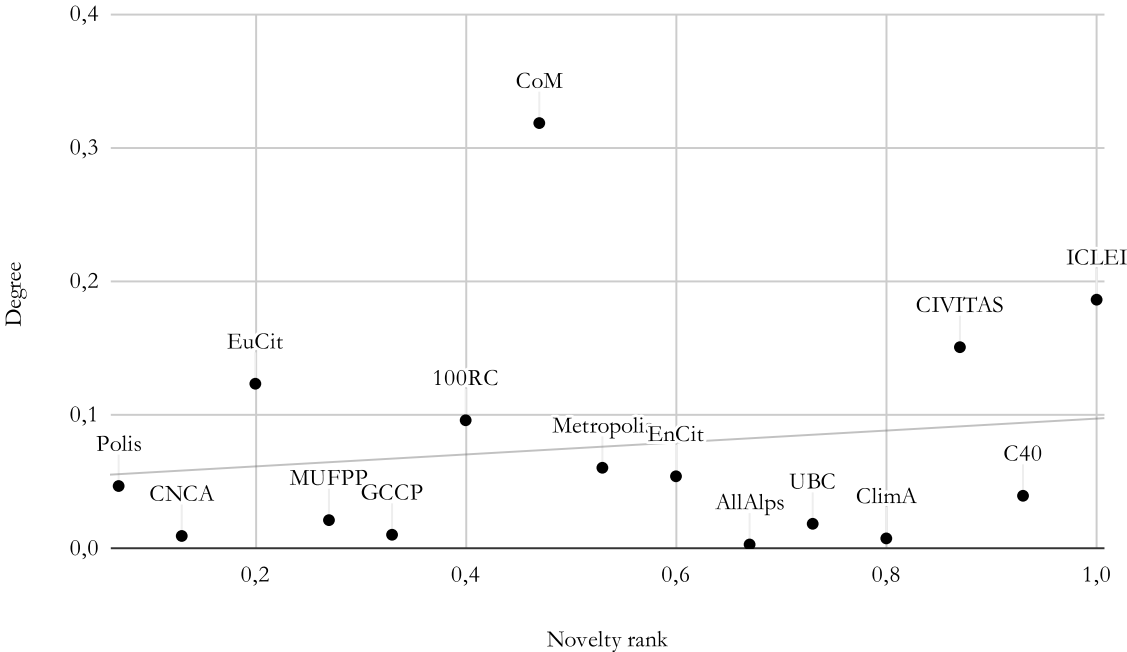


Figure 5.3 The degree of TMNs in the partners subgraph

Comparing the distinct centrality scores and novelty ranks, Table 5.1 helps make sense of the distinct plots. ICLEI, the TMN that most produces novelties, is the third most central node in the members subgraph (with a score of 0.069), the second most central in the partners subgraph (with a score of 0.186), and the third most central overall (with a score of 0.079). CIVITAS, the third TMN in the novelty ranking, ranks fourth in the members subgraph (with a score of 0.025), third in the partners subgraph (with a score of 0.15), and fourth overall

(with a score of 0.035). Climate Alliance, the fourth TMN of the novelty ranking, is the second most central TMN in the whole network and the members' subgraph. These cases suggest that there might be a positive relationship between centrality and the emergence of novelty for those TMNs that most generate novel instruments. Regarding TMNs that are average in terms of novelty generation, the same tendency seems to occur: Energy Cities, Metropolis, and 100RC, which respectively rank seventh, eighth and 10th in the novelty ranking, generally have average centralities. Finally, CNCA and GCCP, which are among the TMNs of the system generating fewest novelties, also have low centralities in distinct networks.

TMN	Degree in the whole network	Degree in members subgraph	Degree in partners subgraph	Novelty ranking
CNCA	0.002	0.002	0.002	14
MUFPP	0.014	0.014	0.021	12
100RC	0.016	0.008	0.096	10
CoM	0.718	0.748	0.318	9
C40	0.011	0.008	0.039	2
CIVITAS	0.035	0.025	0.15	3
GCCP	0.008	0.008	0.01	11
AllAlps	0.021	0.022	0.003	6
ICLEI	0.079	0.069	0.186	1
UBC	0.008	0.007	0.018	5
EnCit	0.016	0.015	0.054	7
ClimA	0.136	0.146	0.007	4
Polis	0.009	0.006	0.046	15
EuCit	0.02	0.011	0.123	13
Metropolis	0.015	0.012	0.06	8

Table 5.1 Degree centrality scores of TMNs in the entire network and in the members and the partners subgraphs

Nevertheless, some TMNs stand out, showing centrality values that contrast with their novelty ranks. C40 ranks second in terms of novelty, but only ninth (with a score of 0.011),

eleventh (with a score of 0.008), and tenth (with a score of 0.039) in centrality in the entire network, and the members, and partners subgraphs, respectively. The Covenant of Mayors ranks first in terms of centrality in all the studied subgraphs, but only ninth in terms of novelty.

Although it might only confirm the existence of a correlation between centrality and the emergence of novelty and not that of a causal relationship between the two variables, a correlation test analysing the relationship between the TMNs' degree centrality and their novelty rank is useful. Using Spearman's method, which is relevant in the analysis of rank correlations, reveals a correlation coefficient of 0.45 for the correlation in the whole network. Regarding the two subgraphs analysed, correlations differ greatly. It is of 0.11 for the partners' subgraph and of 0.53 for the members' subgraph. Thus, it seems that the centrality of TMNs in the members's subgraph and in the whole network correlates to a much greater degree with their novelty rank than does their centrality in the partners' subgraph. The results of the former indeed point to a strong to moderate correlation, while those of the latter point to the absence of a correlation. Partners might not matter as much as members in the diffusion of information and ideas for the emergence of novelty.

Because this study focuses on 15 TMNs only, it may not draw a conclusion from the results of the correlation test. What it may do is use the social network analysis to further analyse the cases that indicate the possibility of a positive relationship between centrality and the emergence of novelty. This will be the goal of section 5.4, which supplements the results of the social network analysis with qualitative data, enabling to draw stronger inferences. In the meantime, the next section expands the social network analysis with the study of diversity variables, which are also part of this study's first hypothesis.

5.1.2 Diversity

The subsection on centrality looked at diverse subgraphs of the TMNs system in order to have a more refined view of the centrality of TMNs and the amount of information to which they might have access. The present subsection looks at the entire system only. Indeed, this is the best way to identify the diversity of contacts of the 15 TMNs, which is at the core of H1. This hypothesis entails that novelty comes from a great amount of information and information that differs from that of other actors.

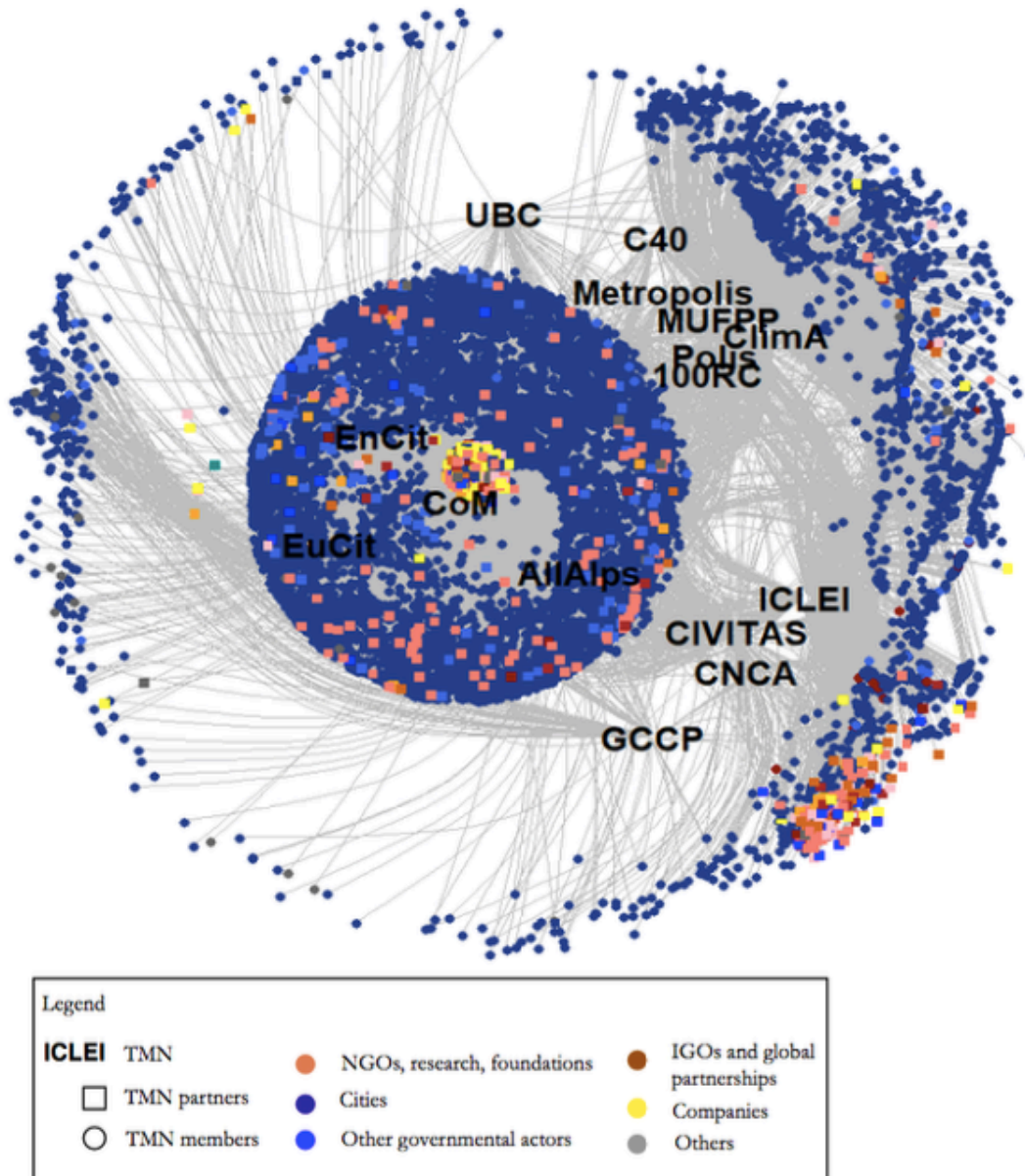


Figure 5.4 The institutional diversity of TMNs

There are different ways to observe and measure diversity in the interactions of nodes in order to evaluate their capacity to attract different information. Structural diversity and substantial diversity are the two forms of diversity on which this chapter focuses. Indeed, I assume that different information might come from contacts to which no other actor is linked or contacts that bring many distinct inputs because of their nature or the issues with which they deal. Using both kinds of measurements offers a more complete view of diversity. Therefore, the next paragraphs present them separately, and then synthesise the results.

As described in Chapter 3, one way to measure the diversity of contacts of a focal node using social network analysis is to focus on its structural dimension. One common way to do so is by looking at the position of the focal node in triads (Burt, 2004). Yet, this study looks at structural diversity looking at TMNs' number of contacts with a degree of one (i.e. which are only connected to one of the 15 TMNs). Doing so facilitates the assessment of TMNs' capacity to receive information to which no other TMN in the system has direct access.

Furthermore, data collected for this study highlight that TMNs, understood as structures, are neither purely public governance networks of cities nor private entities (see also Chapter 4). First, many TMNs are non-profit organisations, which makes them officially private entities. Contrary to traditional national or transnational associations of cities, they are not part of institutional democratic structures that make them legitimate representatives of cities (Bulkeley et al., 2003); therefore, they cannot be considered public entities. Second, and more importantly, many public and private actors work with TMNs, providing them with financial, political, or technical resources. Interviews underline that many of the partners of TMNs are other TMNs (Interviews 8, 9, 13, and 17). Information collected on the TMNs' websites also shows that TMNs are connected to many other kinds of partners, such as companies, private foundations, research institutes, IGO, or NGOs (see Figure 5.4). The strength of their links to those actors also varies greatly. Consequently, we may see TMNs as hybrid governance entities, made of public, private, local, international, and transnational actors. Of course, not all TMNs have the same degree of hybridity. In order to account for diversity, looking more closely at the diverse types of actors to which each TMN is linked and the various issues on which these contacts work is relevant.

Figure 5.4 shows that all the TMNs under study have members and partners in common. For instance, the Covenant of Mayors, Energy Cities, Eurocities, and Alliance in the Alps, which are at the centre of the figure, share a great number of contacts. This might be related to their geographical scope: the four of them are indeed European. All TMNs also have contacts they share with no one else. Some seem to have more than others, however. The density of the entire network does not appear to be very high.⁷⁹

⁷⁹ A measurement of the system's density revealed it is of 0.00017. This score in itself is not very helpful. A comparison with the density of the members's subgraph (density of 0.00019), and that of the partners' subgraph

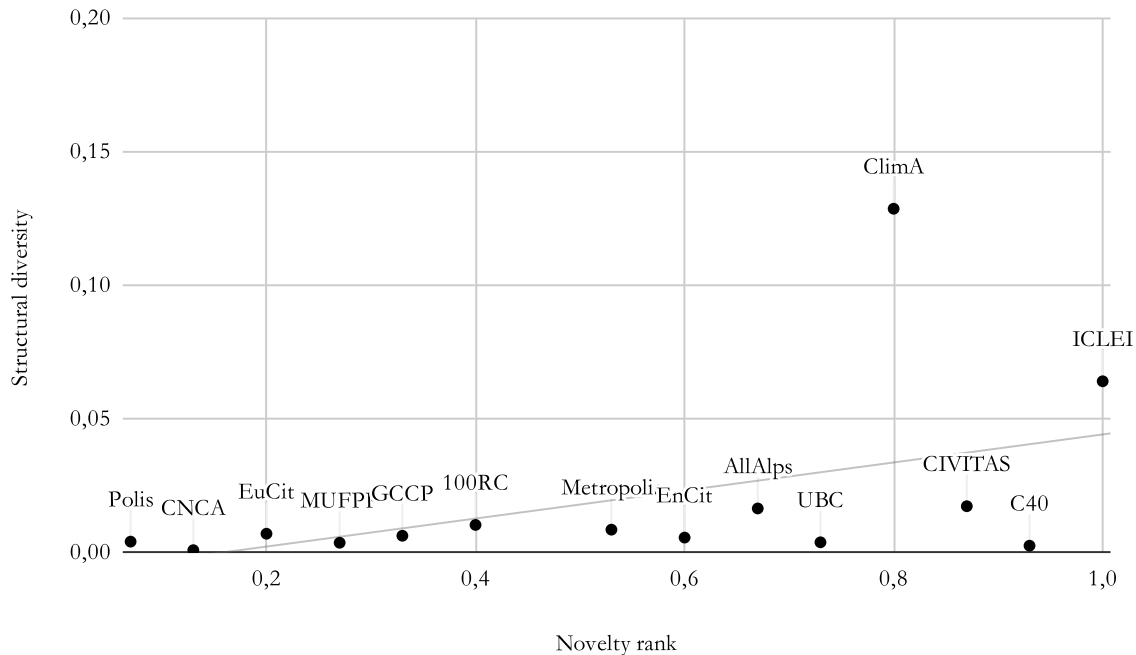


Figure 5.5 The novelty scores of TMNs in relation to their structural diversity scores⁸⁰

Looking at structural diversity measurements stresses the fact that this variable is biased against TMNs with low centrality (see Figure 5.5). The Covenant of Mayors, which has the highest centrality overall, is indeed the TMN with the highest structural diversity score. ICLEI, CIVITAS, and Climate Alliance, which are at the top of the novelty ranking, are also among the TMNs with the highest structural diversity values. Average TMNs such as Energy Cities, Metropolis, or 100RC, have average structural diversity scores. CNCA, which has the lowest centrality score overall, is the TMN with the lowest structural diversity score. The plot suggests a positive but nonlinear trend between structural diversity and novelty. A correlation test using Spearman’s method reveals a correlation coefficient between structural diversity scores and novelty ranks of 0.39. This trend is moderate: even when ignoring the most deviant case of Covenant of Mayors, it is not completely regular, with some values below or above expectations.

(density of 0.00198) suggests that many cities belong to one or few TMNs. This is not true for global and capital cities, however. Montreal, for instance, is member of no less than five out of the 15 studied TMNs.

⁸⁰ As in other centrality plots, Covenant of Mayors does not appear in this plot as its structural diversity score is a lot higher than that of the other TMNs.

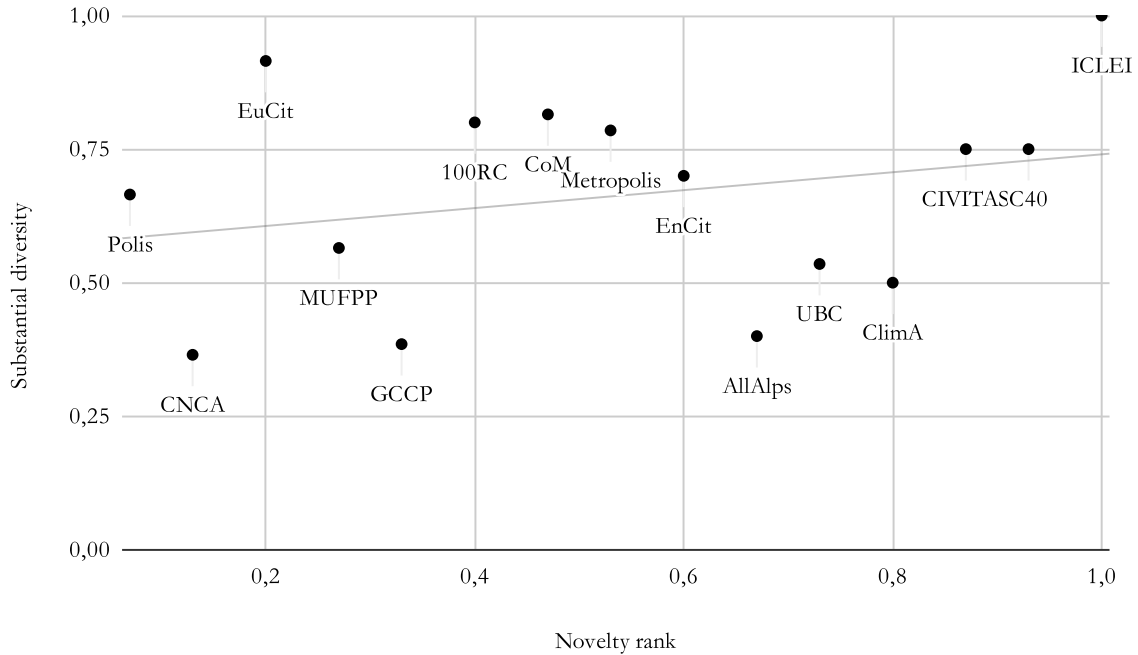


Figure 5.6 The novelty scores of TMNs in relation to their substantial diversity scores

The plot comparing novelty with substantial diversity is less helpful (see Figure 5.6). Indeed, TMNs appear to be scattered. A correlation test between substantial diversity scores and novelty ranks using Spearman’s method shows a correlation coefficient of 0.22. The correlation is thus weak. Nonetheless, the plot shows that ICLEI, the TMN that generates the most novelties, is also the TMN with the highest substantial diversity score. CIVITAS and C40 score relatively high in terms of substantial diversity, although not as high as TMNs with an average to low capacity to generate novel instruments (i.e. Eurocities, Covenant of Mayors, 100RC, and Metropolis). The plot thus points to cases that might confirm the theory developed in this study.

Substantial diversity is an index integrating two indicators, i.e. institutional diversity and topical diversity. The assumption lying behind substantial diversity is that institutional diversity and topical diversity can be summed. Looking closer at substantial diversity (see Figures 5.7 and 5.8), we see that the topical diversity variable (which measures the diversity of issues on which TMNs’ contacts work) might be more related to novelty than the institutional diversity one (which measures the number of types of contacts to which TMNs are connected). Indeed, the dots representing the 15 TMNs seem to be a bit less scattered. ICLEI, C40, and CNCA seem to have topical diversity scores corresponding to their novelty ranks. Regarding institutional diversity, ICLEI, CIVITAS and CNCA seem to have scores

corresponding to their novelty ranks. The correlation coefficient of topical diversity scores and novelty ranks is of 0.28, while that of institutional diversity scores and novelty ranks is of 0.21. Both correlations remain quite weak, however.

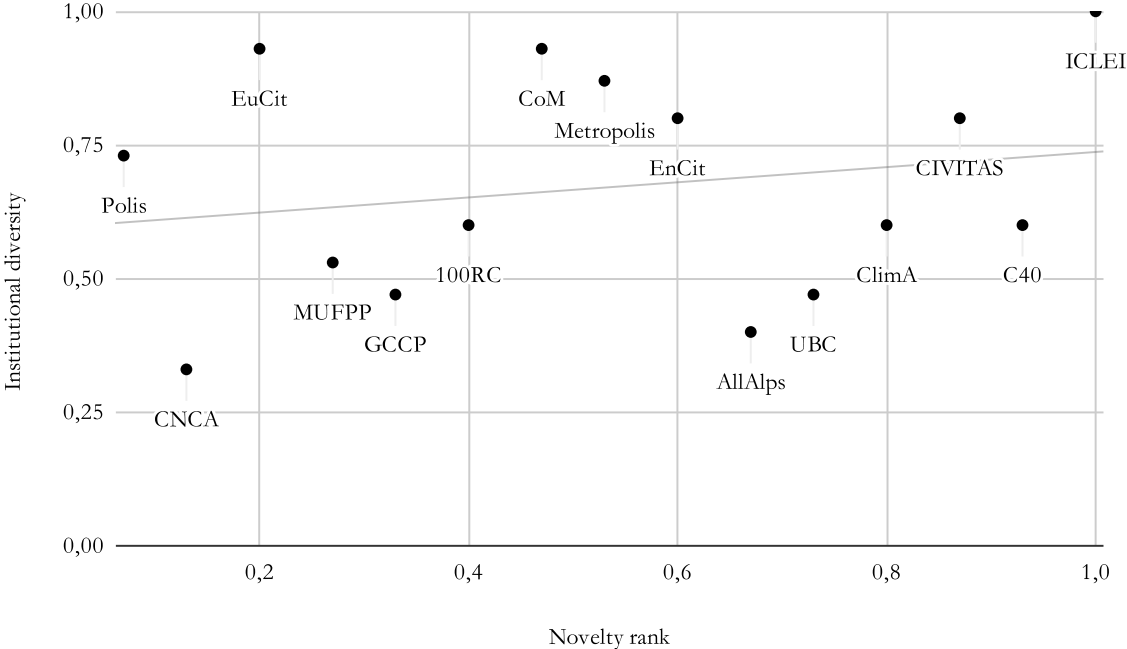


Figure 5.7 The novelty scores of TMNs in relation to their institutional diversity scores

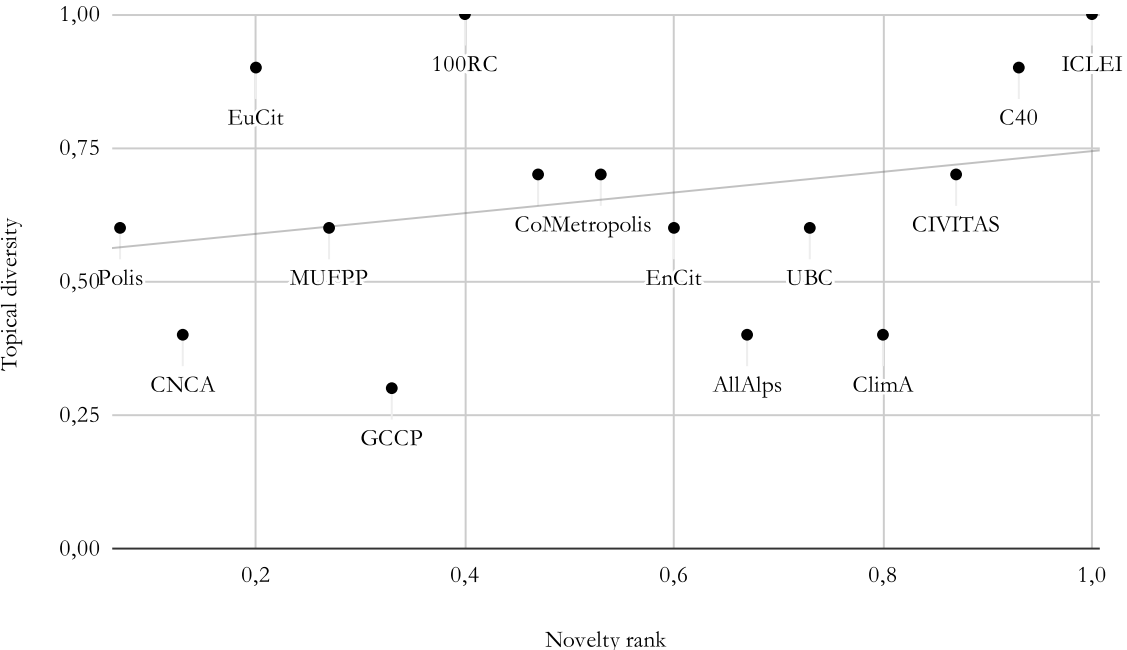


Figure 5.8 The novelty scores of TMNs in relation to their topical diversity scores

Table 5.2 presents the results of the distinct diversity scores of each selected TMN, comparing them to their novelty ranks.

TMN	Structural diversity	Instit. diversity	Topical diversity	Subst. diversity	Novelty ranking
ICLEI	0.064	1	1	1	1
C40	0.002	0.6	0.9	0.75	2
CIVITAS	0.017	0.8	0.7	0.75	3
Climate Alliance	0.128	0.6	0.4	0.5	4
UBC	0.004	0.47	0.6	0.535	5
Alliance in the Alps	0.016	0.4	0.4	0.4	6
Energy Cities	0.005	0.8	0.6	0.7	7
Metropolis	0.008	0.87	0.7	0.785	8
Covenant of Mayors	0.722	0.93	0.7	0.815	9
100RC	0.01	0.6	1	0.8	10
GCCP	0.006	0.47	0.3	0.385	11
MUFPP	0.003	0.53	0.6	0.565	12
Eurocities	0.007	0.93	0.9	0.915	13
CNCA	0.001	0.33	0.4	0.365	14
Polis	0.004	0.73	0.6	0.665	15

Table 5.2 The diversity of members and partners of the 15 selected TMNs in the entire network

Four out of the 15 TMNs see their general diversity measure correspond to their novelty rank in some way, i.e. ICLEI, Energy Cities, MUFPP, and CNCA. At one end of the novelty ranking, ICLEI is the TMN that has generated the most novelties. Its diversity scores are among the highest value, quite above the two TMNs that follow it in terms of novelty (i.e. C40 and CIVITAS). It also has the highest substantial diversity scores and the third highest structural diversity score. ICLEI has contacts from 15 types that tackle 10 distinct issues. More specifically, looking only at ICLEI's 2018 members and partners shows that it is connected to 689 cities, 13 companies, 1 country, 16 governmental agencies, 17 global partnerships, 26 IGOs, 60 local governments, 24 local government associations, 60 NGOs,

11 private foundations, 28 research institutions, 28 subnational governments, 21 TMNs that are not part of the studied system, 6 TMNs from the system under study, and 4 other actors that do not belong to the preceding categories. Furthermore, among all these 2018 ICLEI members and partners, 20 deal with climate change, 4 with energy, 1 with food security, 1 with health, 10 with resilience, 55 with sustainability, 6 with technology, 11 with transportation, and 839 with urban issues in general. ICLEI thus has the greatest diversity of contacts in substance. Structurally, it is the third highest TMN in terms of contacts it does not share with its peers. Its contacts are considerably more diverse than those of CIVITAS, which ranks third in terms of novelty (with six novelties against 17 for ICLEI). Indeed, CIVITAS, in 2018, was connected to 313 cities, 51 companies, 4 governmental agencies, 2 global partnerships, 1 IGO, 4 local governments, 13 IGOs, 2 private foundations, 39 research institutes, 3 subnational governments, 4 TMNs from the system under study, and 7 other actors that do not belong to the preceding categories, hence a total of 12 distinct types of actors. Regarding the issues with which these contacts deal, 1 is related to climate change, 2 to energy, 6 to sustainability, 13 to technology, 59 to transportation, 381 to urban issues, and 44 to other issues, hence a total of seven topical categories. Its structural diversity score (i.e. 0.017) is also quite lower. This comparison shows that ICLEI is not only far above CIVITAS in terms of novelty, it is also in a considerably higher position regarding the diversity of its contacts.

At the other end of the novelty ranking, CNCA, which ranks 14th in terms of novelty generation, respectively ranks 15th, 15th, and 12th in structural diversity (with respective scores of 0.001, 0.33, and 0.4), institutional diversity, and topical diversity. The diversity results of several TMNs, i.e. Energy Cities, GCCP, and MUFPP, are close to corresponding to their novelty ranks. In the three cases, one of the three observed variables does not match the novelty rank.

The social network analysis reveals noteworthy trends regarding the relationship between centrality and diversity on the one hand, and the emergence of novelty on the other hand. It is now crucial to look at the relationship between actor attribute variables and the emergence of novelty.

5.2 A story about time and money? Actor attribute variables and the emergence of novelty

Most scholars looking at the reasons for the emergence of novelty in climate governance focus on actor attribute variables. Examining the literature on policy change in climate governance and organisational studies, this section investigates two of these variables which constitute H2, i.e. organisational age and resources.

5.2.1 Organisational age

Age is a relevant variable to look at when observing change. According to organisational theories, the age of an organisation should influence the emergence of novelty. This argument might apply to TMNs as actors or institutions (see Chapter 1). The younger the TMN, the greater the drive to innovate and generate tools that will match its goals, the more flexible, the fewer bureaucratic rules (Le Mens et al., 2015). The results presented in Table 5.3 and in Figure 5.9 indicate that these conclusions may not apply to the TMNs system. Indeed, the most recent TMNs are not necessarily those that generate the most novelties (see also Chapter 4). The TMN that generates most novelties is ICLEI, which was 27 years old at the end of the studied period and thus one of the oldest TMNs of the system. C40, the second best in terms of novelty, was launched much later, during the strategic urbanism period. It is not the youngest, as no less than four TMNs (i.e. CoM, 100RC, MUFPP, and CNCA) were created afterwards.

A correlation test using Spearman's method reveals a correlation coefficient of 0.11, suggesting there is no correlation between age alone and the emergence of novelty. Figure 5.9 shows that TMNs are scattered around the tendency line. Yet, age does seem to matter to a certain extent. Indeed, the first half of the novelty ranking includes five TMNs from the municipal voluntarism period and only two from the strategic urbanism one. In other words, many older TMNs seem to be among those that generate the most novelties.

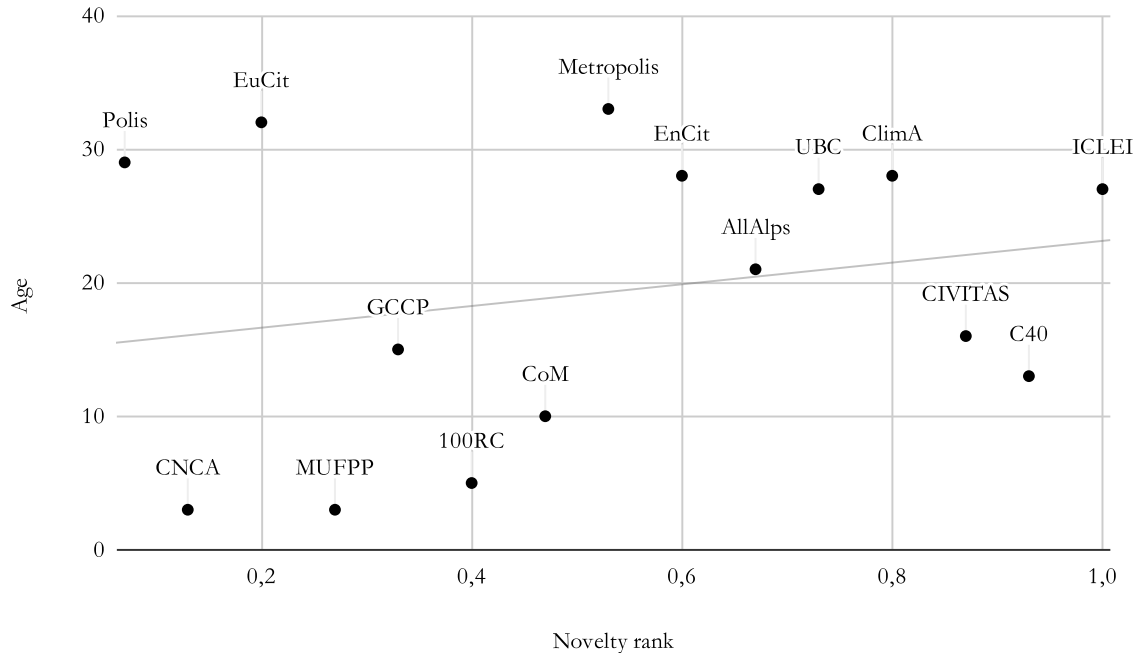


Figure 5.9 The novelty scores of TMNs in relation to their age

This finding is not quite surprising, since it is highly linked to the way novelty is measured. This research’s novelty ranking considers primarily the quantity of novel tools and, to a lesser degree, the early adoption of tools. The most recent TMNs have had less time to generate tools. Consequently, they are less likely to be among the TMNs that generate the most novel instruments or adopt the most novel instruments generated by others. Another reason why older TMNs might produce more novelties than more recent ones lies in the scarcity of novelty. As time goes by in the system, it becomes increasingly hard to generate combinations of governance characteristics (i.e. instruments) that are not already present in the system. Talking about Climate Alliance’s difficulty to adopt practices that make it more visible to cities and other actors of climate governance, an interviewee states that ‘it’s difficult to change’ (Interview 8). Novelties, as evidence of change, are not easy to come by. Thus, older TMNs have an advantage over more recent ones, as they started generating instruments at a time when there were few. It was therefore easier to generate novel ones. The most recent TMNs, MUFPP and CNCA, rank 12th and 14th out of the 15 selected TMNs. Some TMNs nonetheless stand out. C40, which was created in 2005 and was thus 13 years old at the end of the governance tools survey,⁸¹ is the second TMN of the novelty ranking.

⁸¹ Led from 1985, year of launch of the oldest TMN, to 2018, date chosen for the end of the data collection.

Although the measurement method makes it unlikely for C40 to appear at the top of the ranking, it still managed to generate six novel tools in 13 years, and be an early adopter of novel tools, adding up 317 novelty points. Some TMNs, despite the age bias, have managed to be among the ones that generate the most novelties.

TMN	Year of launch	Number of novelties per year	Novelty per year ranking	General novelty ranking
ICLEI	1991	0.6	1	1
C40	2005	0.46	2	2
CoM	2008	0.4	3	9
100RC	2013	0.4	3	10
CIVITAS	2002	0.38	5	3
MUFPP	2015	0.33	6	12
AllAlps	1997	0.24	7	6
ClimA	1990	0.21	8	4
UBC	1991	0.18	9	5
Energy Cities	1990	0.14	10	7
GCCP	2003	0.13	11	11
Metropolis	1985	0.12	12	8
CNCA	2015	0	13	14
Polis	1989	0	14	15
Eurocities	1986	0	15	13

Legend	
■	Voluntary municipalism TMNs
■	Strategic urbanism TMNs

Table 5.3 The novelty ranking of TMNs according to the number of novelties created per year of life⁸²

Given that both old and recent TMNs appear at the top of the novelty ranking, it is worth looking deeper into the age variable to analyse better its possible significance in the

⁸² The TMNs at the end of the table, which have not created any novelty, are ranked according to their organisational age (the more recent, the higher the novelty rank).

emergence of novelty. To do so, it is possible to mitigate the age bias and test whether recent TMNs are more likely to produce more novelties, as argued by organisational theories. More specifically, by looking at the average number of novelties created per year of life, we may eliminate the bias towards older TMNs (see Table 5.3). We should note that this study focuses on the emergence of novelty overall rather than the emergence of novelty per year. In other words, it gives more importance to the sum of novelties generated over time than to the average number of tools generated by TMNs in a given amount of time. Therefore, it uses the first ranking presented rather than the novelty per year one. Yet, looking at the novelty per year ranking enables us to better capture the significance of age in the emergence of novelty.

ICLEI remains the TMN that generates the most novelties in the novelty per year ranking, since it has generated 0.6 tool per year since its creation. C40 follows, with 0.46 tool per year, thus also maintaining its rank. It is important to note that the Covenant of Mayors and 100RC rank third, with 0.4 tool per year, whereas they rank respectively ninth and 10th in the conventional novelty ranking, which is biased against recent TMNs. The age bias might help explain why the Covenant of Mayors, while it generally has the highest centrality and diversity scores, ranks low in the conventional novelty ranking. Had they been created earlier, they might have appeared higher in the conventional novelty ranking. Overall, all the TMNs from the strategic urbanism period rank higher than in the conventional novelty ranking, whereas all the older TMNs rank lower (with the exception of Polis, which goes from 15th to 14th only because, as Eurocities, it has not created novelties, but is a bit younger). This implies that the bias towards older TMNs is mitigated in the novelty per year ranking.

Younger TMNs, in the novelty per year ranking, generally appear to generate more novelties than older ones. Following Chapter 4's findings, this does not mean that recent TMNs generate overall more tools than old ones, or that new-generation TMNs generate more novelties than municipal voluntarism ones. Rather, this observation implies that TMNs might generate more novelties in their first years than later on. ICLEI, which is at the top of the novelty ranking considering age or not, generated only three novelties in the strategic urbanism period, but 17 overall. Results are not clear cut for all TMNs, however. Climate Alliance, although it was launched in 1990, generated five out of its six novelties between

2006 and 2018. Similarly, Alliance in the Alps generated four out of its five novelties between 2003 and 2018, although it was launched in 1997. CNCA, one of the most recent TMNs, has not generated any novel instrument since its creation. MUFPP has so far only created one. Again, this might be related to the fact that generating novelties in the TMNs system is now more difficult than it was when the system emerged in 1985 and almost any new instrument could be a novelty. It may also be that other variables are at play, such as centrality and diversity.

To further investigate the significance of age, looking not only at the year in which TMNs generated novelties, but also at their organisational age when they generated those novelties proves valuable. As mentioned in Chapter 4, there is great variance in the age of TMNs. I thus look at the median age rather than on the mean age. In the TMNs system, the median age of TMNs is 21. The median age in which they generate novelties is 7, meaning that overall, TMNs tend to generate more novel instruments when they are recent (see also Figure 5.10). More than half of the TMN governance tools were indeed generated by TMNs aged 0 to 8. TMNs still generate tools later, but they do so at a slower pace.

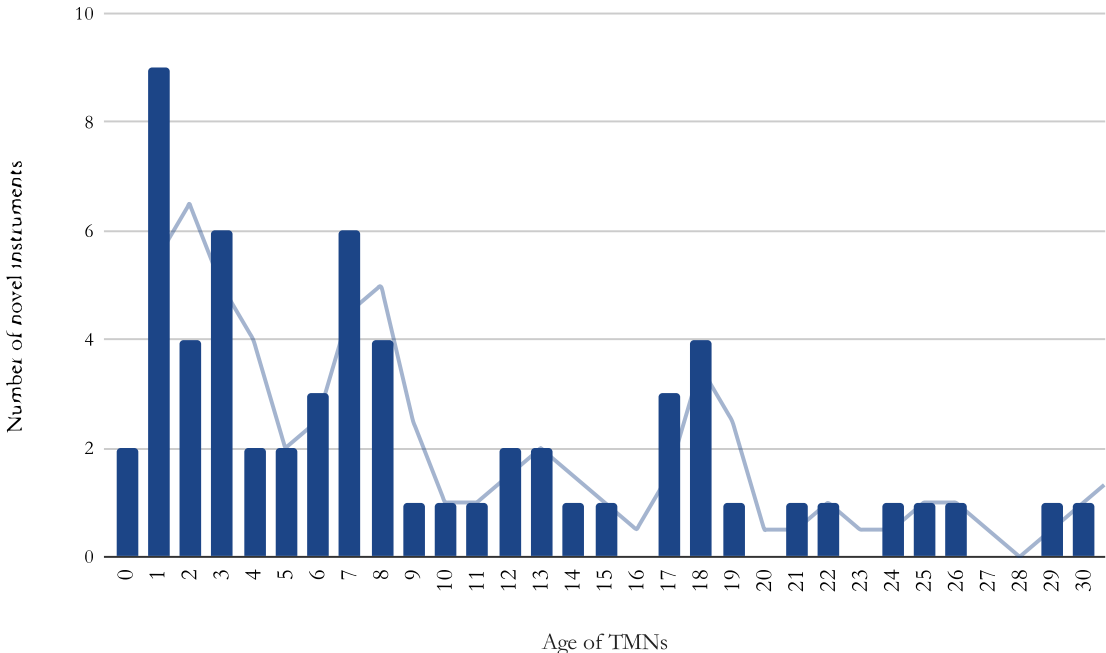


Figure 5.10 The age of TMNs when generating novelties⁸³

⁸³ The line behind the bars illustrates the decreasing tendency of TMNs to create novel instruments as time goes by.

A general correlation test between the number of tools generated and the age of TMNs at the time of generation using Pearson's method (as we deal here with absolute values rather than ranks) shows a strong negative correlation with a correlation coefficient of -0.61. This confirms the relationship observed between age and novelty emergence. TMNs tend to generate more tools when they are young. Figure 5.10 shows that the relationship between age and the emergence of novelty is not linear, however. Individual correlation tests comparing the same variables for each TMN point to some discrepancies. There is a strongly negative correlation for ICLEI, Covenant of Mayors, and 100RC (with respective correlation coefficients of -0.57, -0.54, and -0.41). Therefore, ICLEI is not the only TMN with a frequency of novelty emergence decreasing over time. In contrast, GCCP, Metropolis, UBC, and C40 show a moderate to low negative correlation (with respective correlation coefficients of -0.25, -0.21, -0.17, and -0.15). Finally, Climate Alliance, Alliance in the Alps, CIVITAS, Energy Cities, and MUFPP display no correlation to a moderately positive one (with respective correlation coefficients of 0.25, 0.19, 0.16, 0.13, and 0).

Overall, it seems that age affects the capacity to generate many instruments, which is how the emergence of novelty is measured here. TMNs generate more instruments when they are young, but they need time to produce many instruments. In other words, because of the way this research measures novelty, older TMNs are likely to appear higher in the novelty ranking, since they have overall generated more instruments.

Depending on how it is understood and measured, organisational age might help explain the emergence of novelty. Nevertheless, age alone cannot explain why some TMNs generate more novelties than others. Whether or not we use a temporal perspective, the novelty rankings show that ICLEI, one of the oldest TMNs, is the TMN that generate the most novelties. The second TMN in both novelty rankings is C40, which is the fifth most recent TMN. In addition to relational variables, other actor attribute variables might play a role in accounting for the emergence of novelty.

5.2.2 Organisational resources

Another noteworthy attribute variable lies in the organisational resources of TMNs. The literature on policy change in climate governance sees a negative relationship between lack of resources and innovation (Anguelovski and Carmin, 2011). The organisational theories

literature also sees a link between resources and innovation, although the direction of the relation is not very clear. It often looks like scarce resources can hinder novelty (Löfqvist, 2017). However, in situations of limited resources, scarcity can sometimes foster novelty (Pina e Cunha et al., 2013).

Since the 15 identified TMNs seem to have different amounts of resources, looking at whether the novelty rank of TMNs varies with their amount of organisational resources appears useful. I measure the organisational resources of TMNs by looking at the number of staff members working for the 15 TMNs. The annual budget might serve as a more direct indicator of the organisational resources. Nevertheless, partly because most of the 15 selected TMNs are not public entities, it is hard to find information regarding their financial resources. Assuming that human resources represent a vast part of the budget of TMNs, I use the proportion of staff per city member as a proxy for the organisational resources of TMNs. The organisational resources might positively affect the emergence of novel governance instruments. Indeed, more staff may correspond to more resources to generate tools. This idea assumes that the more tools generated, the higher the probability that TMNs generate novelties. Findings show that this is not the case, however. A comparison of the total number of tools generated by each TMN and the number of novelties generated by those TMNs shows that the TMNs that generated a great number of tools are not the ones that generate the most novelties (see Table 5.4). Although C40 created a total of 73 tools, it only generated six novelties, which means 0.09 novelty per tool generated. By contrast, Alliance in the Alps generated only 21 tools in total, but 5 novelties, which amounts to 0.24 novelty per tool generated.

Organisational resources might influence the rise of novelty in distinct ways. More staff may indeed mean more attention given to the needs of city members, which might lead to more diverse instruments. Furthermore, more staff may mean more resources to analyse the information received and transform it into novel instruments. The number of novel instruments matters more than the quality of the innovation of each instrument in measuring novelty. Because of the way novelty is measured, it seems more likely that more staff would lead to more novel tools than the contrary.

TMN	Number of tools	Number of novelties	Novelties per tool
ICLEI	81	17	0.21
C40	73	6	0.08
CIVITAS	65	6	0.09
Climate Alliance	36	6	0.16
UBC	39	5	0.13
AllAlps	21	5	0.24
Energy Cities	47	5	0.09
Metropolis	33	4	0.12
CoM	28	4	0.14
100RC	19	2	0.11
GCCP	26	2	0.08
MUFPP	9	1	0.11
Eurocities	34	0	0
CNCA	11	0	0
Polis	13	0	0

Table 5.4 The number of novelties per tool created by each TMN

Results show that C40, which is the second TMN of the novelty ranking, is the TMN with the most organisational resources, having 1.58 staff per member (see Figure 5.11 and Table 5.5). ICLEI, the TMN that generates the most novelties, ranks fourth in terms of organisational resources, with a score of 0.32. GCCP, which ranks eighth in terms of organisational resources (with a score of 0.06), ranks 11th in terms of novelty. The organisational resources score of the Covenant of Mayors is quite low and shows a mild correspondence with its novelty rank. This is noteworthy because most of the relational variable measurements of the Covenant of Mayors are quite high, despite its ninth novelty rank. These results point to a positive relationship between organisational resources and the emergence of novelty. Yet, some TMNs show the opposite trend: the organisational resources scores of Eurocities, CNCA and Polis are rather high, whereas their novelty ranks are quite low. 100RC, which has 1.01 staff per member, ranks second in terms of organisational resources. However, it ranks 10th in terms of novelty. C40 and 100RC seem to show

contradictory trends that it might be interesting to further investigate to better understand the role of organisational resources (see Chapter 6).

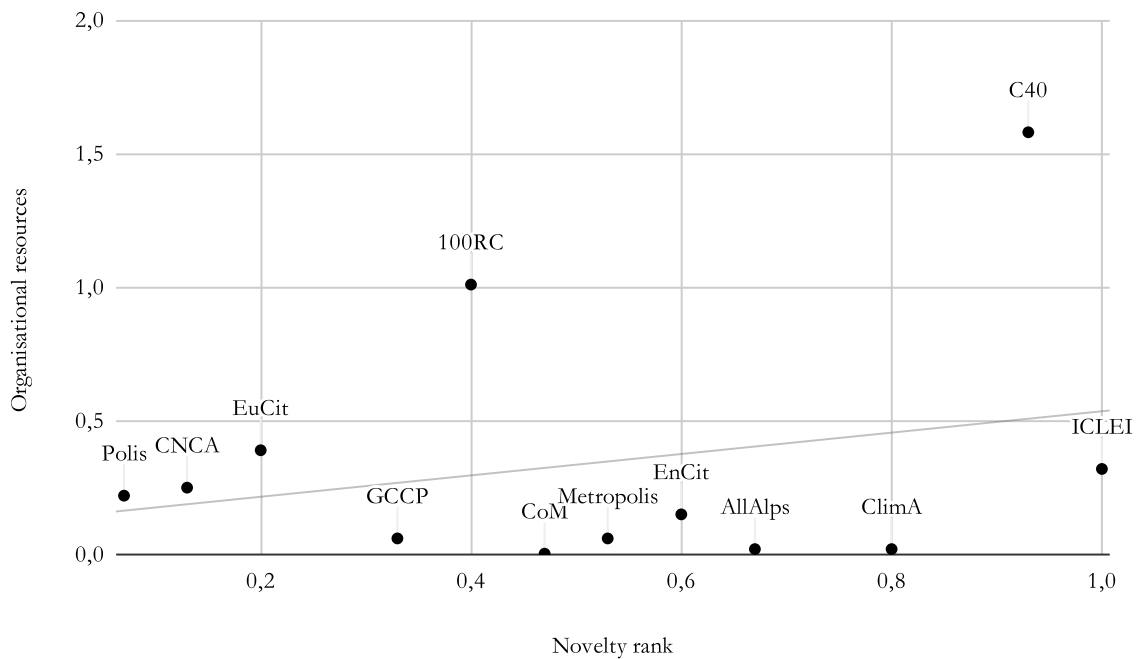


Figure 5.11 The novelty scores of TMNs in relation to their organisational resources

A correlation test using Spearman's method indicates inconclusive results regarding organisational resources, with a correlation coefficient between organisational resources scores and novelty ranks is of -0.06, which makes the correlation non-existent. Overall, organisational resources might facilitate the emergence of novelty in some TMNs, yet they do not seem to be necessary to the emergence of novelty.

TMN	Staff	Staff / members	Novelty ranking
ICLEI	260	0.32	1
C40	152	1.58	2
CIVITAS	NA	NA	3
Climate Alliance	40	0.02	4
UBC	NA	NA	5
Alliance in the Alps	6	0.02	6
Energy Cities	26	0.15	7
Metropolis	13	0.06	8
Covenant of Mayors	24	0.003	9
100RC	99	1.01	10
GCCP	6	0.06	11
MUFPP	NA	NA	12
Eurocities	51	0.39	13
CNCA	5	0.25	14
Polis	15	0.22	15

Table 5.5 The organisational resources of the 15 selected TMNs⁸⁴

This section has shown that some actor attribute variables may help explain why some TMNs generate more novelties than others. The analysis of those variables nonetheless suggests that age and organisational resources overall do not seem to suffice to the rise of novelty. The role of organisational resources remains to be explained.

Looking at the results of each variable (attribute or relational) separately for the sake of clarity is useful. With the possible exception of the relationship between centrality in the whole network or in the members' subgraph and novelty emergence, no positive relationship appears clearly between the independent variables taken independently and the dependent variable under study. This is in line with this study's hypotheses, which consider the complexity of the TMNs system. Moreover, as stated earlier, the social network analysis,

⁸⁴ This table details the organisational resources variable mentioned above. The information regarding the number of staff members is lacking for three TMNs, i.e. UBC, CIVITAS and MUFPP.

performed on 15 networks, does not offer robust conclusions regarding the relationship between centrality and diversity on the one hand, and the emergence of novelty on the other hand. The results of the centrality analysis act as a plausible probe regarding the existence of a causal relationship between the two. The findings of the diversity analysis are more confusing. Nevertheless, they hint at cases that we need to further investigate with qualitative data. Doing so will help us explain and discuss the results of this work, and better capture the relationship between relational and attribute variables on the one hand, and the emergence of novelty on the other hand. Before doing so, however, we need to look at the relationship between several control variables mentioned in Chapter 4 and the emergence of novelty.

5.3 Neither connections nor time and money? Control variables and novelty emergence

It is important to briefly mention here some control variables that might help explain the emergence of novelty. Some of the differences highlighted among the 15 TMNs mentioned in Chapter 4 were not analysed above. These differences correspond to three variables, i.e. the geographical and thematic scopes of TMNs as well as the nature of their founders. These are not part of this research's theory.

Yet, these variables might affect the emergence of novel TMN governance instruments. The geographical scope could indeed be relevant in this explanation. It might be argued that TMNs focusing on European cities generate more novel instruments than global TMNs because of the EU climate policy encouraging cities to act and design and implement climate policies (Jänicke and Wurzel, 2019). Another relevant element is TMNs' thematic scope. Indeed, some argue that large and technical organisations might be more innovative than other types of organisations (Strang and Soule, 1998). Finally, it might be pertinent to look at the nature of founders. As mentioned in Chapter 4, TMN founders often maintain a significant role in the functioning and managing of the network they created. Those that are private might, precisely because of their nature, import distinct governance practices in the steering of cities.

TMN	Geographical scope	Thematic scope	Founders	Novelty ranking
ICLEI	Global	Sustain. (large)	Cities	1
C40	Global	C.C. (average)	Cities	2
CIVITAS	Europe	Transport. (narrow)	European Commission	3
ClimA	Europe	C.C. (average)	City of Frankfurt	4
UBC	Baltic region (Europe)	Urban issues (large)	Cities	5
AllAlps	Alps (Europe)	Sustain. (large)	NGO	6
EnCit	Europe	Energy (narrow)	Cities	7
Metrop	Global	Urban issues (large)	Cities	8
CoM	Europe	C.C. (average)	European Commission	9
100RC	Global	Resilience (narrow)	Rockefeller Foundation	10
GCCP	Global	Sustain. (large)	UN + city of Melbourne	11
MUFPP	Global	Urban food policy (narrow)	Cities	12
EuCit	Europe	Urban issues (large)	Cities	13
CNCA	Global	Carbon neutrality (narrow)	Cities	14
Polis	Europe	Transport. (narrow)	Cities	15

Table 5.6 Control variables to explain the rise of novelty⁸⁵

I consider these variables to be control variables. They are not part of the theory developed in this research for various reasons. One is that the theories used in this research (i.e. network theory, complexity approaches, and organisational theories) usually do not consider them.⁸⁶ Other reasons are specific to each variable. Regarding the geographical scope, it could be argued that the EU push for local climate policies might facilitate the diffusion of local climate policies. Yet, it is less likely to be able to foster novel climate policy, as novelty does

⁸⁵ The three control variables analysed here (i.e. the geographical scope, the thematic scope, and the nature of TMN founders) are highlighted in blue.

⁸⁶ With the possible exception of the thematic scope, as mentioned later. Some studies of organisational theories (such as Strang and Soule's) have indeed looked at the narrowness of the scope as a driver of innovativeness.

not happen on request.⁸⁷ To echo earlier comments, it is improbable that many local policies would be linked to many novel local policies. Likewise, the idea that the EU push for local climate policy could foster the rise of novel TMN governance tools seems rather far-fetched. Indeed, there is no apparent link between the number of governance tools and the number of novel governance instruments (see Section 5.2.2).

Regarding the thematic scope, the organisational resources variable already considers the size of the organisation. It does not take into account the scope of the issue tackled, however. In the context of the present study, working exclusively on climate change may be considered as average scope. Any TMN encompassing more than climate issues may be considered as having a large scope. Conversely, any TMN focusing on issues encompassed by climate issues may be considered having a narrow, or technical scope (see Table 5.6).

Finally, the presence of private actors among the TMN founders is not part of this study's theory because of its diversity argument. What matters is not necessarily the presence of private actors in the founding and further managing of TMNs, but the diversity of contacts, whether those have weak or strong links to TMNs.⁸⁸ As the nature of founders argument partly contradicts the diversity of contacts argument of this approach, I use it as a control variable.

Table 5.6 suggests that the identified control variables do not follow the novelty ranking of the 15 TMNs. Both global and European TMNs appear at the top and at the bottom of the novelty ranking, contradicting the possibility of the geographical scope influencing the capacity of TMNs to generate novelties. Furthermore, general TMNs (i.e. TMNs working on urban issues or sustainability) do not appear to generate less novelties than technical ones. The presence of private actors in the founders does not seem to influence the capacity of TMNs to generate novelties either. Only three TMNs, i.e. Climate Alliance, Alliance in the Alps, and 100 Resilient Cities, were created by private actors. Their novelty ranks go from

⁸⁷ It might be a relevant variable to study the dissemination of instruments and related social learning processes, however.

⁸⁸ The findings of Chapter 6 indicate that some actors with strong links to TMNs, identified as governance entrepreneurs, might facilitate the rise of novelty. Nevertheless, these are not necessarily founders.

fourth to 10th, thus contradicting the idea of a link between the presence of private actors among the founders of TMNs and the emergence of novelty.

The interviews do not underline a possibly positive relationship between the three control variables and the emergence of novelty. One interviewee does seem to imply that the C40 owns its capacity to generate novelties partly to its maintained focus on climate change (Interview 12). Yet, in the context of the TMNs complex system studied in this study, the climate change focus cannot be considered technical. Indeed, all TMNs have climate-related knowledge (even when their scope is larger or narrower), since climate action is one of their priorities. Furthermore, while other interviews note that 100RC is a technical TMN (Interviews 5 and 15), its average novelty rank shows it does not generate more novel governance instruments than others.

Overall, the results of the control variables, i.e. the variables that are not considered in this research's hypotheses, do not seem to highlight a causal relationship with the emergence of novelty. To further investigate the relationship between the diverse possible independent variables described in this chapter and the emergence of novelty, it is now crucial to examine in more details the qualitative data collected for this research.

5.4 Uncovering the causal relationship: a cross-case analysis of the 15 TMNs

The present section synthesises the presentation of the actor attribute variables identified and the results of the social network analysis, and discusses the 15 cases in light of the additional qualitative data collected for this study. It compares the results of the empirical analysis to the propositions of the first two hypotheses presented in Chapter 2, i.e.:

H1: The TMNs generating the most novel governance instruments are likely to be central and have diverse contacts in the TMNs complex system.

H2: The TMNs generating the most novel governance instruments are likely to be among the oldest ones and the ones with most organisational resources.

This section also emphasises the relevance of considering qualitative data in the analysis. The social network analysis points to the existence of a correlation between centrality and

the emergence of novelty. Results regarding diversity are more confusing. Nevertheless, the analysis hints at several noteworthy cases regarding the relationship between centrality and diversity on the one hand, and the emergence of novelty on the other hand. It overall suggests there might be a positive trend between relational variable and the emergence of novel TMN governance instruments. However, a social network analysis on 15 cases can only go so far. It does not enable us to confirm the existence of such a relationship. Supporting this analysis with qualitative data is crucial. Thus, the following subsections look at the different cases, which support or contradict the hypotheses, or present puzzling results. To make sense of these cases, I introduce qualitative data collected from a documentary observation including a survey of the literature survey, and interviews.

We should note that the distinct tables presenting the results below do not look at all the indicators mentioned above regarding centrality and diversity. In order to facilitate the analysis, I focus only at the centrality of TMNs in the entire system, and omit the distinction between institutional and topical diversity to look only at substantial diversity.

5.4.1 Qualitative data confirming the theory

The social network analysis and the study of attribute variables underlined some correlations between independent and dependent variables. They also pointed to several cases that seem to show a positive causal relationship between the selected relational variables (i.e. centrality and diversity, mentioned in H1) and the emergence of novelty. They showed there might be a link between age and the emergence of novelty and left unknown the relationship between organisational resources and the rise of novelty (i.e. the variables mentioned in H2).

The following paragraphs elaborate on the social network and actor attribute variable analysis results and confirm this study's theory using qualitative data gathered through a documentary observation including a survey of the literature, and interviews. The documentary observation used the documents or website information presenting the TMNs, their goals, their functioning, and the rules related to their membership and partnership. The 18 semi-structured interviews were conducted with staff members of TMNs, their members, and their partners. The questions were related to the role of interactions, the relationships of TMNs and their members and partners, and the steering practices of TMNs (see Appendix A for the list of interviews). The literature survey, based on the analysis of in-depth cases studies

conducted by other scholars on several of the TMNs analysed here, helped get more data when it was missing from this research’s data collection (especially for Energy Cities, Metropolis, and Covenant of Mayors).

5.4.1.1 ICLEI and CIVITAS, two TMNs that generate many novelties and confirm H1
 ICLEI and CIVITAS are two of the three TMNs that generate the most novelties, ranking respectively first and third. While ICLEI has generated 17 novelties in total, CIVITAS has produced six, which is as many as C40.⁸⁹ As highlighted by Table 5.7, their different relational variable scores are in line with their novelty ranks. The cases of ICLEI and CIVITAS thus follow H1.

TMN	Relational variables			Attribute variables		Novelty ranking
	Degree in the whole network	Struct. divers.	Subst. divers.	Age	Org. resources	
ICLEI	0.079	0.064	1	27	0.32	1
CIVITAS	0.035	0.017	0.75	16	NA	3

Table 5.7 The independent and dependent variable scores of ICLEI and CIVITAS

ICLEI and CIVITAS show that TMNs’ centrality (i.e. their high number of contacts), and their diversity of contacts (i.e. the fact that they are linked to nodes to which other TMNs are not linked or they are linked to nodes that are of very diverse types and issues) correlate with their novelty ranks. Being central gives access to a lot of information. Having diverse contacts allows receiving information to which other nodes might not have access. Assuming that a great amount of diverse information is key to generating novelty, the cases of ICLEI and CIVITAS illustrate well the theory of change developed in this study.

The qualitative data collected on ICLEI is particularly useful. It first confirms both ICLEI’s centrality and diversity of contacts in the TMNs system. As focal point of the LGMA constituency of the UNFCCC, ICLEI collaborates with many distinct nonstate actors dealing in one way or another with climate change and interested in the UNFCCC process (Interviews

⁸⁹ CIVITAS nonetheless ranks lower because of its total of novelty points, based on its capacity to adopt novelties generated by other TMNs.

2 and 14). Like many other networks, ICLEI seeks inclusion in its network rather than exclusion from it. It is thus open to many kinds of members and partners. Contacts that seem to have too diverging interests might nonetheless be discarded in order to avoid hijacking of city members (Interview 2).

Interviews of ICLEI's staff underline the manifold functions of interactions. First, interactions are inevitable in a world in which there have been more and more TMNs and interest in working with cities at the global level (Interview 3). There are many overlaps in terms of goals and memberships (Interview 2 and 3). These overlaps lead either to competition or to collaboration.

Second, being a network, ICLEI sees itself as a facilitator that seeks to bring the right actors together around urban issues. It does not have the internal resources to be an expert on every issue it tackles, nor does it seek to. Rather, it aims to partner with actors that do:

'Rather than us now trying to work as climate finance experts, we would rather look to organisations that we can partner with, to then bring in their expertise to either help the assessment of urban projects and say "how can we make this more bankable?", or try to fundraise or to bring in people who can speak the language of the financial institutions to help [cities] better understand what needs to be done.' (Interview 3).

While emphasising ICLEI's dimension of structure of interactions, this quote also points to its agentic dimension, since it ultimately decides on the actors with whom to work.

Third, there is competition around access to funding, which is limited, yet crucial to the work of TMNs. Funding helps TMNs achieve their goals. To get access to funding, it is often best to ally with other TMNs or non-TMN partners. Nevertheless, to some extent, TMNs also need resources to dedicate time and energy to obtaining and managing partnerships (Interview 2). The data displayed in Section 5.2.2 indeed seems to indicate that most central TMNs have many organisational resources (with the notable exception of the Covenant of Mayors). A staff member from the Global Covenant of Mayors, which is a partner organisation to several TMNs such as ICLEI and C40, mentions that some partners nonetheless 'just don't have the financial resources to spend the time to be part of an

initiative' (Interview 4). Thus, it seems that the TMNs that already have a certain amount of resources attract partners and consequently funding more easily.

This finding follows Barabási's analysis of complex networks in which the scholar argues that the rich get richer (2002). Affluence can here be understood as a large amount of resources, but also, in Barabási's understanding, as a high number of connections. Indeed, in a complex world, nodes fight for connections because those mean survival (Barabási, 2002: 106). Through the principles of growth (i.e. networks grow over time) and preferential attachment (i.e. new nodes tend to connect to already well-connected nodes), Barabási argues that nodes that are already rich in connections will likely become richer over time. A node such as ICLEI, that already has a high number of connections and resources, might get more connections and more resources more easily. An interviewee confirms this idea, mentioning that ICLEI has been in the system for a long time, and has a global reach; therefore, many actors want to work with this TMN (Interview 2). Overall, how a node is positioned, the amount of its initial resources, and its age might influence the emergence of novel governance instruments in ICLEI.

Fourth, partnerships are a way for ICLEI to work differently. By interacting with partners coming from distinct areas, ICLEI may have managed its projects differently than it would have done on its own: 'different sectors bring different strengths, in different adventures to the table, so their having us working together, it's also affected the way the projects are being executed, yeah, to the best of ability.' (Interview 3)

Coordination is visibly hard for TMNs (Interviews 2, 3, 8, 10, and 12). Yet, it can lead to new or diverse perspectives (Interviews 8 and 11). Ultimately, these new perspectives might lead to novel governance instruments.

Finally, in relation to the former, ICLEI, like other TMNs, sees partnerships as enabling effectiveness and greater impact (Interviews 2, 4, 7, 8, 10, 11). Summing up ICLEI's vision

of partnerships, a recent tweet from the TMN states: ‘Partnerships are the new normal for achieving integrated, effective #climateaction.’⁹⁰

In line with the social network analysis, interviews indicate that interactions may affect ICLEI’s governance practices. Qualitative data also points to the process linking interactions and novelty. Collaboration and competition are both at play in the TMNs complex system. Through collaboration, TMNs have access to a diverse set of resources, among which funding. All these resources can help TMNs be more efficient, but also work differently.

Regarding attribute variables, ICLEI and CIVITAS are not recent TMNs. ICLEI is probably, with Climate Alliance, one of the first TMNs to have seen climate change as a priority, notably through its 1993 Cities for Climate Protection (CCP) campaign, identified as a novelty in this study’s database (see Appendix C).⁹¹ CIVITAS, the third TMN of the novelty ranking, is much more recent than ICLEI, since it was launched at the beginning of the strategic urbanism period. Still, it was already 16 years old at the end of the governance instruments survey. Figure 5.10 (Section 5.2.1) shows that TMNs tend to generate most of their instruments before they are 19. This means that CIVITAS was close to the end of its most intense period in terms of novelty emergence. In the novelty per year ranking (described in Section 5.2.1), which mitigates the age bias of the conventional novelty ranking, ICLEI still appears as the TMN that generates the most novelties, with 0.6 novelty per year. In the same ranking, CIVITAS ranks fifth, with 0.38 novelty per year, thus still quite in line with its relational variable scores. In other words, both ICLEI and CIVITAS have a relatively high number of novelties per year. Accordingly, age is not the only variable explaining their capacity to generate novelties. Yet, it has given them time to generate overall more novelties than recent TMNs. Furthermore, for an interviewee, ICLEI’s age influences the number of interactions that this TMN has: ‘we’ve been working with the cities for a long time, so we get approached a lot as well from people.’ (Interview 2). Age may therefore affect the

⁹⁰ See ICLEI’s Twitter profile page. URL: <https://twitter.com/ICLEI/status/1179737880861777923> (last accessed October 3, 2019).

⁹¹ Several TMNs of the complex system (i.e. Metropolis, Eurocities, Polis, and Energy Cities) were created before or at the same time as ICLEI. Yet, as briefly mentioned in Chapter 4, TMNs tend to evolve over time. An overview of the governance tools of the TMNs launched in 1991 or earlier suggests that they did not focus on climate change in their first years. They nonetheless gained interest in this matter over time.

emergence of novelty by giving TMNs time to generate both more novelties and more interactions.

The organisational resources ranking is harder to interpret, especially since information is missing regarding CIVITAS. This study hypothesises a link between organisational resources and the rise of novelty. More staff might indeed mean more attention given to the needs of city members, which might lead to more diverse instruments. More staff might also mean more resources to analyse the information received and transform it into novel instruments. ICLEI's organisational resources are a lot lower than those of C40 or even 100RC. They nonetheless are quite high when compared to those of the other TMNs. As some interviews underline, organisational resources seem to be necessary to ensure functioning partnerships, which in turn might help TMNs generate novelties (Interviews 2 and 4). Yet, interviews regarding ICLEI's case do not clarify the link between organisational resources and the emergence of novelty. Overall, it is hard to say, looking at ICLEI and CIVITAS, whether organisational resources play a role in the emergence of novelty. It is necessary to turn to other cases to both further investigate this idea and confirm the significance of the other variables studied.

5.4.1.2 GCCP, MUFPP and CNCA, three TMNs that generate few novelties and confirm H1

GCCP, MUFPP, and CNCA are also cases that seem to confirm H1 in the social network analysis. Indeed, they represent TMNs that have not generated many novelties and that have low relational variable scores. The three of them are in the bottom third of TMNs regarding novelty. While GCCP generated two novel instruments between the time of its launch and 2018, MUFPP only generated one and CNCA did not generate any. Most of the relational variables scores of the three TMNs also belong to the last third of TMNs' scores. This study's qualitative data underlines that GCCP, MUFPP, and CNCA are rarely mentioned among the identified TMNs. Thus, they do not appear to be central in the TMNs complex system. GCCP was funded by an important actor of global environmental governance, namely the UN Global Compact, which gathers more than 12,000 business and non-business actors. It also has, among its partners, several UN agencies, such as UN-Habitat. Yet, this does not translate into many contacts, many diverse contacts, or many resources for the TMN. As we will see later, being created by a prominent IGO, as is the case of the Covenant of Mayors, does not

ensure a vast amount of resources or connections. Likewise, the nature of TMN founders does not appear to influence the emergence of novelty.

TMN	Relational variables			Attribute variables		Novelty ranking
	Degree in the whole network	Struct. divers.	Subst. divers.	Age	Org. resources	
GCCP	0.008	0.006	0.385	15	0.06	11
MUFPP	0.014	0.003	0.565	3	NA	12
CNCA	0.002	0.001	0.365	3	0.25	14

Table 5.8 The independent and dependent variable scores of GCCP, MUFPP, and CNCA

As illustrated in Table 5.8, GCCP, MUFPP, and CNCA have centrality and diversity scores that roughly correspond to their novelty ranks. Centrality and diversity of contacts seem to affect poorly innovative TMNs in the same way they do very innovative ones.

The attribute variable scores of GCCP, MUFPP, and CNCA are difficult to interpret. The three TMNs were created in the strategic urbanism period. GCCP, which was 15 years old in 2018, is one of the oldest TMNs coming from strategic urbanism, along with CIVITAS. Over half of the novelties were generated when TMNs were aged 0 to 8, and more than 85% before they reached 19 (see Figure 5.10, section 5.2.1). Although it did not have as much time as Metropolis or Eurocities to generate tools, it surely had enough time to generate several ones. CIVITAS and C40, launched respectively in 2002 and 2005, generated six novelties in approximately the same amount of time. Regarding organisational resources, GCCP’s score is quite low. This low level of resources does not counterbalance the TMN’s low interaction variable scores and thus does not enable the TMN to generate many novel instruments. In accordance with the rich get richer argument mentioned above, it seems that the lack of resources of GCCP prevents it from attracting more resources. The same goes for its connections. Following Barabási (2002), the example of GCCP suggests that only the rich get richer in the TMNs complex system. The latecomers in the system, which do not start with many resources and contacts, are unlikely to catch up and become rich themselves.

Launched in 2015, CNCA and MUFPP are the most recent TMNs of the system. They therefore had little time to generate novelties. CNCA ranks far higher in terms of organisational resources score than in terms of novelty. Because it only had 20 members in 2018, its staff of five people makes CNCA rank higher than two thirds of the selected TMNs in terms of organisational resources. Qualitative data reveals that CNCA is funded by six private foundations and has an annual budget estimated to 1.3 million dollars (see also Chapter 4). Although this seems quite low in comparison to that of ICLEI (12 million) or C40 (9.3 million), it is actually only a bit below C40 and much above ICLEI when divided by the number of members. This might explain why it can afford five staff for 20 city members. The documentary observation also highlights that CNCA has strong links with C40, which partly administers it. The latter might have influenced the business model of the former, either through coercion or social learning. Both TMNs were indeed created by cities, but heavily depend on private funding. They also have a relatively low number of member cities and include new members by invitation only. Another possible reason for these similarities is the fact that both C40 and CNCA are new-generation TMNs. Yet, because of the strong links between the two and because not all new-generation TMNs are have so similar business models, the first reason mentioned (i.e. the influence of C40 on CNCA) is the most likely.

Even with proportionately more staff per member, CNCA ranks very poorly in terms of novelty. The age variable appears significant here. Indeed, CNCA has clearly had less time than other TMNs to generate instruments. Besides, because generating novel instruments in the TMNs system was harder between 2015 and 2018 than it was in 1985, the fact that CNCA did not generate novel instruments is coherent with this study's theory. In the same amount of time, MUFPP only generated one, but it also ranks higher than CNCA in all the relational variable indicators. Figure 5.10 (section 5.2.1) shows that 21 novel instruments (that is, one third of the novelties identified) were generated by TMNs aged 0 to 3. Thus, even though CNCA did not have time to generate as many tools as most other TMNs, it might have generated some, were it to be a potentially innovative TMN. The fact that it did not, despite its high organisational resources, suggests that other variables were at play. It is thus likely that its low relational variable scores affected the emergence of novelty in this TMN. Contrary to CNCA, MUFPP generated one novel instrument. Thus, in the novelty per year

ranking, MUFPP ranks sixth. No information regarding its organisational resources could be found. Qualitative data reveals that MUFPP is managed by the city of Milan, but does not reveal how many staff members work on the management of MUFPP. The most visible difference between CNCA and MUFPP's independent variable scores thus lies in MUFPP's higher centrality and diversity scores.

As in the case of the TMNs generating many novelties that confirm this study's theory, relational variables and age seem to correlate with the novelty ranking of TMNs, but the analysis of organisational variable scores is inconclusive. To further investigate the significance of the independent variables under study, we need to look at TMNs with average ranks in the novelty ranking.

5.4.1.3 Energy Cities and Metropolis, two TMNs that generate some novelties and confirm H1

Energy Cities and Metropolis appear to be average TMNs in terms of novelty, ranking seventh and eighth in that matter. Between the time of their launch and 2018, both TMNs generated four novel instruments.⁹² As underlined in Table 5.9, their relational variables scores correlate roughly with their novelty rank. Their centrality scores seem to follow the tendency of the other theory confirming TMNs. Energy Cities's structural diversity score is slightly low, which is related to the fact that it shares many of its members and partners with other European TMNs. Energy Cities seems to give importance to interactions. One of its goals is defending cities' interests in front of EU institutions through lobbying (Kern and Bulkeley, 2009). Interviews generally show that collaboration enhances the capacity of TMNs to engage in climate-related issues and lobby (Interviews 4 and 10). The lobbying activity of Energy Cities is actually quite strong, compared to other TMNs such as ICLEI and Climate Alliance (Kern and Bulkeley, 2009). Lobbying for cities in EU institutions does not imply generating governance tools, understood as steering techniques directed at members. Although Energy Cities did generate a great number of governance tools overall (albeit not that many novelties), it might have used interactions to lobby more than to create novel practices.

⁹² However, Metropolis has a slightly lower number of novelty points for all its tools, which makes it rank lower than Energy Cities in terms of novelty.

TMN	Relational variables			Attribute variables		Novelty ranking
	Degree in the whole network	Struct. divers.	Subst. divers.	Age	Org. resources	
EnCit	0.016	0.005	0.7	28	0.15	7
Metrop.	0.015	0.008	0.785	33	0.06	8

Table 5.9 The independent and dependent variable scores of Energy Cities and Metropolis

Metropolis’s substantial diversity score is rather high, meaning it has contacts of varying natures and that work on wide-ranging issues. In her Metropolis case study, Bouteligier (2013a) underlines that the TMN has always given access to and exchange of information as a priority; as part of this effort, Metropolis has sought to create partnerships. This research’s social network analysis seems to lead to similar findings. Metropolis is among the fifth TMNs that have most partners per member, which indicates that this TMN values partnerships.

Regarding the importance of attribute variables, and more specifically age, Energy Cities is one of the oldest TMNs of the system. It was indeed launched in 1990, during the municipal voluntarism period. Some scholars consider it to be one of the first three European TMNs engaged in climate action (Kern and Bulkeley, 2009). Age visibly had an impact on Energy Cities’s novelty rank. In the novelty-per-year ranking, Energy Cities indeed ranks 10th instead of seventh in the conventional ranking. The TMN had more time to generate tools than many other TMNs but did not generate that many overall. Age might compensate for Energy Cities’s slightly low diversity scores.

Similarly, age seems to have affected Metropolis’s capacity to generate novel instruments. Being the oldest TMN, Metropolis had more time to generate novelties than any other TMN. Being the first one launched, any instrument it generated in 1985 would be a novelty. In the novelty-per-year ranking, which eliminates the age bias, Metropolis only ranks 12th. Therefore, an important reason explaining why Metropolis has an average capacity to generate novelties is that it has had more time to do so. As a matter of fact, out of the four novelties Metropolis generated between 1985 and 2018, three emerged between 1985 and 1990, at a time when only five TMNs had been launched.

Considering its age and its relational variable scores, it seems that Metropolis could have generated more novelties than it actually has. Energy Cities and Metropolis have the same number of novel instruments, and close scores of novelty points. Yet, Metropolis is five years older, which should have given the TMN time to generate more novel instruments. Three elements might help explain why it has not done so, i.e. Metropolis's low-key governance approach, its wide thematic scope, and the relative impact of age.

First, Bouteligier's case study of Metropolis shows that this TMN seems to have overall few governance practices, leaving its members much room to act on their own: 'apart from pointing out the usefulness of working through partnerships, recognizing the cross-sectoral aspect of sustainability, and working through the given institutional setup, there is few aspects in Metropolis's program that direct the cities to act in a particular way' (2013a: 101). It seems that Metropolis, as other TMNs have done, has valued interactions for visibility and greater impact rather than for gaining new perspectives and generating novel governance practices. Likewise, this research's analysis of governance tools shows that Metropolis generated only 33 governance tools in total (including its four novelties). By comparison, Energy Cities, launched five years later, generated 47. As underlined above, it seems that Metropolis spent more time creating partnerships than generating tools to steer its members more directly.

Second and in relation to earlier remarks on the evolution of TMNs, the analysis of governance tools reveals that Metropolis probably did not see climate action as a priority when it was launched. In 1985, the global climate change awareness was very low. The Toronto Conference on the Changing Atmosphere and the creation of the IPCC only date back to 1988, and the UNFCCC to 1992. Climate action came to be a priority of Metropolis over the years, when climate change became a more pressing issue at the global level. This is visible in the listed tools generated by Metropolis. Indeed, only in 1999 did the TMN generate a tool specifically related to climate change. The three tools it generated before that are in line with climate action, but they remain rather general, and could be used in other issue-areas. Energy Cities, on the contrary, was considered to be a climate-related TMN early on (Kern and Bulkeley, 2009).

Third, as illustrated in Figure 5.10 (Section 5.2.1), TMNs tend to generate most of their novelties between years 0 and 18. Metropolis and Energy Cities, at the end of the governance tools survey, were both above 18. Thus, their five-year organisational age difference is unlikely to have affected to a large extent their difference in terms of capacity to generate novel instruments.

Regarding organisational resources, Metropolis appears to be a TMN that dedicates an average number of staff to its city members. Its organisational resources score indeed correlates with its novelty rank. So does Energy Cities'. Being among the first TMNs to make of climate action and collaboration a priority probably helped them generate novelties. Yet, it seems that these TMNs used their interactions with other actors for purposes that were not directly linked to the emergence of novel governance instruments.

Overall, Energy Cities and Metropolis's distinct scores explain why they have a position in the system and resources that make them average TMNs in terms of their capacity to generate novelties.

To conclude this subsection, the social network analysis presented in Section 5.1 highlighted a correlation between centrality and the emergence of novelty, and pointed to several cases (with varying dependent variable scores) indicating a positive relationship between diversity and the rise of novelty. The positive relationship between centrality and diversity on one side, and the emergence of novelty on the other side, seems to exist whether the TMNs considered are high in the novelty ranking or not. The qualitative data confirms the existence of this relationship. Interactions do not directly lead to the emergence of novelty, however. The qualitative data presented above started to highlight the process between interactions and the emergence of novelty. Competition regarding funding might encourage more collaboration, which in turn leads to access to diverse resources and new ideas or perspectives on how to steer cities. Age appears to complement the effect of relational variables on the emergence of novelty. Being older helps get more connections and resources and more time to generate novelties. The role of organisational resources in the emergence of novelty remains unclear. It seems that having resources helps get more resources. Yet, in accordance with the argument of Section 5.2.2, access to resources seems to help do more in the hope of having a greater impact than help do differently or have a novel approach.

Sometimes, however, the positive relationship between centrality and diversity of contacts and the emergence of novelty does not appear in the social network analysis. As the following subsection reveals, qualitative data in those cases helps highlight the causal relationship and start specifying the process between interactions and novelty.

5.4.2 Qualitative data specifying the theory

This subsection focuses on cases whose relational variable scores do not clearly correlate with their novelty rank. The qualitative data helps explain these results, and specify this study's theory.

5.4.2.1 Climate Alliance and Alliance in the Alps: two TMNs that generate many novelties but have low substantial diversity scores

Climate Alliance and Alliance in the Alps rank respectively fourth and sixth in the novelty ranking. Another similarity between the two TMNs lies in their high number of novelties per tool (see Table 5.3) and related low early adoption point scores (see Chapter 4, Table 4.2). Both TMNs seem to have a high capacity to generate novelties but a low capacity to quickly adopt the novelties of others. They also have low substantial diversity scores. Qualitative data is necessary to make sense of these results.

Climate Alliance is one of the oldest TMNs; it also has high centrality and structural diversity scores (see Table 5.10). As mentioned above, its substantial diversity score is quite low, however. Data analysis highlights that Climate Alliance has many members that it does not share with other TMNs, but very few partners overall. Interviews reveal that Climate Alliance might not have enough visibility, which would result in a greater difficulty to attract partners. It appears that Climate Alliance has had trouble showcasing its results and thus gaining visibility: 'If you are not visible, you cannot discuss, you cannot bring your arguments to the table, and that's important. It's important to, like, not just work with cities, but also in international or global fora.' (Interview 8). This might have affected its attractiveness to potential partners, thus translating into a low substantial diversity score. It is possible that the low substantial diversity score of Climate Alliance be partly related to the TMN's lack of communication regarding its partners. Indeed, little information on the TMN's partners could be found on its website and Twitter profile, in comparison with the data collected for other cases.

TMN	Relational variables			Attribute variables		Novelty ranking
	Degree in the whole network	Struct. divers.	Subst. divers.	Age	Org. resources	
ClimA	0.136	0.128	0.5	28	0.02	4
AllAlps	0.021	0.016	0.4	21	0.02	6

Table 5.10 The independent and dependent variable scores of Climate Alliance and Alliance in the Alps

Interviews, which provided more information on Climate Alliance’s interactions, undermine this idea, however. They highlight that collaboration is crucial: for one of its staff members, ‘collaboration is not a choice, it is a need’ (Interview 11). Interviews further reveal Climate Alliance’s focus on cities and city networks as partners and underline that Climate Alliance members have a high influence on the TMN (Interviews 7, 8, and 11). The TMN seems to avoid certain types of partners, such as companies, whose goals might be too different (Interview 11). Climate Alliance staff members consider that, while worth the effort, it is hard to coordinate interests of diverse actors in the collaboration process (Interviews 7 and 8). This might explain Climate Alliance’s low substantial diversity score. The capacity of Climate Alliance to generate novelties thus seems to be based partly on its influential member cities, which make it both central and diverse (since this TMN does not share many of them with other TMNs). Climate Alliance uses the great amount of diverse information it receives from them to generate novel instruments. Its overall limited contacts with partners might prevent it from quickly adopting the novelties of others, although no evidence from the qualitative data could confirm this idea.

Interviews also stress the fact that Climate Alliance, unlike other TMNs, has been keen on providing its members technical governance tools, focusing on norm-setting, capacity-building and the empowerment of cities (Interviews 7, 8, and 9). Its pragmatic focus (Interview 8) and its dedication to the collaboration of cities (Interview 7) might help account for its capacity to generate novelties.

Regarding Climate Alliance's attribute variable scores, its novelty per year rank is average, which means that its conventional novelty rank is age biased. Climate Alliance ranks high in terms of novelty partly because it had more time to generate novelties than many other TMNs

in the system. The years of emergence of its novelties (i.e. 1990, 2006, 2008, 2015, 2018) are quite scattered. This suggests that time helped Climate Alliance generate more novel instruments. Interviews confirm that its existence at the very beginning of the construction of the global climate governance system benefited the TMN (Interviews 7 and 11). Besides being one of the oldest TMNs of the system, Climate Alliance is the oldest TMN working directly and explicitly on climate change (see also Kern and Bulkeley, 2009). When it was launched, Climate Alliance set some novel and rather radical goals:

‘at that time there had not been the conference of Toronto, there was no United Nations, IPCC, none of all of that, the German government had instituted a commission or head commission that was looking into climate change, and we thought, given the fact that cities are the place where most measure emissions originate, if we get together as cities, we cut our emissions in half by 2010, then the problem should be solved, which today may sound a little naive but again I like to remind you that this was in 1990.’ (Interview 7)

The 1990 Climate Alliance Manifesto, to which all the cities participating in the TMN must agree, and which mentions the targets set by the TMN and its members, is indeed one of the five oldest novelties identified in this study, and one of the three oldest novelties to be constraining to TMN members.

Climate Alliance’s governance style and behaviour are in line with Bulkeley’s argument on municipal voluntarism (see Chapter 4). It seems to focus more on mitigation (as underlined by its above target) and less on adaptation and other urban concerns, and to concentrate on cities rather than on other actors. Older TMNs do not have a lower capacity to generate novelties; their governance style is distinct, however. Thus, Climate Alliance seems be less competitive and strategic (as suggested by its lack of visibility) than new-generation TMNs and more driven by the global climate action cause. A Climate Alliance staff member thus claims that ‘each success of any of these networks is a success for all of us because it increases the legitimacy of local climate policy’. Likewise, a representative of a Climate Alliance city member belonging to four of the 15 studied TMNs, describes Climate Alliance as a friendly TMN: ‘Climate Alliance, it has a smaller, cozy atmosphere. Single events, single campaigns, we discuss together. They are working more with people, more campaigns, tools, for mobility, not so much policy. And they are really supporting the suburbs and developing

the country, with actions. It's an easier way to get together, not so much politics, more technical things.' (Interview 9)

To conclude on this TMN, it seems that Climate Alliance's age and high structural diversity score, which is the result of its focus on city members rather than partners, counterbalance its low substantial diversity score.

Although less qualitative data was collected regarding Alliance in the Alps, it seems to follow the same dynamics (albeit to a lesser degree). Alliance in the Alps, a TMN launched in 1997 that has few organisational resources, appears to have a rather high capacity to generate novelties. The governance tools analysis shows that four out of the five novelties generated by the TMN involve funding, a rare governance function among TMN governance tools. Because it has very few identified partners, Alliance in the Alps has a low substantial diversity score. Alliance in the Alps is the last TMN of the municipal voluntarism period. It had more time to generate novelties than half the TMNs of the system. Figure 5.10 (Section 5.2.1) suggests that it might not generate many more novelties in the future, being above 18 years old. Yet, age is not the only variable explaining its rather high novelty rank. Indeed, its novelty-per-year rank is just one point below its conventional novelty rank, meaning that time must not have played a big part in the emergence of novelties in this TMN. Except for substantial diversity, its relational variable scores are quite high. As in the case of Climate Alliance, it is possible that its high structural diversity score counterbalanced its low substantial diversity score and enabled it to have a rather high capacity to generate novelties.

5.4.2.2 Covenant of Mayors, a TMN with an average capacity to generate novelties but high relational variable scores

Another relevant case that the preceding study of relational variables did not explain is that of the Covenant of Mayors (see Table 5.11). The Covenant of Mayors stands out in most of the social network analysis. It is the TMN with the greatest centrality in the TMNs system, with more than 8,800 members and 350 partners. It also has quite a high diversity among its contacts. It is the TMN with most contacts to which no other TMN is connected (i.e. structural diversity). Its substantial diversity score is relatively slightly lower than its other scores, but remains in the top third. Interviews also highlight that interactions with other actors are fundamental to the Covenant of Mayors: 'this whole cooperation of different actors with the cities is key of the Covenant of Mayors' governance, and it's key also to enable cities to go

further in doing climate action and energy transition’ (Interview 1). Some scholars consider the Covenant of Mayors to be ‘an institutional innovation’ (Kemmerzell, in Hughes et al., 2018: 54-55) or an innovative climate governance architecture (Domorenok, 2019). In contrast with other TMNs, the Covenant of Mayors, created by the European Commission, has its members make stronger commitments in terms of climate action and is more capable of aggregating the interests of its members towards the European level (Kemmerzell, in Hughes et al., 2018).

TMN	Relational variables			Attribute variables		Novelty ranking
	Degree in the whole network	Struct. divers.	Subst. divers.	Age	Org. resources	
CoM	0.718	0.722	0.815	10	0.003	9

Table 5.11 The independent and dependent variable scores of the Covenant of Mayors

Yet, the ninth novelty rank of the Covenant of Mayors is average. This goes against H1, which maintains that TMNs with high centrality and diversity scores are more likely to generate many novel governance instruments.

Attribute variables, and more specifically age, help better understand the poor scores of the Covenant of Mayors in terms of relational variables. Indeed, the Covenant of Mayors, launched in 2008, is one of the most recent TMNs. It only had 10 years to generate novelties in the period under study. In those 10 years, the Covenant of Mayors generated four novelties, which is as many novelties as Metropolis in 33 years. The reason why it ranks lower than Metropolis is that it does not have as many early adoption points, meaning that it has not adopted as many novelties of other TMNs as Metropolis, or not as quickly. Age may be of importance here. The novelty per year ranking shows that, when eliminating the age bias, the Covenant of Mayors ranks third, just below ICLEI and C40. Had it had more time in the system, the Covenant of Mayors might have generated more novelties and adopted more novelties of other TMNs. A TMN with low relational variable ranks might appear to have a greater capacity to generate novelties than a TMN with high relational variable ranks because it is older.

Another variable to consider in explaining the novelty rank of the Covenant of Mayors is the amount of organisational resources it has. Indeed, the Covenant of Mayors ranks last (among the TMNs whose data on organisational resources was available) in that category, as it only dedicates 0.003 staff member per city. As in the case of GCCP, the fact that the Covenant of Mayors has a prominent IGO as its founder (i.e. the EU) did not give it more organisational resources than other TMNs.⁹³ This might help explain why it has a rather low novelty rank. The analysis of the impact of organisational resources on novelty emergence has so far been inconclusive, however. Likewise, the qualitative analysis of the Covenant of Mayors suggests that the significance of the organisational resources score of this TMN might be low. For a Covenant of Mayors staff member, the Covenant of Mayors has a loose relationship with its cities, which distinguishes it from other city networks (Interview 1). Other interviews underline the strong relationship of TMNs such as C40 and 100RC with their members (Interviews 6 and 9). The documentary observation further indicates that the Covenant of Mayors works a lot with its members through its coordinators, i.e. numerous European public actors that support the TMN's members strategically and financially. This seems not to be the case with other TMNs, which lack such a support. Thus, it might be that the local support of the Covenant of Mayors coordinators to member cities gives the Covenant of Mayors staff resources to focus on elaborating governance instruments for cities. In other words, the strength of some of the links of the Covenant of Mayors might enable the TMN to concentrate its relatively small resources on the creation of governance instruments. Organisational resources might not matter very much.

Another element to consider in the study of the Covenant of Mayors is the fact that some interviewees actually consider that it is not a network, but an initiative (Interviews 1, 7, 8, 11).⁹⁴ This might explain why it has a looser relationship to its members, and why it has not, overall, generated many governance tools. The Covenant of Mayors was created by the European Commission. Talking about the global version of the Covenant of Mayors (which copied the European Covenant of Mayors's model), an interviewee described the climate action floor above which all cities should aim to be (Interview 12). For a city staff member

⁹³ The weight of the EU might nonetheless have played a part in the TMN having so many contacts, unlike GCCP and Energy Cities.

⁹⁴ Several scholarly works nonetheless see it as a TMN (e.g. Kern, 2019; van der Heijden et al., 2019; Lee, 2018).

whose city belongs to four of the 15 studied TMNs, ‘The Covenant of Mayors does nothing for you. It only wants to show your data’ (Interview 9). Since the Covenant of Mayors fulfills the criteria set when defining the TMNs complex system, this study sees it as a network. Nonetheless, the interviews still lead us to picture the Covenant of Mayors as a special type of network, which might not interact with its city members as much as most TMNs.

The qualitative data collected regarding the Covenant of Mayors shows that the still recent TMN has the potential to generate more novelties in the future. For now, it seems that its recent character overrides its high relational variable scores. Yet, the weight of these interactions and the comments regarding the novelty that the TMN in itself represents suggest that it may keep generating novelties at a fast rate. Although it is becoming harder to generate novelties, the potential of the Covenant of Mayors and the changing context which might give nonstate and substate actors more agency in global climate governance, make it likely that it will. The Covenant of Mayors is thus unmistakably a TMN worth investigating in the coming years. Overall, the example of the Covenant of Mayors informs this research’s theory by showing that centrality and diversity are significant, but not sufficient conditions for the rise of novelty. Combined with age, however, they appear to form sufficient enabling conditions for the emergence of novel governance instruments.

To conclude this subsection, the cases of Climate Alliance, Alliance in the Alps, and the Covenant of Mayors help specify this study’s theory. They indeed show that H1 and H2 are not completely valid and need to be adjusted. Centrality, diversity, and age do matter, but not how this study expected them to. It seems that it is the combination of centrality, diversity, and age that leads to the emergence of novelty. Regarding diversity, it seems that high structural diversity might counterbalance low substantial diversity, meaning that the emergence of novelty does not require both variables to be present. The analysis of the significance of organisational resources in the emergence of novelty remains inconclusive.

The ten cases examined so far have helped specify this study’s theory. The other TMN cases are harder to interpret, however. The next subsection presents them and highlights their challenging results in view of the theory presented.

5.4.3 Some unexplained results

Some results seem to contradict this study’s theory, although no other explanation could be found to account for their novelty rank. Others neither confirm nor invalidate the theory, and are thus hard to explain.

5.4.3.1 Some visibly deviating cases

Table 5.12 presents several deviating cases, that seem to contradict this study’s theory.

TMN	Relational variables			Attribute variables		Novelty ranking
	Degree in the whole network	Struct. divers.	Subst. divers.	Age	Org. resources	
EuCit	0.02	0.007	0.915	32	0.39	13
Polis	0.009	0.004	0.665	29	0.22	15
UBC	0.008	0.004	0.535	27	NA	5

Table 5.12 The independent and dependent variable scores of Eurocities, Polis, and UBC

Eurocities and Polis are puzzling. Indeed, they both have relational variable measurements that suggest they should have high novelty ranks, yet they rank poorly in that area. Eurocities and Polis were both launched at the beginning of the TMNs system. Their novelty per year ranks are in line with their novelty ranks. None of them generated novel instruments.⁹⁵ One reason that might explain Polis's low novelty rank is the lack of information available regarding its instruments at the time of data collection.⁹⁶ As mentioned in Chapter 3, a limitation of the data collection was that the documentary analysis was based on what was available on the TMNs’ websites. Thus, if some TMNs displayed few information on their work and practices with cities on their website, only some of their instruments would be considered in the analysis and they would incorrectly get ranked low. Some measures were taken to mitigate this risk, such as the observation of those TMNs’ social networks in the data collection and interviews. Yet, no interview with Polis staff could be conducted, which might have affected Polis’s novelty rank. Another reason explaining the low novelty ranks

⁹⁵ Their novelty rank is thus only based on the early adoption points they received for adopting the novel instruments of other TMNs.

⁹⁶ The lack of information regarding Eurocities was less substantial.

of Eurocities and Polis is their thematic scope. Eurocities works on urban issues. Its initial meeting dealt with economic recovery (Payre, 2010). Polis focuses on transportation, a question that it might be easier to relate to climate change. The two TMNs are obviously not the only ones to work indirectly on climate change (e.g. Metropolis, Energy Cities, or CIVITAS). Nevertheless, the documentary observation reveals climate change may not be as crucial a priority for Eurocities and Polis as it is for other TMNs. Since this study only looks at governance instruments that directly or indirectly deal with climate action, it ignored many of the other governance tools of the two TMNs. Eurocities and Polis might have generated more novelties than highlighted here, but those do not appear because they do not deal with climate action.

Furthermore, regarding Eurocities, it is possible that, as in the case of Energy Cities, interactions were used as a way to make lobbying more effective than as a way to develop new perspectives which might lead to novel governance instruments. Both interviews and the literature survey point to the will of Eurocities to defend the interests of cities in front of EU institutions (Interviews 9 and 10; also Payre, 2010). Besides, Eurocities only generated 34 tools overall. In comparison with other TMNs (see Table 5.10, Section 5.2.2), this score is low and suggests that Eurocities has overall not sought to design techniques to steer its members.

To a lesser degree, UBC also seems to deviate from this study's theory. It has indeed relational variable scores that point to a low novelty rank. Yet, it actually ranks in the top third of the novelty ranking. Its novelty-per-year rank indicates an age bias. Indeed, because it was launched in 1991, it had more time to generate novelties. It nonetheless created fewer novelties per year than other TMNs. UBC created its four novelties respectively in 1998, 2000, 2002, and 2011. It thus seems that it generated most of its novelties when it was still rather recent, and then almost stopped generating more. The unavailability of data regarding its organisational resources makes it impossible to consider this attribute in the analysis of UBC's innovativeness. Overall, the age bias helps explain why its novelty rank is high despite its low relational variable scores. Yet, as mentioned earlier, age itself cannot account for the rise of novelty. Other unknown elements must help explain why it has generated a rather high number of novelties.

5.4.3.2 A few cases requiring further investigation

For two TMNs, i.e. 100RC and C40, the results of the social network analysis are rather scattered and thus hard to interpret (see Table 5.13).

TMN	Relational variables			Attribute variables		Novelty ranking
	Degree in the whole network	Struct. divers.	Subst. divers.	Age	Org. resources	
100RC	0.016	0.01	0.8	5	1.01	10
C40	0.011	0.002	0.75	13	1.58	2

Table 5.13 The independent and dependent variable scores of 100RC and C40

100RC, created in the strategic urbanism period by the Rockefeller Foundation, ranks 10th in the novelty ranking, but has diversity and centrality scores that suggest a higher novelty rank, according to this study's theory. Its high novelty per year rank makes this case even more intriguing. 100RC would probably have appeared higher in the novelty ranking had it been launched earlier. Its high relational variable scores also suggest that, even without considering age, the novelty rank of 100RC should be higher.

C40's scores are also difficult to understand in the light of this study's theory. Indeed, as mentioned on several occasions, C40 ranks second in the novelty ranking. Even in the novelty-per-year ranking, C40 ranks second, which seems coherent, since C40 is a new-generation TMN launched in 2005. Nevertheless, its relational variable scores are quite low. C40 indeed has centrality and diversity scores linked to its small number of members and partners.

We should note that 100RC scores slightly higher than C40 in each relational variable. Yet, its novelty rank is much lower. C40 surely had more time than 100RC to generate novel instruments. Their distinct ranks in the novelty-per-year ranking highlight the fact that C40 is slightly more productive than is 100RC. This means that time does not really explain why C40 has a higher capacity to generate novelties than 100RC. C40 also has more organisational resources, a variable whose significance has been dismissed above. Yet, both

TMNs have organisational resources scores that are a lot higher than all the other TMNs. The presence of large private philanthropies among their funders might explain why.

Overall, the commonalities and differences between C40 and 100RC beg for further investigation. A crucial question that remains after the social network analysis and cross-case analysis is: why does C40 generate many more novelties than 100RC although their relational variable scores actually suggest it should generate fewer? Chapter 6 looks at these two TMNs to better understand the process at play here. While enabling us to understand the differences between the two TMNs in terms of novelty emergence, this comparative case study will more importantly help us look deeper into the relationship between interactions and the emergence of novelty and uncover the role of social learning.

5.5 Concluding remarks

This chapter has sought to test the causal relationship propositions made in H1 and H2 and start providing an explanation for the emergence of novel TMN governance instruments. It has especially emphasised the relevance of considering relational variables in the study of the factors influencing the emergence of novelty. The social network analysis was conducted on 15 cases, thus preventing us from drawing strong causal inferences on the hypothesised relationship between centrality and diversity on the one hand, and the emergence of novelty on the other hand. The social network analysis nonetheless helped highlight noteworthy correlations between centrality and novelty emergence (and, to a lesser extent, between age and novelty emergence). It also pointed to several cases that suggest the existence of a positive relationship between diversity and the emergence of novelty. In these cases, it seems that the more central the TMN and the more diverse contacts, the more novelties; conversely, the less central the TMN and the less diverse contacts, the less novelties.

The qualitative data collected through documentary observation including a survey of the literature, and interviews, tested H2 and specified the causal relationship between interactions and the emergence of novelty and started revealing the causal process between the two. Looking at the 15 cases, we saw that centrality and diversity alone do not lead to novelty. The analysis also stressed that the benefits of having many diverse contacts include access to knowledge and skills TMNs alone do not have. Furthermore, it started clarifying the process linking both variables. Interacting is part of the mission of TMNs and their nature

of facilitators. Because TMNs have different goals, there might be conflict among their interests, which leads to either competition or collaboration. Collaboration requires intense efforts. Those who manage to agree might get new perspectives, which facilitate experiments, and novelty. Because TMNs are more and more numerous, interactions are inevitable, in the form of overlaps, competition, or collaboration. Through collaboration, TMNs also seek funding. Funding constrains TMNs to collaborate and get the most out of the money received. Funding itself thus does not lead to novelty. However, it might lead to collaboration, which leads to novel governance instruments through the opening of diverse perspectives and experiments. Collaboration also leads to more resources, which help do more, generate tools, and possibly novel instruments. The role of social learning remains unclear so far.

The cross-case analysis also showed that the causal relationship between interactions and the emergence of novelty is not always clear-cut. Some cases seem to contradict this relationship, forcing us to question the validity of H1. The case of the Covenant of Mayors shows that centrality and diversity together are not sufficient for the rise of novelty. Age visibly matters. Indeed, it seems that the younger the TMN, the harder it is for it to generate novelties. Organisational resources, which seem insignificant in most cases, might matter in the C40 case. The qualitative analysis did not lead to the confirming of H2. Besides, the C40 case revealed that centrality and diversity are not necessary for the emergence of novelty. The cross-case analysis informed us that centrality, diversity, and age might actually form insufficient but non-redundant components of causal conditions that are unnecessary but sufficient for the outcome (also known as INUS conditions; see Mahoney and Barrenechea, 2019; Mackie, 1974). Several cases (i.e. ICLEI, CIVITAS, Energy Cities, GCCP, MUFPP, and CNCA) indeed show a correspondence between centrality, diversity, and age on the one hand, and the emergence of novelty on the other hand. In other words, together, centrality, diversity, and age are sufficient for the emergence of novel governance instruments, albeit not necessary. Another combination of INUS conditions for the emergence of novelty might lie in organisational resources and the presence of one or several governance entrepreneurs, as Chapter 6 will highlight.

To be sure, neither H1 nor H2 were confirmed by the social network analysis and cross-case analysis. Yet, these two hypotheses are not completely invalid. Rather than the combination

of centrality and diversity or that of age and organisational resources, it appears that it is the combination of centrality, diversity, and age which leads to the emergence of novel governance instruments.

The empirical analysis has shown the relevance of a framework based on network theory, complexity approaches and organisational theories. It has highlighted the significance of relational variables, and the relevance of envisioning TMNs as both structures and actors, as posited in the theoretical framework, as well as that one of the attribute variables analysed. The significance of these distinct variables must be considered within a specific context, as prescribed by complexity approaches. Climate-related TMNs today are more numerous than they were at the beginning of the 1990s. Thus, actors of the TMNs system might be more constrained by their interactions than at the time of emergence of global climate governance. In other words, relational variables might be more significant nowadays.

The next chapter seeks to make better sense of how the identified variables may act to generate social learning processes and novel instruments (thus testing H3). Because the nature of H3 is different (i.e. it seeks to uncover a causal process rather than a causal relationship), the next chapter uses a different method, conducting a comparative case study of C40 and 100RC, two similar TMNs that yet have distinct relational variable and dependent variable scores.

Chapter 6 Interacting to survive

Following Chapter 5's testing of the first two hypotheses of this research, this chapter focuses on testing this study's third hypothesis (i.e. *H3: Social learning follows interactions, and precedes the emergence or adoption of novel governance instruments, and the evolution of TMNs*). Social network analysis and cross-case analysis enabled us to test H1 and H2, which looked at causal relationships. Because H3 seeks to confirm a causal process (presented as a chain of causal relationships), a qualitative analysis using the comparative case study method is more appropriate. Indeed, it enables us to conduct a finer qualitative analysis by focusing on two cases only. Besides, as Sartori explains, 'to compare is to control' (1970: 1035); a comparative case study allows us to isolate certain factors at play in a causal process and thus better analyse their significance. It is thus particularly helpful to test H3. This type of analysis implies a deeper qualitative study. It differs from the social network analysis and cross-case analysis which look more alike because both consider 15 TMNs. Thus, it appears relevant to present the results of the comparative case study in a different chapter.

To further investigate the process through which novel governance instruments emerge in TMNs, the present chapter looks at two cases left unexplained in Chapter 5, i.e. C40 and 100RC. It appears that 100RC has few contacts and not very diverse ones, is rather young, and does not generate many novelties. Its relational variable scores are generally slightly higher than those of C40. Yet, C40 ranks a lot higher than 100RC in the novelty ranking. Looking more closely at this process might help us better account for the role of relational and attribute variables in the emergence of novelty. Chapter 5 presented the first elements of this process, looking transversally at the 15 cases. Chapter 6's comparative method aims to add depth to the analysis and explain incoherencies, looking more closely at two cases that should behave in the same way, yet do not.

The findings presented in this chapter are mostly based on a documentary observation comprising of documents produced by the two TMNs and published on their websites and a survey of the academic literature on the two TMNs. The section on governance entrepreneurs uses information collected in the various publications Michael Bloomberg authored or co-authored as well as publications authored by others on him. Data used for this chapter also include the analysis of 10 interviews with 100RC and C40 staff members and representatives

of their members and partners, informal talks, and observations at the 2017 and 2018 Conferences of the Parties to the UNFCCC. It is important to note that interviewees are generally more aware of agents and less aware of the role of structural variables. Because this study uses mainly a structural approach, the role of the interviews was to supplement the information gathered in the documentary observation. Using diverse sources of information helped mitigate the risk of attributing too much importance to agency. We should note that the interviews included questions on interactions, understood as structural processes, to which many respondents provided valuable answers. This also mitigated the risk of a focus on agentic variables. Finally, the generalisations to the other TMNs of the system under study use the data already exploited in Chapter 5 (and presented in Chapter 3).

The next section presents the two cases of the comparative study drawing from the method of difference. It highlights their similarities and differences, and describes their interactions. Doing so, it confirms the presence of social learning processes. The second section then shows that, in both cases, interactions appear to be necessary to the survival of TMNs. More specifically, it highlights that interactions bring resources, among which knowledge and funding. These resources are crucial to the survival of TMNs. They are strongly linked to their funders, which might impact the functioning of TMNs. Interactions also bring information, which enables social learning. This appears to be necessary to TMNs' generating novel instruments or adopting the novel instruments of others, and their evolution. It might also facilitate the adaptation of the system. The third section then identifies a crucial difference between the two TMNs, i.e. the presence of a governance entrepreneur in the C40 case. Considering the presence of a governance entrepreneur might help account for some deviant cases regarding the distinct trends observed in Chapter 5. The last section synthesises the findings of the chapter. It also shows that the presence of governance entrepreneurs in a TMN does not contradict the relational argument on which this study is based. At the individual or at the network level, it seems that interactions can facilitate the emergence of novelty.

6.1 C40 and 100RC: differences, similarities, and synergies

Studying C40 and 100RC together is relevant for several reasons. The two have several commonalities and differences that make a comparative study valuable. Comparing implies

identifying a common ground on which to analyse the differences of the cases under study, especially in a design drawing from the method of difference. In the words of Sartori, ‘we obtain comparability when two items appear “similar enough”, that is neither identical nor utterly different’ (1970: 1035). Besides, the two TMNs have had various types of interactions since their launch. Examining these interactions might help reveal processes of social learning to which we alluded earlier in this research. After presenting the differences on which the comparative study builds, the following subsections analyse these similarities, and interactions to start underlining variables that might explain the different processes at play inside the two TMNs. Identifying similarities and differences between the two TMNs might enable us to isolate factors that play a role in the emergence of novel governance instruments. This is the main reason for resorting to a comparative approach.

6.1.1 The main differences between the two TMNs

C40 and 100RC have several differences which are mostly related to variables studied earlier (i.e. their founders and the themes on which they focus, see Chapter 4). Their most important difference lies in their outcomes.

6.1.1.1 In their creation

C40 was launched by cities, or, more accurately, city mayors. Its first meeting, officially called the World Cities Leadership and Climate Summit, was indeed convened by ex-London mayor Ken Livingstone in October 2005 as a two-day gathering of mayors of 18 large cities.⁹⁷ This founding network came to be known as the C20. As it grew, it officially became the C40, although its membership quickly exceeded 40 cities. Although the TMN works with a variety of non-city actors, cities keep playing an important role today. C40 indeed has a steering committee made of city members. It also has an elected city mayor chair. According to an interviewee:

‘a lot of these organizations say that they are city-led. C40 started that concept. C40 basically put a governance structure in, so that the organisation was managed and governed by cities. So, it wasn't a bunch of people like me running an organisation, deciding what was best for cities. We structured it so that the cities

⁹⁷ The 18 cities that were represented at the meeting are: Barcelona, Beijing, Berlin, Brussels, Chicago, London, Madrid, Mexico City, New Delhi, New York, Paris, Philadelphia, Rome, San Francisco, São Paulo, Shanghai, Stockholm, Toronto, and Zurich (Lin, 2018).

sat on a strategic board that we had to annually get their approval on, so we came up with a strategy, but they had to approve it. (Interview 12)

In contrast, 100RC was ‘pioneered by the Rockefeller Foundation’ (as indicated in its original denomination) on the 100th anniversary of the philanthropic foundation. It does not have founding city members, since cities gradually integrated the network, mostly through a competitive selection process (i.e. the 100 Resilient Cities Challenge).

The origins of the two TMNs clearly differ. The agency of cities is prominent in the foundation of the C40.⁹⁸ This TMN was first known as C20 in comparison to the G20 and the G8, organised three months earlier in Gleneagles. At the time of its creation, C40 was not linked to philanthropic organisations. Its founder and first chair, the ex-mayor of London Ken Livingstone, had an important leadership role in the network, and gave the C40 visibility outside of it. So did following chairs (ex-mayors of Toronto, New York, and Rio de Janeiro, current mayor of Paris and now current mayor of Los Angeles). On the contrary, 100RC has always been related to its main funder. Like C40, albeit in a different way, its launch date is symbolic. It is indeed linked to the prominence of its founder and funder, the Rockefeller Foundation. The relationship between 100RC and the Rockefeller Foundation is visibly strong, as underlined in Chapter 4. Yet, formally, all staff members, except for the 100RC President Michael Berkowitz, are employees of 100RC’s, not the Rockefeller Foundation’s. Furthermore, an interviewee clearly states that 100RC and the Rockefeller Foundation are distinct (Interview 5). This is not to say that cities do not hold a fundamental position in the network. Rather, cities did not play an important role in the founding of 100RC, contrary to C40. Overall, while the latter emerged out of the initiative of megacities, the former started as a private foundation project.

6.1.1.2 In their focus and work with cities

Although C40 and 100RC both have climate action as one of their priorities (hence their belonging to the TMNs complex system), they do not have the same thematic focus. Since its beginning, C40 has focused on climate action. Although it started with a stronger mitigation focus, it has increasingly gained interest in adaptation as well (Reckien et al., 2015). Chapter 5 suggested that the specificity of the focus does not seem to affect the

⁹⁸ As argued before, it is yet not completely absent from 100RC’s discourse.

emergence of novelty (see Section 5.3). Yet, different foci might lead to different interests and practices. Several interviewees highlight the question of the thematic focus when discussing novel practices (Interviews 3, 11, 12, and 14). An ex-C40 employee explains that: ‘we found that the more you stay focused and true to your original mandate, the better and better you did, the more value added that they receive downstream and the more well received you are from your constituents, clients, audiences and funders. So, I think those are some of the things that are unique and that set the C40 apart.’ (Interview 12)

Interviews also reveal some differences in the approaches of the two TMNs with their members. For a Mexico City staff member who has worked with both TMNs, C40 has a more general approach to climate change, while 100RC gets to the specifics of issues faced by its cities (Interview 6). The assistance offered to cities is also different. When a member asks for support to organise an activity, 100RC provides contacts of other actors and lets the city coordinate the event, while C40 gets involved in the organisation. For that same interviewee, this might have to do with the fact that C40 has more money (Interview 6). Another reason might be that 100RC dedicates an important amount of money to the hiring of CROs for two to three years, the support of a variety of partners for a limited period, and capacity building activities especially at the beginning of city membership. It seems that it seeks to help cities achieve resilience by offering them resources to act themselves for a limited amount of time, and empowering them to act on their own later on. In contrast, C40 has a larger internal staff, enabling the emergence of more TMN governance tools and member support from within on a longer timeframe.

Another important element to underline is that the two TMNs work with different actors inside cities. Unlike other TMNs (e.g. ICLEI), C40 is above all a network of mayors. Its political nature, also visible in its motto, is hard to contradict. In contrast, 100RC is a network of cities, although informal talks with 100RC partner staff reveal it has several internal networks (also Interview 5). Among those is the network of CROs, to which 100RC dedicates many resources. In 100RC, mayors matter especially at the time of enrollment of cities. Informal talks with city staff representatives stress that cities must demonstrate that their mayor supports the urban resilience process. Failing to do so can compromise their membership. Yet, as soon as they are selected, CROs become a close number two, or a

‘Mayor-1’ (Nielsen, 2019). CROs coordinate their city’s resilience efforts. Their role seems mostly technical. So does 100RC’s, since an important function of the TMN is capacity building (see Chapter 4). As a matter of fact, 100RC claims to be a technical network (Nielsen, 2019). Yet, the issues discussed by 100RC are clearly political, since they affect the way cities are developed and rebuilt to better face shocks and stresses. Furthermore, the TMN and the Rockefeller Foundation clearly have a specific understanding of urban resilience and the solutions that must be implemented in the face of shocks and stresses. Most of the tools used by 100RC have norm-setting as one of their functions. The practices of this TMN are certainly not value neutral. While defining itself what urban resilience is, it also selects the information it passes on to cities, and decides on the norms promoted as best practices and protocols to adopt. Although it is less visible than in the case of C40, 100RC, albeit not a network of mayors, is unmistakably a political network.

Finally, and most importantly, as underlined above, C40 and 100RC differ in their outcomes. As a matter of fact, one of the main reasons for selecting these two TMNs in the comparative case study lies in their distinct novelty ranks. While C40 ranks second, with six novel instruments generated since its launch, 100RC ranks 10th, with two novelties. Besides, while C40 generated 73 governance tools in total (or 5.62 per year), 100RC only generated 19 (3.8 per year). In terms of early adoption points, C40 scores 317 points, whereas 100RC scores 145 points. C40 thus generated more novelties and more tools than 100RC during the period under study. To investigate the reasons explaining this discrepancy, we need to look better at the similarities between the two TMNs. Doing so will help us disqualify possible explanations.

6.1.2 The main similarities between the two TMNs

In order to isolate the factors that might play a role in the process leading to the emergence of novel instruments, it is important to note that C40 and 100RC share several characteristics other than the ones which led to their selection within this study. It is crucial to identify them in order to rule them out of the possible reasons why C40 generates more novel instruments than does 100RC. More specifically, they have similar attributes (i.e. they were created in the same period, have high organisational resources scores, and have private foundation funders) and practices (i.e. they use enforcement mechanisms and are exclusive).

6.1.2.1 In their attributes

Both C40 and 100RC are among the five youngest TMNs of the TMNs complex system. Although C40, launched in 2005, is older than 100RC, created in 2013, both TMNs emerged in the strategic urbanism period. They both have a mainstream vision of climate change, relating it to other issues, such as resilience and economic development.

C40 and 100RC respectively rank second and 10th in the conventional novelty ranking. The age bias of the conventional novelty ranking seems to have impacted 100RC (see Table 5.3, Section 5.2.1). 100RC was only five years old at the end of the governance tools survey. As underlined earlier, TMNs tend to generate most of their novelties before they are 19 (see Figure 5.10, section 5.2.1). Half of the novelties of the TMNs complex system emerged when TMNs were aged 0 to 8. 100RC has relational variable scores in line with TMNs that have a mild capacity to generate novelties (see Table 5.13, Section 5.4.3.2). Consequently, it is possible that, with more time, it might have generated more novel instruments. The age bias of the conventional novelty ranking did not impact C40. After five years of existence, C40 had generated three novelties, that is, a third more than 100RC.

C40 and 100RC also bear similarities regarding their organisational resources. Indeed, they respectively rank first and second, with above one staff person per city member (see Figure 5.11 and Table 5.5, Section 5.2.2). The third TMN in that ranking is Eurocities, with 0.39 staff person per member. C40 and 100RC have about the same number of members (i.e. respectively 97 and 100). They are in the bottom third of TMN membership size (see Figure 4.2, Section 4.1.3). Their very large staff in comparison to other TMNs of the system (except for ICLEI) enables them to closely follow their members, albeit in different ways (Interview 6). It also implies important funding. As described in Chapter 4, the annual budget of C40 is estimated to be about 9.3 million dollars and that of 100RC about 11 million dollars. This makes them two of the five most funded TMNs of the system under study.

Likewise, they have rather strong links to philanthropic foundations. C40 has worked with the Clinton Foundation and Bloomberg Philanthropies for a long time. The Clinton Foundation, through its Clinton Climate Initiative, started to work with C40 as early as 2006 and progressively became its implementing partner (Román, 2010). In 2011, C40 and the Clinton Climate Initiative announced their merger (Barbaro, 2011). That same year,

Bloomberg Philanthropies became one of C40's main funders. The other two, Children's Investment Fund Foundation, and Realdania, are also private foundations. 100RC was launched and funded by the Rockefeller Foundation, which has been active in the urban resilience field even before the launch of this TMN. 100RC's links to this foundation are very strong. Both Bloomberg Philanthropies and the Rockefeller Foundation are both among the 40 largest foundations in the United States. Their assets respectively exceed seven and four billion dollars (Foundation Center, 2014). The literature on TMNs has started to pay attention to the growing significance of important philanthropic organisations, highlighting the cases of C40 and 100RC (Nielsen and Papin, 2020; Davidson et al., 2019; Haupt and Coppola, 2019). We should therefore keep in mind the possible influence of these foundations when analysing the output and outcomes of TMNs.

Another attribute similarity between the two TMNs is their global scope. C40 and 100RC are both global TMNs, with cities belonging to countries of distinct economic levels and from five continents.

6.1.2.2 In their governance practices

C40 and 100RC also show some resemblance in relation to their governance practices. As mentioned above, both are new-generation TMNs, since they were created during the strategic urbanism period. As such, they bear characteristics that TMNs launched at that time have in common (see Chapter 4). The strategic urbanism period witnesses the growing involvement of private actors in TMNs. The presence of philanthropic foundations is one evidence of it. Another one is network procurement from the private sector, another governance practice of C40 and 100RC (Davidson et al., 2019). The strong participation of private actors leads Román to claim that 'Through its own network of corporate actors and different interest groups, the [Clinton Climate Initiative] extends the C40 network beyond the public realm.' (2010: 76). Others underline the 'hybridisation' of the TMN (Acuto, 2013). Similar comments have been made regarding 100RC's practices. Indeed, some argue that 100RC is at the centre of an urban resilience complex which includes intergovernmental organisations, global companies, technology and finance companies, NGOs, etc. (Leitner et al., 2018). C40 and 100RC also share a discourse of city agency against the immobility of other actors. Although it is mostly visible in the case of C40 and its famous 'while nations talk, cities act' motto, 100RC diffuses this idea as well. An illustration of it lies in the

Rockefeller Foundation president Raj Shaw's words during the 100RC 2017 Urban Resilience Summit, stating that 'While others are talking about what can't be done, this is a moment for cities to get things done.' (100RC, 2017a)

New-generation TMNs also tend to give more importance than others to rule-setting and constraint, even though these governance characteristics remain scarcer than information sharing and norm-setting in governance instruments. As exemplified in Chapter 4, C40 and 100RC are not afraid of resorting to obligation mechanisms to make their members act the way they prescribe. C40 seems to promote its enforcement mechanisms, as illustrated in the participation standards cities must follow to remain active members. Describing this tool, an ex-C40 staff member explains that: 'we literally track that and give them a report card every six months. And if they don't keep up, they can fail out and we'll kick them out, invite a new city' (Interview 12). As argued earlier, the same goes for 100RC, although the risk of expulsion is not expressed as explicitly (see Chapter 4, Section 4.2.3.2).

This characteristic leads us to another governance practice that C40 and 100RC have in common, i.e. their exclusivity (Davidson et al., 2019). Indeed, both see their network as a club. In that regard, a C40 staff member explains that: 'we're a club that cities want to be part of, we're called the climate leadership group for good reasons. And if cities are not genuinely acting as leaders, then we say, well, you shouldn't be in our club.' (Interview 13) Following the participation standards is part of the C40 club's membership requirements and proof that they are acting as leaders. Besides, C40 is an 'invitation-only' network: only by being invited by a C40 member and respecting certain criteria (such as size and climate leadership) can a city become a full member. Although the word 'club' does not appear in the 100RC interviews and documents collected for this study, the idea of exclusiveness and member access to club goods is clearly present. The 100RC network was built to include 100 cities only, selected through a challenge (at least in the first stage of the TMN). As mentioned in Chapter 4, it offers these cities specific benefits such as the funding of a Chief Resilience Officer (CRO) position for two to three years, and access to the platform of Partners which includes pro-bono services provided by the partners present on the platform (100RC, 2017b). Furthermore, the main mechanism to become a 100RC city is the 100 Resilient Cities challenge, a membership application process through which cities had to demonstrate they

were the best candidates to be part of the network.⁹⁹ Contrary to many other networks, usually seen as voluntary and inclusive structures (Busch, 2015; Kern and Bulkeley, 2009), C40 and 100RC are exclusive networks, only open to a certain city elite. The exclusivity of the network appears to be a characteristic that other new-generation TMNs share (e.g. CNCA).

6.1.2.3 In their interactions

Finally, another similarity between C40 and 100RC is that they share members and partners. The two TMNs have also interacted directly for collaborative purposes.

C40 and 100RC appear to share a vast number of members. Indeed, as evidenced in Figure 6.1, 40 cities are members of both TMNs. Those are mostly important global ones from both the North and the South, e.g. New York City, London, Singapore, Mexico City, Buenos Aires, or Nairobi. Interviews also describe the interactions of member cities with both TMNs. Interactions tend to show that C40 and 100RC work differently and bring them distinct benefits (Interview 6). Overall, they do not seem to be conflicting. Informal talks with a C40 and 100RC city staff member suggest that city members discuss the work they do with one with the other. The CRO of Mexico City was, for instance, was involved in the organisation of the 2016 C40 Summit in Mexico City and was also invited to participate in the 2017 C40 Dubai Adaptation Conference. Each TMN might thus learn about what the other is doing and the tools it uses through its city members. In other words, there might be social learning processes indirectly, that is, through the relationships with TMN members. This is not always the case: the same informal talks show that sometimes, the two TMNs interact with different municipal departments that do not always talk to each other.

⁹⁹ Another mechanism emerged in 2018, with the inclusion of Houston in the network. This membership relied on the 1.8 million USD support of Shell Oil company. The announcement related to the participation of Houston alludes to the maintaining of a highly selective process. See Houston, 100RC and Shell. (2018) City of Houston Selected to Join 100 Resilient Cities Global Network.

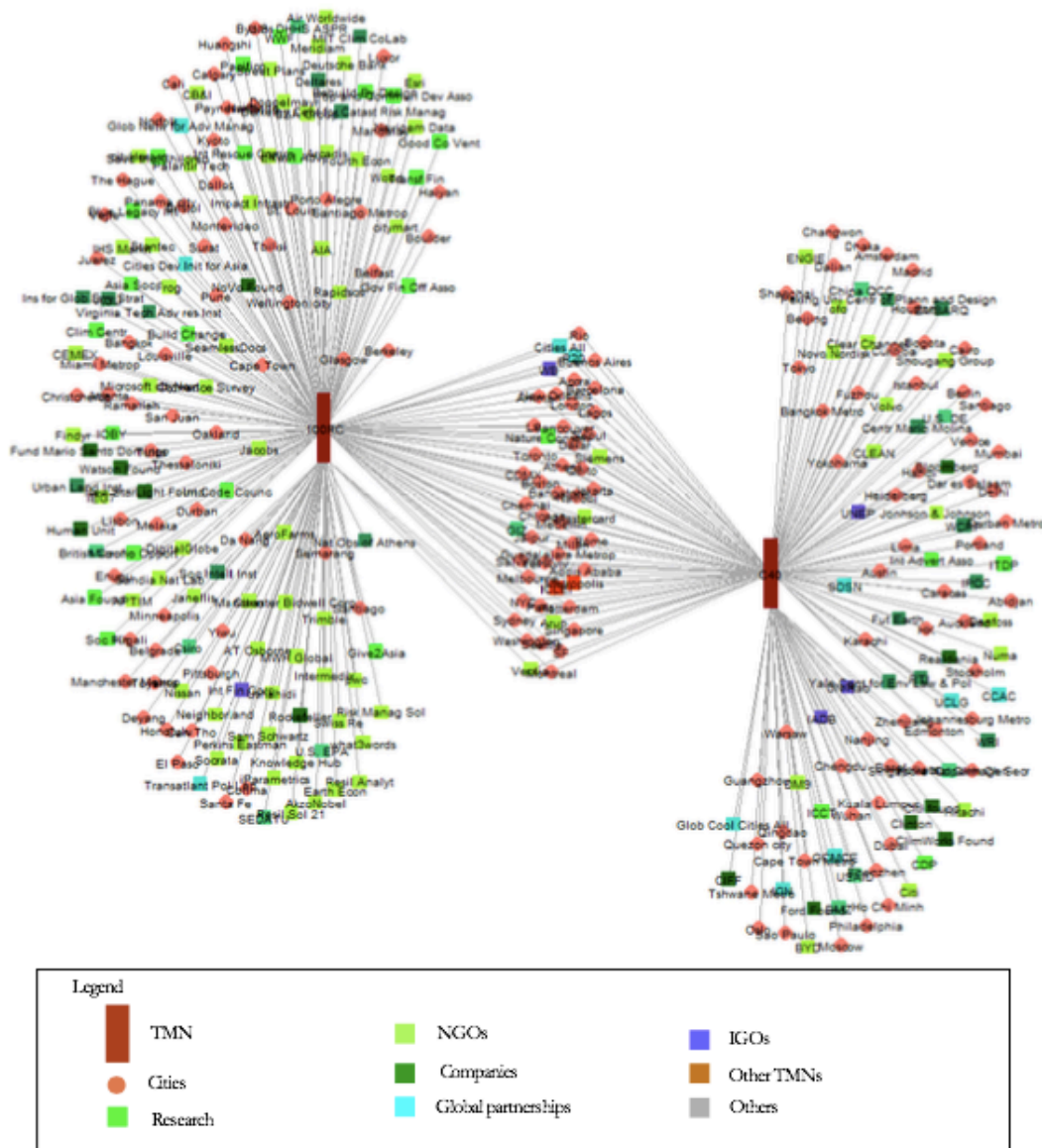


Figure 6.1 The 2018 C40 and 100RC memberships and partnerships

Figure 6.1 also highlights some shared partnerships between C40 and 100RC. The partners that the two TMNs have in common are diverse, e.g. the World Bank, the NGO Nature Conservancy, the global company Veolia, or the German development agency GIZ. Two global consultancies, i.e. ARUP and AECOM, seem to have played a particularly important role in the two TMNs over the recent years. Other works have underlined their presence and possible influence on cities (Leitner et al., 2018). In the case of 100RC, both consultancies appear to be ‘Strategy partners’, meaning that they are paid to help 100RC cities design their resilience strategies. It seems that 100RC chooses which Strategy partner (among which AECOM and ARUP, but also Rand Corporation and others) will assist each city (Interview

16). ARUP has also played a role elaborating or helping elaborate tools for 100RC cities to develop their strategies. In the case of C40, the direct link of the global consultancies with cities is less clear. Nonetheless, the two companies have played the same role of designing or helping design tools for C40 to offer its member cities. Overall, the partners of C40 and 100RC are similar in nature. Compared to the actor composition of the other TMNs of the system, they indeed include a vast proportion of companies, global partnerships (i.e. public-private partnerships at the global level), and private foundations.

It is also important to mention the direct interactions between C40 and 100RC. As evidenced by a 2016 press release, the two TMNs are official partners (100RC and C40, 2016). The details of this relationship are nonetheless unclear in the press release. It appears that the two TMNs, at the time of the press release, sought to enable the dissemination of tools among joint members and other cities. Informal talks with a C40 and 100RC city staff reveal that 100RC staff members were present at the Mexico City C40 Biennial Summit convened a few days after the press release. Several side events were related to urban resilience, and 100RC was invited to coordinate a workshop. Staff members from at least one other TMN were also invited to that summit. Indeed, ICLEI's secretary general was one of the speakers of the event.

Interviews also reveal that C40 and 100RC were interacting even before 100RC was launched (Interview 12). Indeed, as underlined in Chapter 4, it appears that some 100RC staff members met with C40 staff members when elaborating their governance model and structure. The purpose of the meeting was to learn from C40's experience with cities in a collaborative spirit, the two TMNs generally working in different subfields of environmental governance (i.e. climate action and urban resilience). It seems that these discussions helped 100RC develop the CRO tool. Since C40 was already eight years old at the time of the 100RC launch and the city adviser tool was launched in 2007, 100RC likely took advantage of C40's experience. The CRO tool resembles in several ways the C40 City adviser tool (Interview 12). Likewise, the discussions between C40 and 100RC (before its launch) appear to have helped 100RC design its business model:

‘So, we sat down with them like six years ago and they were like “we're going to do this, how are we going to do this?” We said “this is what we've done. This is what works, this is what didn't work’. And then 100RC launched their thing,

picking 30 cities at the time to get to 100 cities, which is, you know... Our first business model at C40 was 100RC's. So, when we started C40, we picked 40 cities, and we put a city director, a person in each city, in 2007. That's how we started it. So, what did 100RC do? They picked 30 cities and they called it the CRO, climate resilience officer. And they gave each city a million dollars and a CRO in each city, which is exactly where we started 15 years ago.' (Interview 12)

The preceding comments and interview quote reveal the likely occurrence of a process of social learning from C40 to 100RC. In the case of the 100RC business plan and CRO tool, the social learning process seems to have had a large impact on 100RC. Although this is the only explicit example of social learning between the two TMNs, others might have occurred. Indeed, the two TMNs' formal partnership and their many indirect interactions through both members and partners point to other possible information exchanges. The presence of ICLEI's secretary general at the 2016 C40 summit indicates social learning processes might occur frequently among TMNs of the complex system.

To conclude on this subsection, C40 and 100RC have several similarities, both in their attributes and their practices. These similarities might encourage their interactions, or their interactions might make them look more alike through social learning. As argued in Chapter 5, both TMNs have relational variable results that, according to this study's theory, should translate into average to low novelty ranks. As a matter of fact, 100RC has relational variable scores that should translate into a higher novelty rank than C40. These similarities cannot explain the difference in outcomes of the two TMNs. C40 and 100RC's organisational resources and sources of funding are too similar to explain why the former ranks second and the latter 10th in the novelty ranking. They belong to the same launch period (i.e. strategic urbanism), although they are not the same age. Yet, this cannot explain their different novelty ranks. As argued in Chapter 5, age in itself does not suffice to the emergence of novelty. Besides, even without the age bias (looking at the novelty per year ranking), C40 still generates more novelties than does 100RC.

The other differences highlighted above, i.e. the distinct natures of their founders, their different thematic scope and work with their members, constitute variables that Chapter 5 already excluded as explanations for the emergence of novelty. It is crucial to look more in

depth at these two cases to help specify this study's theory. The shared interactions and social learning processes described above might also be a valuable element to investigate.

6.2 Why interact? A common need for interactions

Looking at the C40 and 100RC cases helps clarify the causal relationship between interactions and age and novelty emergence that Chapter 5 started to uncover. As the following subsections highlight, following the explanation building technique described in Chapter 3, TMNs such as C40 and 100RC interact between themselves, and with a variety of actors to get access to resources which are crucial to their survival. Interactions might provide TMNs with information and knowledge which they might use to learn and evolve, or develop new perspectives leading to experiments and, ultimately, the emergence of novel instruments. Interactions also facilitate TMN access to funding. This enables them to act towards achieving their goals and gain effectiveness and efficiency, which can help them increase their legitimacy, access more resources, and survive. The comparative case study also unravels the critical role of funders in the survival and the determination of the practices of C40 and 100RC. When funders take a step back, the survival of TMNs is threatened. Funders may pressure TMNs in abiding by their rules and following their norms, thus affecting TMN practices. Funding constraints might sometimes impede TMNs from evolving. They might also include looking for new perspectives. Selecting funders wisely is thus crucial to generating and adopting novelties.

Figure 6.2 synthesises the causal process envisioned through an explanation building exercise. In line with a systemic view, it extends the process from TMNs' need to survive to their survival and adaptation of the system. This representation of the causal process identified is simplified in order to underline better the most important aspects of the process. Although it does not present all the variables discussed in Chapter 5, it does not go back on the findings of said chapter. Rather, its goal is to highlight what might happen between interactions and novelty and beyond, and stress the role that governance entrepreneurs seem to play.

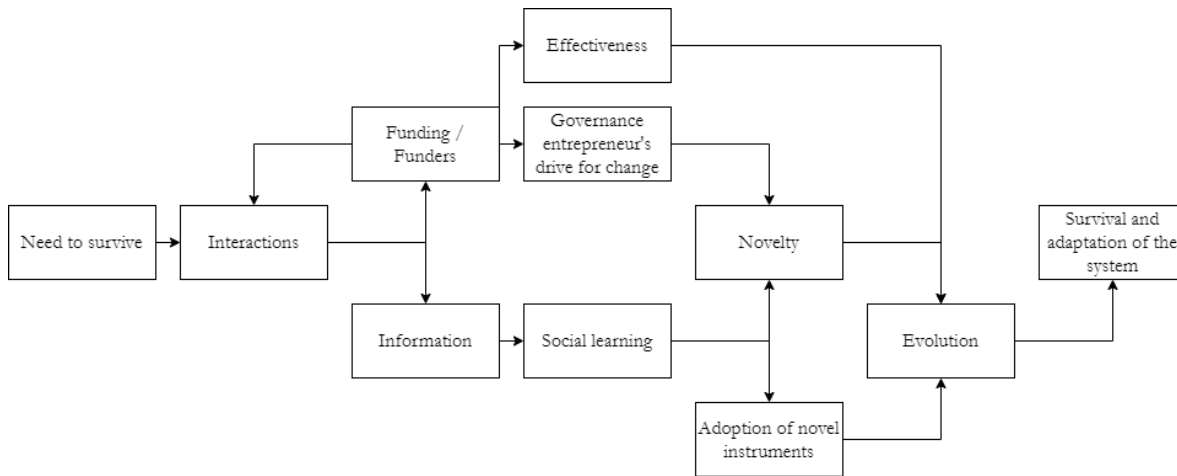


Figure 6.2 The causal process between interactions and novelty¹⁰⁰

6.2.1 The need to survive

According to Barber, ‘Cities have little choice: to *survive* and flourish they must remain hospitable to pragmatism and problem solving, to *cooperation* and *networking*, to *creativity* and *innovation*’¹⁰¹ (2013: 15). To a certain point, the same can be said about the networks they form. To survive, TMNs must acknowledge and abide by certain constraints. The comparative case study of C40 and 100RC highlights the constraints of the system in which TMNs operate. Like any other entity, TMNs need resources to survive. Yet, these resources are limited, and TMNs are more and more numerous. To get access to resources, TMNs need to interact. Interactions are indeed key to their survival, since they bring funding and knowledge which might help the TMN evolve.

6.2.1.1 The scarcity of resources

There is a growing number of actors in the TMNs system, as evidenced by the thirty-year span in which the 15 TMNs were launched. The same goes for global climate governance (Interview 7). However, the amount of resources available to TMNs is limited, or at least does not grow as fast as their needs.

In the cases of C40 and 100RC, documentary observation and interviews put emphasis on the lack of funding. Both C40 and 100RC get a lot of funding from private foundations, possibly more than the other TMNs (Haupt and Coppola, 2019). Yet, interviews often stress

¹⁰⁰ Funding caused by interactions and encouraging more interactions represents one of the possible feedback loops of the TMNs complex system.

¹⁰¹ My emphasis.

the limited resources they have at their disposal to do their work, and the need to find more. For instance, 100RC seems to be concerned with the scalability of its model (Interview 15). This model is indeed based on a strong funding strategy. It implies investing an important amount of money in each of its 100 city members to help them institutionalise the CRO position and the resilience strategy tool. In the long run, 100RC aims to make 10,000 cities resilient through its resilience strategy design model (100RC, 2016). This is evidence of 100RC's goal to make its model scalable. The membership benefits linked to the TMN's first phase are vast, including a CRO hiring for two to three years and access to pro bono services on the Platform of Partners. 100RC estimates the amount of money invested in each member city to be of up to one million USD. This is in stark contrast with the practices of most TMNs, which seldom generate funding tools (see Chapter 4). As a matter of fact, 100RC is the only TMN offering so much funding to each of its members. Even so, it remains unclear how 100RC would steer the 10,000 cities targeted in a second phase.

Interviewees related to C40 also raise the question of the scalability of 100RC's actions. They seem skeptical as to the probability that 100RC will achieve its goals with such an approach. A C40 staff member thus comments: 'I think the Rockefeller model is tricky, and I'm not sure how effective it is. And I think, I don't know if you're going to be able to dig into enough detail with them, but I think their model is close to being in danger, and I think, you know, they've now got these resilience plans agreed with some of their cities. But their problem is "what happens now?".' (Interview 13)

The same interviewee also raises the question of the scalability of C40's past approach, which, according to another interviewee, 100RC's approach parallels (Interview 12). Referring to C40 city adviser positions (from which 100RC CRO positions emerged as a novel governance instrument), this other interviewee stresses the fact that 'You can't have every new member get a new staff member that sits inside that city' (Interview 13). The main reason is related to the large budget it involves. Regarding C40's current situation, interviewees also highlight the scarcity of resources, especially regarding funding:

There's very, very little funding out there. We are all fighting for funding. And that funding is livelihood. If you don't get money, then you're not delivering on the broader goals, which are very, very... This is where this goal and passion becomes a roadblock, because [NGOs] are so passionate about delivering their

solutions for their specific niche that they then get competitive for those very small amounts of dollars.’ (Interview 12)

The previous comment underlines an important aspect of TMNs, i.e. their nature of NGO. There are great differences among NGOs regarding the amount of funding received (Morin and Orsini, 2015). Yet, for most TMNs, the quest for funding might be endless. Several interviews, not limited to the 100RC and C40 cases, stress the limited resources that TMNs receive to do their work (Interviews 3, 4, 13). Acuto confirms the seeming lack of funding of TMNs in the case of the C40 (i.e. the TMN with the most organisational resources in this study's system): ‘Even in the relatively well-backed C40 group, almost two-thirds (64%) of climate actions are funded solely from individual cities’ budgets or savings.’ (Acuto, 2016: 613)

6.2.1.2 The need for interactions amplified by TMNs’ role of facilitators and connectors

The need to interact to survive in a resource-constrained system is all the more vigorous as TMNs, because of their nature of networks, work as connectors and facilitators among actors of climate governance (Gordon, 2019). Networks do not have all the resources necessary to foster and strengthen urban climate governance. One of their goals is indeed to attract these resources and make them altogether available to cities or use them to promote cities’ climate interests and actions. Interactions are in that sense fundamental. The cases of C40 and 100RC both highlight the relevance of mentioning this TMN characteristic when discussing the role of interactions.

Commenting on the limitations of the C40 city adviser position, an interviewee adds: ‘We also realised is that we were missing a huge trick. And this is where C40 has moved now, that the people that have the skills and expertise are not somebody that we send into a city or a city administration, but it's the other cities around the world that are part of C40 that we know, that we have very strong connections to, that have done the same thing before.’ (Interview 13)

C40 eventually chose to put aside the city adviser tool to create a new network approach based on the idea of ‘the power of global collaboration’ (C40, 2019a). In 2011, C40 thus started to launch a variety of networks which seek to ‘provide a range of services in support of cities’ (C40, 2019a). The TMN currently has 16 networks stemming from five initiatives

related to the responsibilities that cities share worldwide (i.e. adaptation implementation; air quality; energy and buildings; food, waste and water; and transportation and urban planning).

The rationale behind this network approach is four-fold: ‘*Connect* city officials with their peers around the world to help deliver solutions to climate challenges’; ‘*Inspire* innovation by showcasing the ideas and solutions of leading global cities’; ‘*Advise* city peers based on experience with similar projects and policies’; and ‘*Influence* national and international policy agendas and driving the market by leveraging the collective voice of cities’ (C40, 2019a). C40’s networks seem to be a specific steering approach that other TMNs, such as 100RC, do not have (Interview 6). C40 presents them as essential to fulfilling its mission: ‘the peer to peer connections and city sharing one thing to another through engagements between city officials and facilitating that is one really key part of the work that we do’ (Interview 13). Through its networks, which connect certain actors together according to C40’s understanding of the responsibilities of cities and climate solutions, C40 seeks to orient the behaviour of not only its city members, but also national and international actors. For Gordon, building on Acuto’s 2013 work, the increasing C40 partnerships with a variety of strategic actors since 2011 have acted as ‘a means of enhancing the internal imperatives acting on member cities to accord to network standards and objectives by linking them to the ability to access outside financial resources or expert knowledge’ (2013: 294). Networks and partnerships have helped C40 leverage the potential of city knowledge and expertise exchange (Mintrom and Luetjens, 2017). Instead of internalising climate expertise to help cities develop their climate action, C40 thus has sought to create more links between cities and expert non-city actors. Likewise, Román’s ‘governance from the middle’ (2010) argues that through a procurement strategy, C40 has become an intermediate among distinct actors offering complementary activities.

Echoing C40’s ‘power of the global collaboration’ is 100RC’s ‘power of the network’. 100RC’s strategy puts emphasis on the benefits brought by integrating 100RC’s network of cities and partners. Documentary observation shows that the power of the network is a crucial concept in relation to 100RC’s steering approach. Yet, contrary to C40, 100RC lets its members make this network what they want it to be. For a city representative who has worked with both TMNs, 100RC connects the cities that ask for it when dealing with a similar issue,

while C40 leads the exchanges among cities (Interview 6). In other words, contacts among cities are less formal in 100RC than in C40, where they can be part of compulsory participation standards. Yet, the power of the network is still an important part of 100RC's steering approach. Román's theory (2010), which is applied to the case of C40, could be used in the case of 100RC as well (see also Davidson et al., 2019). By curating a platform of partners which gives 100RC cities access to a variety of actors offering pro-bono services, 100RC has indeed created links between cities on the one hand, and local, global, public and private actors on the other hand. Interviews show that 100RC cities favour mostly contacts with other cities. The contacts with companies seem to fade away in the long run (Interviews 6 and 16).

Both cases reveal that C40 and 100RC are visibly engaging with their role of connectors or facilitators of actors of global climate governance. The need of TMNs to interact to survive is thus magnified by the fact that their primary means of action is connecting actors. It is now important to highlight what resources interactions bring and how they facilitate the survival of TMNs.

6.2.2 Different types of resources for various purposes

6.2.2.1 *The role of information and funding*

It seems that TMNs interact to attract resources and survive. How resources lead to survival remains obscure, however. Interviews outside of the C40 and 100RC cases are here helpful. TMNs' limited resources are of diverse types. To survive, that is, stay in operation, TMNs visibly need funding (Interview 12), since it enables them both to maintain their operations and do more. They also need members (Interview 2), which gives them effectiveness and legitimacy. In addition, they need visibility (Interviews 8 and 11), to get access to more funding and action, legitimacy, and eventually effectiveness and efficiency. It seems that the most effective way to get these resources is through interactions. Yet, interactions, either in the form of collaboration or competition, require time and other resources (Interviews 2 and 4). TMNs often compete for individual access to resources (Interviews 7, 13). They might also collaborate with a variety of actors to get a collective access to these resources (Interviews 7, 11). Then, through collaboration or competition on a specific project, they receive different information about the practices of the distinct actors, which gives them new perspectives facilitating the emergence of novelty (Interviews 1, 2).

Looking into details at the resources needed, two kinds of resources seem to matter more than others. Information is one of them. Through information, TMNs manage to generate novelties or to adopt the novelties of others. Both actions help them evolve in their practices. Chapter 5 already discussed the role of interactions in attracting large amounts of diverse information which might lead to the emergence of novelty. Comments above also briefly mentioned possible social learning processes related to the interactions of TMNs at play. Social learning explains how interactions might lead to novelty through information. It can both prevent the duplication of efforts and enable the adoption of novel instruments generated by other TMNs and the differentiation of TMNs. An employee of Climate Alliance considers that a diversity of collaborators enables networks to broaden their understanding of climate governance (Interview 11). As mentioned earlier, this interviewee also states that these interactions are not a choice, but a need. Learning from others appears to be crucial to survival. Preventing the duplication of efforts seems to be another important goal of interactions and social learning. An ICLEI interviewee explains that this TMN has shared one of its novel tools with other TMNs such as C40 or Eurocities to make sure that other networks, and ultimately cities, could learn from it (Interview 3). Interactions among TMNs help novel instruments emerge through social learning processes. In other words, TMNs use the social learning coming from interactions to generate novel instruments or adopt the novel instruments of others. I discussed earlier the example of the CRO tool. ICLEI's interviewee also describes the example of the Global Protocol for Community-scale GHG emission inventory, which stems from earlier tools that emerged out of ICLEI and C40 with a similar yet slightly different combination of governance characteristics. In that specific case, interactions provided the TMNs involved with information about what already existed. This triggered a social learning process culminating in the emergence of a new instrument with an obligation component in the case of C40 but not in that of ICLEI. The emergence of this tool for urban GHG measurement impacted the practices of several TMNs. Likewise, discussing the benefits of collaboration, an interviewee working both for Climate Alliance and the Covenant of Mayors argues that the European Commission used governance elements of Climate Alliance to build a new network, the Covenant of Mayors, with different characteristics (Interview 8).

Thus, it seems that interactions bring information. Through social learning processes, TMNs diffuse their novelties, generate some, and, overall, evolve in their governance practices. The adoption, by some TMNs, of governance instruments previously generated by other TMNs, appears to be at least partly deliberate. While exchanging information, TMNs learn from one another and might use these learnings to evolve in their practices. Drawing from some Climate Alliance practices, such as setting GHG emission reduction targets, the Covenant of Mayors emerged as a new-generation TMN with obligation mechanisms which Climate Alliance mostly lacked. Social learning processes might therefore help TMNs evolve or new TMNs emerge with new characteristics. This kind of process thus seems to participate in the evolution of TMNs and, possibly, the adaptation of the system to an environment in which the increasing number of actors requires them to prove their legitimacy to survive.

The second type of resource that seem to matter greatly is funding. Funding is crucial in many ways. As stressed above, funding enables TMNs to maintain their operations, reach their goals and sometimes do more, thus possibly increasing their effectiveness, legitimacy, and, ultimately, their durability. As expressed by an interviewee, ‘If you don’t get money, then you don’t deliver on the broader goals’ (Interview 12). As argued in Chapter 5, funding is also necessary for TMNs to engage in partnerships (see Section 5.4.1.1). As partnerships are a vast part of the interactions of TMNs, lack of funding makes interactions harder, and survival less likely.

It seems that lack of funding is less of a concern for C40 and 100RC. Both TMNs seem to be in a strong position in comparison to the other TMNs in that regard. Indeed, they have the highest amount of organisational resources in the TMNs complex system. They also seem to have high budgets. Interviews and documentary observation underline the fact that the city adviser position and the CRO position were expensive; it is because both TMNs do not have many members that they could afford it. Informal talks with staff members of 100RC cities indicate that the funding of a CRO for two to three years by 100RC attracted many cities.

It is important to consider 100RC's current situation, however. This situation confirms that ‘Funding is livelihood’ (Interview 12) and reveals that no TMN is safe from a radical drop

in money endangering its existence. In July 2019,¹⁰² the Rockefeller Foundation announced the end of the funding allocated to 100RC and the subsequent merger of the programme into an internal Rockefeller Foundation Climate and Resilience initiative (Rockefeller Foundation, 2019c). While deciding to terminate the 100RC programme, the Rockefeller Foundation allocated an additional 8 million USD to the programme for its conclusion and merger with its internal initiative. It also hired an ex-100RC staff member to run its internal initiative. The Rockefeller Foundation did not completely break from the TMN it created. As is already visible on its website, this operation enabled the Foundation to reclaim ownership of the 100RC initiative and use its legacy for further projects and positioning in the urban resilience and climate governance system (Rockefeller Foundation, 2019b). Yet, this example stresses that TMNs are highly dependent on funding and thus funders, and more generally speaking on certain basic resources. Without them, they might cease to exist.

This idea echoes recent questionings regarding the possible natural selection of city networks in general: ‘is it possible that we are in such vastly networked conditions that, in fact, we might be witnessing a progressive ‘natural selection’ among city networks, where only the ‘stronger’ and more environmentally-fit (in terms of funding, visibility and efficacy) networks will in fact survive?’ (Acuto et al., 2017: 19) These changes in the environment of the TMNs complex system under study might force the system to adapt through the evolution of its entities. This evolution implies attracting resources such as funding, which might facilitate effectiveness and efficiency, and also affect the emergence of novelty. In that sense, funders play an important role in the evolution and effects of TMNs.

The 100RC example shows that the source of funding, i.e. funders, also seems to matter a lot. It can indeed foster or impede change, and possibly novelty. In that sense, the next paragraphs look more closely at the role of funders in the functioning of TMNs and the rise of novelty.

6.2.2.2 The significance of funders in the diffusion of ideas and the emergence of novelty

The example above shows the importance of attracting funding for survival. Funding is obviously closely linked to funders. These funders play a significant role not only in TMNs'

¹⁰² The Rockefeller Foundation announced its decision at the time of writing of the present study. It is thus hard to tell how it will affect the network of 100RC cities and the use of 100RC tools.

access to resources, but also in the ideas diffusing inside TMN structures and in the possibility of novelties to emerge.

Discussions with TMN staff and TMN partner staff point to the role of funders in the diffusion of specific ideas in the networks. A 100RC partner staff person mentions that there are several networks inside the 100RC architecture. Above the CRO network and the more restricted advisory group of mayors seeking to orient 100RC is the network of actors involved in the Bellagio retreats. The Rockefeller officially hosts the Bellagio meetings. On its website, it mentions that the Bellagio conference themes ‘align with its mission “to promote the well-being of humanity,”. They ‘include but are not limited to health, economic opportunity and jobs, urban resiliency, food and agriculture, clean energy, the field of philanthropy, and innovation for development.’ (Rockefeller Foundation, 2019a) Yet, the account made by the 100RC partner staff member uncovers more obscure dynamics. It appears that this network includes only certain mayors, heads of large technology companies such as Lyft, and venture capital representatives. Like the 100RC network of cities, it is exclusive. During those retreats, participants discuss political issues related to finance and technology, the needs of cities and of technology companies, etc. A 100RC staff member interviewee also notes the existence of distinct networks inside the 100RC architecture. The actors of these networks get to talk informally among themselves. They also intersect officially on occasions, like in 100RC meetings (Interview 5). It is likely that the ideas spearheaded by the Rockefeller Foundation and discussed in the upper-level networks might diffuse throughout the 100RC structure, especially through the various norm-setting tools of the TMN.

Likewise, the influence of the C40 funders is quite visible, as mentioned in Chapter 4 (Section 4.2.1.2). Bloomberg has thus had a large impact on the focus of C40 on data and measuring its impact on cities. As explained by an interviewee:

‘This is again where C40 becomes quite interesting: it is philanthropically funded. And that makes us quite different, because our donors have a huge role in shaping how C40 works. And so, for example, the network model was something that C40 wanted to do, but it was partly driven by our donors, by Bloomberg Philanthropies, by CIFF, the Children’s Investment Fund Foundation, who said “great, the network is great, but how are you gonna prove impact?” And so, the development of all of our metrics for understanding and

proving our impact actually is one of the things that actually allowed us to have impact.’ (Interview 13)

Another interviewee explains that C40 has been very specific about whom it takes money from, understanding the role that funders might have in the decision-making process of C40 priorities (Interview 12). According to this interviewee, this helps explain why C40 has been so innovative. Indeed, some funder constraints might hinder the innovation process: ‘what happens oftentimes is NGOs get tied into, again, a source of funding, and that funding dictates what they're doing, and they don't evolve as much’ (Interview 12). For the interviewee, C40’s capacity to generate novelties is thus partly linked to the focus of its funders on innovation and data. This might help explain why 100RC recently collapsed. Its main funder might indeed have perceived the limits of the 100RC model and put an end to it. Informal talks with Montreal Resilience Office partners underlined their surprise at the time of the Rockefeller Foundation’s announcement regarding the end of the 100RC funding, notwithstanding the difficulties of the 100RC model foreseen by several observers (e.g. Interview 13). The Rockefeller Foundation seems to have acted as a strict stakeholder in the spirit of what another interviewee calls ‘venture capitalism philanthropy’ (Interview 12). Because it was the most important funder of the TMN as well as its founder, the Rockefeller Foundation had even greater power and influence on the evolution of 100RC. It might thus have been able to expect a return on investment, impose its norms and eventually put an end to the TMN. C40 is also funded by ‘venture capitalism philanthropists’ (Interview 12). It has three funders, which were not part of its launch. Therefore, they might have slightly less influence on the TMN. According to the interviewee, C40 was able to choose its funders, i.e. those who were going to affect the decisions of the TMN. 100RC was not.

The same interviewee points to the role of specific individuals who push for novelty in TMNs. These can be funders, but not necessarily. They are risk-seeking actors with strong links to TMNs, actively taking part in the TMN decision-making process. These actors use their personal connections and seek to convince them to engage in the creation of novelty (Interview 12). This next section identifies them as governance entrepreneurs and describes their role using the case of the C40 president of the board, Michael Bloomberg. Whereas the Rockefeller Foundation created 100RC to enhance urban resilience and become a fundamental actor in urban resilience, Michael Bloomberg took over the C40 using his

personal skills and network to achieve a political project that might go beyond global urban climate governance.

6.3 A distinguishing feature: the presence of a governance entrepreneur

This section argues that, in the absence of high centrality, diversity, and age scores, the presence of a governance entrepreneur and high organisational resources might enable the emergence of novelty in a TMN. The presence of a governance entrepreneur in C40 and not in 100RC seems to be the most relevant difference explaining the high capacity of the former to generate novel governance instruments and lack thereof of the latter.

Governance entrepreneurs such as Michael Bloomberg, through their own experience, skills and personal networks, seem to be able to champion novelty when massive and diverse information and time is missing. As argued in Chapter 5, and drawing on Barabási's insights on the dynamics of complex networks, it seems that TMNs rich in connections get richer. Barabási (2002) also argues that those that are not already rich may gain connections through fitness, i.e. a measure of a node's ability to make friends and stay in front of the competition (see Chapter 2). Echoing this theory, this section shows that governance entrepreneurs might play the same role as fitness. Using their experience, skills and personal connections, these agents are more eager to take risks and launch new tools, although they are uncertain of their effects, to serve their own interests.

The governance entrepreneur argument does not contradict the centrality and diversity argument developed in Chapter 5. It indeed applies to cases in which TMNs with a high capacity to generate novelties do not appear to have high centrality, diversity, and age scores. Besides, governance entrepreneurs seem to bring TMNs their own strong contacts. Thus, the presence of governance entrepreneurs can be considered, at least partly, another relational variable, albeit at the individual rather than at the structural level.

6.3.1 Defining governance entrepreneurs

As underlined above, it seems that an important difference between C40 and 100RC lies in the distinct role of their private foundation funders. Although both seem to influence their respective TMNs, it appears that they have engaged with them in different ways. Bloomberg

Philanthropies, and more specifically its founder Michael Bloomberg, did not create C40.¹⁰³ As a matter of fact, the foundation started funding the TMN in 2011. Yet, Michael Bloomberg has taken an increasingly important role in the TMN's development, acting as a funder, a mayor of a major C40 member, a chair, and the president of the C40 board of directors.

TMNs evolve in a system that is also a political arena. They help cities develop climate actions, promote their work, and defend their interests in global climate governance. They also compete among themselves for resources, thought leadership, and notoriety (Interview 4). Their different interests and goals might conflict. Talking about the Global Covenant of Mayors creation process, an interviewee mentions the following:

'There's a lot of politics around this as well. So, there's always politics around. Coming from India, there's politics around everything. So, what happens at the global level, you need people who are able to position it in a certain way. And so, there are the PR, a lot of billboards, and so on, who have not only the resources but also have reached, key people, institutions like ICLEI and now people who can take the message, bring people together.' (Interview 2)

While emphasising the political context in which TMNs work, this ICLEI interviewee also highlights the fact that some actors have the capacity to help spread a message and shake the political order. To do so, they might push for the production of new governance instruments. This idea echoes Strang and Soule's argument, in their work on diffusion in organisations, that 'Internally, the adoption of new practices requires the active efforts of innovation champions and a robust coalition for change.' (1998: 270) These actors do not just try to change institutional practices to make them more efficient. They also, and most importantly, seek to advance specific interests, whether at the individual or at the group level.

To identify these 'innovation champions', this study uses the governance entrepreneur concept, which builds on the concepts of norm (Finnemore and Sikkink, 1998) and policy (Mintrom, 1997; Kingdon, 1984) entrepreneurs. The concept of governance entrepreneur, focusing on actors enabling change in the broad governance system rather than the narrower

¹⁰³ Others argue that Ken Livingstone is the C40 governance entrepreneur (Mintrom and Luetjens, 2017), or that both Ken Livingstone and Michael Bloomberg played a crucial role in the evolution of C40 (Lee and van de Meene, 2012). As his role after the launch and first of the C40 is unclear, this work argues that Michael Bloomberg is the true governance entrepreneur of C40. The observed influence of New York City on the TMN since its beginnings tends to confirm this idea (Lee and van de Meene, 2012).

policy system, has gained momentum over the last few years (Andonova, 2017; Boasson and Huitema, 2017; Pattberg, 2017). Andonova (2017) uses it in her theory of institutional change related to the rise of global public-partnerships. She defines those partnerships as: ‘voluntary agreements between public actors (IOs, states, or substate public authorities) and nonstate actors (nongovernmental organizations [NGOs], companies, foundations, etc.) on a set of governance objectives and norms, rules, practices, or implementation procedures and their attainment across multiple jurisdictions and levels of governance.’ (2017: 2)

Governance entrepreneurs appear to have been crucial in the rise of global public-private partnerships, as they use their ‘agency, resources, expertise, and norms’ to push for change (Andonova, 2017: 3). Although Andonova argues that governance entrepreneurs facilitate institutional change in the form of global partnerships in the multilateral system, this study considers that governance entrepreneurs push for change in the form of novel governance instruments in TMNs. When the combination of high centrality, diversity, and age is absent, governance entrepreneurs might still enable novelty to emerge.

This research thus sees governance entrepreneurs as another possible independent variable explaining the emergence of novelty in TMNs. Governance entrepreneurs are ‘political actors actively seeking institutional change. [...] [T]heir essential characteristics are specified as “expertise and persistence,” which they use to advance personal, agency, or interest group agendas.’ (Andonova, 2017: 21). Actors involved in climate governance entrepreneurship do more than what their job requires, seeking to ‘punch above their weight’ (Green, 2017a: 1473). Governance entrepreneurs share similarities with policy or institutional entrepreneurs. ‘Policy entrepreneurs distinguish themselves through their desire to significantly change current ways of doing things in their area of interest’ (Mintrom and Norman 2009: 650, cited Pattberg, 2017: 2). In contrast, institutional entrepreneurs are ‘actors who create new or transform established institutions in ways that diverge from the status quo.’ (Waldron et al., 2015: 132, cited Pattberg, 2017: 3) Governance entrepreneurs differ from both other types of entrepreneurs in that they seek change in governance rather than change in policies or institutions. Likewise, Boasson and Huitema (2017), focusing on acts rather than actors, define two types of entrepreneurship. On the one hand, structural entrepreneurship is ‘aimed at enhancing governance influence by altering the distribution of authority and information’

(2017: 1347). It involves creating networks, and strategically using decision-making processes and information. On the other hand, cultural-institutional entrepreneurship underlines ‘what actors may do to ensure that their ideas and suggestions appear more attractive’ (2017: 1349). Both types of entrepreneurship affect climate governance in non-exclusive ways. Finally, Green (2017a) sees entrepreneurship as encompassing entrepreneurs as an independent variable, and their strategies, as the causal mechanism leading the entrepreneurs to a form of policy change.

All these definitions link governance entrepreneurs, agency, and change through similar arguments. They define entrepreneurs or entrepreneurship quite broadly, targeting distinct entities. These might be institutions (Andonova, 2017; Pattberg, 2017), individuals (Pattberg, 2017), or acts (Boasson and Huitema, 2017). Some scholars stress the expertise of governance entrepreneurs (Andonova, 2017), while others also emphasise their network abilities (Boasson and Huitema, 2017).

Drawing from this literature, this study sees governance entrepreneurs as agents that take part in the functioning and steering of TMNs and use their personal skills, experience, and social capital to develop strategies that push forward novel ideas or actions to advance personal or group interests. They thus have the capacity to foster change inside TMNs and might play an important part in some TMNs' capacity to generate novelties. As will be underlined in the following subsection, it seems that Michael Bloomberg, founder of a global data and media company and a large philanthropic foundation, former Mayor of New York City, special envoy of cities and climate change to the United Nations, candidate to the 2020 Democratic primary, and founder or co-founder of several U.S campaigns for climate action, has played such a role in C40's evolution.

The presence of governance entrepreneurs is here considered an attribute variable, even though it could be seen as a relational one. Indeed, while governance entrepreneurs might be the founders of TMNs, they can also join them later on, because TMNs have connected them to their structure. Having a governance entrepreneur might be a question of relationships. As a matter of fact, Goddard (2009) uses network theory semantics to describe political entrepreneurs as brokers. Thanks to their position of bridges between two networks, entrepreneurs can facilitate change. In other words, being linked to a political entrepreneur

can help foster change in a network. Yet, because I see governance entrepreneurs as becoming part of the TMN, I consider them as being an attribute variable. Since governance entrepreneurs act inside TMNs, I do not see them as a relational variable here. Nevertheless, as will be underlined, they might use their connections to push for novelty, thus showing the relevance of interactions at the individual level rather than the network one. In that sense, part of the explanation is, once again, relational.

6.3.2 The significance of governance entrepreneurs in the absence of centrality, diversity, and time?

Considering the preceding argument, this subsection presents evidence of the presence of a governance entrepreneur developing specific strategies for change in the C40 case as an explanation for its capacity to generate novel governance instruments notwithstanding its low relational variable scores and relatively young organisational age. It focuses on Michael Bloomberg. While not specifically referring to him as a governance entrepreneur, interviews do allude to him as a crucial actor in the development of C40. Besides, the documentary observation reveals that some scholars see his foundation, Bloomberg Philanthropies, as an orchestrator of urban climate action through the C40 (Gordon and Johnson, 2017). Likewise, other commentators see Bloomberg himself as ‘the mayor of mayors’ or as ‘the first urban global diplomat’ (Sherman, 2012; Barber, 2013). The documentary observation also highlights several actions that are in line with Michael Bloomberg developing a governance entrepreneur strategy. An interviewee stresses the critical role of Michael Bloomberg in the C40:

‘Michael Bloomberg, when he was mayor of New York, was actually the chair of C40. Now he's no longer the mayor of New York. He's the president of the board of C40, which sits underneath our steering committee. And he's doing a lot of work, he's in a very unique position as both a philanthropist, a businessman and a former mayor. So, he's got a lot of position and of course got major UN envoy role as well. And so, he's an amazing person have as part of our organization.’ (Interview 13)

The above description of Michael Bloomberg suggests he might be a governance entrepreneur. It is important to investigate whether his profile fits Andonova’s understanding of those novelty champion actors of global governance explained below:

‘These actors operate across the international and domestic domains and use a variety of strategies to explain, justify, and promote the adoption as well as the uptake and institutionalization of *new governance instruments* (...) Actors with strong incentives and motivation to spur institutional change engage in identifying and placing on the *governance agenda a set of problems and ideas for new institutional solutions*. The *strategies* by which they present their ideas for institutional change will necessarily involve *building supporting political coalitions*, as well as some degree of consensus between public and private entrepreneurs on the ends and means of new governance. (2017: 21)¹⁰⁴

The following paragraphs present Michael Bloomberg’s profile and then analyse the strategy through which the businessman and elected politician seems to have helped novelty emerge in C40. Finally, they highlight the apparent absence of governance entrepreneurs in the 100RC case. This leads to the conclusion that the presence of a governance entrepreneur plays a significant role in the emergence of novelty in the absence of high centrality, diversity, and age scores.

6.3.2.1 Michael Bloomberg: a self-made business and political career of data, business and cities

Michael Bloomberg is today the ninth richest person in the world (Forbes, 2019). He has built his wealth on his company, Bloomberg LP, which he founded in 1981. Bloomberg LP is a technology, data and media company. It is most famous for offering financial data analysis services through its Bloomberg terminals (Bloomberg and Winkler, 1999). After attracting the investment bank Merrill Lynch as its first client, it rapidly grew to become the service provider of thousands of finance institutions. It also developed around other media, through Bloomberg News, Bloomberg Television, or Bloomberg Radio. It has today a revenue of about 10 billion USD and employs around 20,000 people around the world (Bloomberg, 2019a). His autobiography alludes to his belief in doing rather than talking. It further describes his work as being about receiving new ideas to then make them reality (Bloomberg and Winkler, 1999).

After spending 35 years in the Wall Street world, Bloomberg turned to politics. He was elected Mayor of New York City in 2001, and completed his third term in 2013. As New York City mayor, he is known for aiming to achieve specific grand urban visions and for fostering neoliberal urbanism, through the rationalisation of urban governance for economic

¹⁰⁴ The emphasis does not appear in the original text.

development and the favouring of money and upper-class power (Brash, 2012). For Barber, Bloomberg, as mayor, talked like a businessman, and, as a businessman again now, talks like a mayor (2013: 26). Among his distinct initiatives is PlaNYC, an urban planning policy that ‘included 127 initiatives aimed at creating the world’s most environmentally sustainable city’ (Bloomberg and Pope, 2017: 27). PlaNYC also paid attention to climate risks (McArdle, 2014). During his mandate, Michael Bloomberg was involved in the launch of the C40 as mayor of one of the 18 C40 founding cities (see Section 6.1.1.1). During his mandate of New York City mayor, he also served a term as C40 Chair. He thus gradually positioned himself as a ‘Batman for cities’, to borrow an interviewee’s self-description.

Following three terms as New York City mayor, Michael Bloomberg resumed his work at Bloomberg LP. His former deputy Mayor, Patricia Harris, who had previously been running Bloomberg LP’s philanthropy division, became CEO of Bloomberg Philanthropies, a private foundation with a ‘data-driven approach to global change’ (Bloomberg, 2019a). Michael Bloomberg is the founder and ‘guiding force behind Bloomberg Philanthropy’ (Bloomberg, 2019a). He sees philanthropy as crucial. For him, it is mostly about participating in a better world and making others benefit from his luck. As a businessman, it is certainly also about receiving benefits. Indeed, he explains that giving out helps ultimately gaining more (Bloomberg and Winkler, 1999). In other words, Bloomberg’s philanthropic activity is not just for the sake of doing what is good or appropriate. It is also in the view of meeting his interests and those of his company.

Bloomberg Philanthropies, as mentioned before, is one of the largest philanthropic foundations in the United States. Since its beginnings, it has gradually given out more money and launched more environmental initiatives. Some examples include Beyond Coal (a campaign to close coal mines launched by the Sierra Club NGO in 2010), America’s Pledge (a campaign to measure the climate actions of U.S. states, cities and businesses founded with California Governor Jerry Brown after President Trump’s to withdraw from the Paris Agreement), American Cities Climate Challenge (an acceleration programme designed to help 25 cities reach or go beyond their mitigation goals), and Beyond Carbon (a U.S. subnational campaign which aims to create political leadership for decarbonisation) (Bloomberg, 2019a).

In 2014, Michael Bloomberg was appointed United Nations Secretary's Special Envoy for Cities and Climate Change. Ban Ki-moon's successor António Guterres later appointed him UN Special Envoy for Climate Action. Michael Bloomberg is also co-chair of the Global Covenant of Mayors for Climate and Energy (with which the European Covenant of Mayors studied in this work merged in 2014). In late 2018, upon request of António Guterres, Michael Bloomberg formed the Climate Finance Leadership Initiative, a private sector initiative for the mobilisation of finance in climate action. In November 2019, Michael Bloomberg announced his candidacy to the U.S. Democratic primary, his official motivation being defeating Donald Trump in the 2020 U.S. Presidential election (Scherer, 2019). By March 2020, he had spent around 500 million USD of his own money for said campaign.

To conclude, Michael Bloomberg's profile shows a man who built his fortune on data diffusion and analysis. It also reveals a man believing in ambitions, hard work, and tenacity as keys to success. It finally shows a man who defines himself as a businessman who progressively entered the political sphere, while distinguishing himself from Washington people by seeking action rather than political debates. His recent U.S. presidential candidacy announcement email confirms this description: 'I offer myself as a doer and a problem solver – not a talker. [...] I've spent my career bringing people together to tackle big problems – and fix them. It has worked well in business – and in running the country's largest, most progressive city. I know it can work in Washington, too – and I have the leadership skills and experience to make it happen.' (Bloomberg, 2019b)

Bloomberg's description unquestionably fits that of a governance entrepreneur. Yet, building on Green's argument (2017a), looking like a governance entrepreneur is not enough; acting like one is also necessary to foster change.

6.3.2.2 Michael Bloomberg's governance entrepreneur strategy to instill novelty

Michael Bloomberg has acted as more than just a funder to C40. He has indeed used distinct personal resources and skills to facilitate the emergence of novelty in C40 practices. His governance entrepreneur strategy appears to comprise the following elements: some internal pressure to include data and metrics in C40's practices; an external communication approach promoting both personal and group successes and a specific urban climate agenda on a variety of fora; and a capacity to network with diverse high-level entities. Here, I argue that,

while the first element directly led to novel instruments, the other two helped increase C40's visibility and legitimacy, which helped attract distinct partners and increase the TMN's capacity to generate novel governance instruments.

First, several elements show the pressure to measure imposed by Bloomberg and his foundation to C40. This improvement of measurement methods has itself generated novelty. It may also have increased the C40's legitimacy, which is likely to have helped the TMN build new important partnerships. The documentary observation reveals that an important goal of his as C40 Chair was to 'improve reporting methods and increase accountability.' (Parvez et al., 2019; Bloomberg Philanthropies, 2013) He used his famous motto 'if you can't measure it, you can't manage it' in his company, as well as in his foundation and in city hall (Bloomberg and Pope, 2017).¹⁰⁵ Documentary observation and interviews reveal he also did inside the TMN (Watts, 2015). Listing the reasons for C40's capacity to generate novelties, an interviewee mentions the influence of funders: 'Bloomberg is one of the wealthiest individuals in the world private sector of tech data innovation. One of his famous sayings is "I believe in God, everyone else brings data."' (Interview 12). The interviewee also alludes to the importance that C40 gives to measuring and assessing cities and its own actions.

The pressure to measure is also visible in C40's novel instruments. One of the six C40 novelties identified in this work is the Global Protocol for Community-scale GHG Emission Inventories, which provides standards for cities to measure their emissions (see previous comments in this chapter and also Chapter 4) Another one is the networks mentioned earlier in this chapter (see Section 6.2.1.2). As argued by an interviewee, the shape that the networks tool took overtime was partly driven by Bloomberg and the other funders with the aim of better measuring the impact of the TMN and of cities in climate action (see Section 6.2.2.2). C40's already mentioned participation standards are also based on the idea that they may help C40 track the progress and achievements of its cities. C40 launched its participation standards in 2012, during Bloomberg's leadership. Although they do not represent a novelty, they are linked to at least two C40 novelties, i.e. the networks and the C40 annual summit, which, in contrast with most other TMN annual summits and as part of the participation

¹⁰⁵ While this motto is not an invention of Bloomberg's but a business world quote, the businessman has managed to make it his own in the political world.

standards, is compulsory. Overall, these comments show that Bloomberg's drive to measure influenced C40's practices and directly fostered some of its novelties.

Second, it is important to mention Michael Bloomberg's communication efforts to promote his and C40's successes as well as their specific urban climate agenda. These may have increased the visibility and, in turn, the legitimacy of the C40, as well as help attract partners. Bloomberg's agenda has involved putting cities at the front of climate governance as doers (in contrast with states who passively discuss climate issues). It has also emphasised the need of cities to work with a variety of companies including in the finance sector to receive enough funding for the implementation of high-impact climate actions (including technology solutions).

This study's data illustrates the scope of this communication approach. It is indeed partly based on Michael Bloomberg's various publications (i.e. his 1997 autobiography, a 2015 Foreign Affairs article on the century of cities, and a 2017 book on cities, businesses, and citizens in climate action co-authored with former Sierra Club leader Carl Pope), his personal website and his company's. Through these publications, Bloomberg has been able to reach different audiences and promote his and C40's agenda. His autobiography is not about cities, but his expertise in data and business. Yet, his final statement regarding the reasons for writing such a book uncovers Bloomberg's political will. He indeed claims that he had to write this book because he had something to say and had the opportunity to do so, so why not say it. His book is also a way for him to emphasise his hard work, going beyond what is expected of him. This idea follows several scholars' understanding of entrepreneurs: 'People acting in line with the logics of appropriateness cannot be said to be performing entrepreneurship' (Boasson and Huitema, 2017: 1351).

Furthermore, through his autobiography, he shows his preference for action over words, an idea he repeatedly stresses when advocating for cities in climate governance. Bloomberg has often sought to put forward his sense of action and that of cities, contrasting it with the immobility of federal governments, states, or politicians in general. Many of his statements and communications convey this idea. For instance, it is visible in the book Michael Bloomberg co-authored with Carl Pope, an essay on the role of cities, businesses and citizens

in climate governance. These elements are also part of C40's approach.¹⁰⁶ Discussing technology solutions in the transportation sector, Bloomberg synthesises several core C40 ideas:

'First, city leaders are talking with each other more and collaborating more than ever before, through organizations like C40 and the Global Covenant of Mayors for Climate and Energy. Second, it's easier to collect and report data, and more and more cities are doing it. This gives cities evidence of what works and confidence to invest precious resources in what will be effective—not just in transportation but elsewhere. And third, cities frustrated by the slow pace of national action on climate change are taking matters into their own hands.'
(Bloomberg and Pope, 2017: 145-146)

The last part of this quote refers to the action of cities in contrast with the immobility of states. Similarly, as C40 chair, Michael Bloomberg has used many times C40's popular antithetical motto, 'While nations talk, cities act', which some attribute to David Miller, former Mayor of Toronto and C40 Chair.¹⁰⁷ Whomever the source of the motto, 'the statement embodies much of the ethos of the leadership of former Mayor of New York Michael Bloomberg in his tenure (2010–13) as chair of the C40 Climate Leadership Group.'
(Acuto and Curtis, 2018) A New York Times journalist reports Bloomberg's comments during the 2011 announcement of C40's partnership with the World Bank as follows: 'Mayors can't just talk about goals for the year 2050, which some congressmen in the United States want to set as a goal,' he said. "Cities are where you deliver services. Federal governments and state governments sit around talking and passing laws or recommendations that don't have any teeth.' (Barrionuevo, 2011)

Another example lies in a 2007 issue of TIME magazine titled 'Who needs Washington? How a billionaire mayor and a celebrity governor are showing what it takes to get things done' and displaying a photo of Arnold Schwarzenegger with an arm around Michael Bloomberg's shoulder in which the two protagonists appear as 'buddies' (see also Bloomberg

¹⁰⁶ The business element is particularly clear in C40's procurement function and his governance from the middle, as characterised by Román (2010).

¹⁰⁷ See Michael Bloomberg's Twitter account, online. URL: <https://twitter.com/mikebloomberg/status/311547333500358656> (last accessed November 26, 2019).

and Pope, 2017). A previous 2006 article highlights the similarities between the two subnational actors and friends (Steinhauer, 2006).

This leads us to the third aspect of Michael Bloomberg's governance entrepreneur strategy, i.e. his capacity to link C40 to a variety of high-level individuals and organisations. Informal talks with a C40 partner (i.e. R20, a network of regions led by Arnold Schwarzenegger) pointed to the charismatic and therefore crucial role of former California governor Arnold Schwarzenegger, who enabled the network to be heard in diverse COP fora. It seems that a similar process happened with C40 and Michael Bloomberg. A New York Magazine journalist, describing Bloomberg's involvement in C40, argues that 'Every time he touches down in a new place, he's building out an already gilded Rolodex with a loyal network of international politicians whom he can enlist at key moments' (Sherman, 2012). Thus, it appears that Bloomberg has used his personal contacts for the promotion of C40.

This process is visible in the previously mentioned merger of C40 and Clinton Climate Initiative, which coincides with Bloomberg Philanthropies' decision to fund C40 (Gordon, 2013). A 2011 New York Times article actually titles 'Bloomberg and Clinton to merge climate groups', referring to Bloomberg as New York City mayor and C40 Chair, in which the two philanthropists are described as long-time friends (Barbaro, 2011). This merger has had a strong impact on C40, especially in terms of wider economic support for the TMN. That same year, another important C40 partnership was built with the World Bank. Although the role of Michael Bloomberg in the signing of the partnership is unclear in the documentary observation, it was visibly made possible by C40's commitment to measurement and assessment of impact (Gordon, 2019), which ultimately went along Bloomberg's strategy and participated in C40's innovativeness.

Another example lies in the collaboration of C40 in the launch of the Compact of Mayors, an initiative encouraging cities to commit to climate action and measure their efforts, which later merged into the Global Covenant of Mayors for Climate and Energy. In 2014, Ban Ki-Moon appointed Michael Bloomberg his Special Envoy for Cities and Climate Change. Subsequently, during the 2014 UN Climate Summit, both actors announced the launch of the Compact of Mayors, under the leadership of C40, ICLEI, and United Cities and Local Governments (also known as UCLG), and with the support of UN-Habitat. Bloomberg's

agency both in the creation of the Compact of Mayors and in that of the Global Covenant of Mayors is prominent. According to several interviewees, this effort was led by global TMNs and Bloomberg Philanthropies (Interviews 3 and 4). Another interviewee sees the Compact of Mayors as an initiative of Bloomberg himself (Interview 9). An article co-authored by C40 executive director and ICLEI secretary general point to the leadership of Michael Bloomberg in the launch of the Global Covenant of Mayors (Watts and van Begin, 2016). Michael Bloomberg himself explains the relationship between his work with the UN and the Global Covenant as follows:

‘Through my work as special envoy, Bloomberg Philanthropies joined the UN and the European Commission to create an organization that would come to be called the Global Covenant of Mayors for Climate and Energy. Under the Global Covenant, cities commit to publicly measuring and reporting their carbon emissions using a standard measurement system. Today, our group includes more than 7,000 cities in 112 countries.’ (Bloomberg and Pope, 2017: 33)

Bloomberg’s UN nomination gave him leverage in the creation of the Compact of Mayors and of the Global Covenant of Mayors. These two initiatives are very much in line with the measurement work that C40 started under Bloomberg’s leadership. Yet, C40 has less than 100 members, which gives it an insignificant weight in these agglomerative initiatives of several thousand members. It is likely that either C40’s practices or Bloomberg’s strong links with the TMN helped C40 become a founding and leading member of the Compact and the Covenant of Mayors. Neither the documentary observation nor the interviews could yet confirm this idea. Yet, Bloomberg’s UN nomination clearly appears to have participated in giving C40 international recognition (Chan, 2016).

To conclude on this last part of the governance entrepreneur strategy, it appears that Bloomberg’s contacts have also played a part in his push for change. As indicated by a senior adviser of Bloomberg’s, ‘[Bloomberg has] used mayors around the world and his network of philanthropy to produce what I would say are the beginnings of an international infrastructure that can promote a level of change that is hard to fathom’ (Barber, 2013; Sherman, 2012).

The internal pressure to measure and assess impact led directly to novel governance instruments. Furthermore, it might have given the C40 more legitimacy in global climate governance. Bloomberg’s communication strategy helped promote his and C40’s actions and

results, which also seems to have increased C40's legitimacy. Additionally, it gave the TMN more visibility. The use of his personal connections possibly helped Michael Bloomberg attract more partners to C40. The three elements altogether make up Bloomberg's strategy to push for change in C40 practices.

Thus, Michael Bloomberg has acted as a facilitator of change in C40. Not only does he have experience, skills and social capital conducive to change, he has also made use of all these resources to foster change within C40, making it one of the TMNs with the highest capacity to generate novelties in the system. Novelty here appears to be an outcome of governance entrepreneurs pushing an agenda and doing things differently. Thus, although it does not have high centrality, diversity, and age scores, the presence of a governance entrepreneur might help explain C40's high novelty rank, especially since it is an element missing from the 100RC case.

6.3.2.3 The absence of a governance entrepreneur in 100RC

The in-depth study of 100RC did not reveal the existence of a governance entrepreneur in the TMN. Two actors, more often mentioned in 100RC publications, come to mind as possible governance entrepreneurs. Michael Berkowitz, the 100RC president, might appear at first to be a governance entrepreneur. Before working for the Rockefeller Foundation, Berkowitz worked for the Deutsche Bank in issues related to security and risk management. Before that, he was Deputy commissioner at the New York City Office of Emergency Management. He has worked in resilience-related issues for many years. Yet, although he did take a prominent role during the operations of 100RC, he did not appear to do more than was expected of him, or to use his skills or his personal connections to push for novel governance practices. No primary or secondary source document refers to his use of specific skills, experience, or personal contacts in the promotion of change inside 100RC. Few documents mention him outside of his 100RC president role. The interviews led for this study do not mention him. This leads us to assume that he did not go beyond the logic of appropriateness (Boasson and Huitema, 2017). It seems that he worked for and promoted the urban resilience agenda already set by the Rockefeller Foundation.

This leads to the second possible actor representing a governance entrepreneur, i.e. the Rockefeller Foundation. The interviews and informal talks with 100RC staff, members and

partners do not refer to any actor possibly taking a role of governance entrepreneur. They do refer to the Rockefeller Foundation as being behind the 100RC initiative, however. The Rockefeller Foundation has played a different role in the development of the initiative from Bloomberg with C40. As founder and funder of 100RC, the Rockefeller Foundation set the TMN's agenda, priorities, and rules. While 'pioneering' the network at the beginning and maintaining a strong relationship to it over time, it eventually decided to put an end to it. Interviews with 100RC staff members suggest that the Rockefeller Foundation closely oversaw the development of the TMN, but that 100RC and the Rockefeller Foundation were always separate (Interview 5; see also Nielsen and Papin, 2020).¹⁰⁸ Informal conversations with 100RC city staff members report that the Rockefeller Foundation observed the process as any funder would, but did not seem excessively involved. Borrowing Green's words (2017b), the Rockefeller Foundation does not appear to have 'punched above its weight' to promote novel practices in the 100RC initiative. It seems that the Rockefeller Foundation set up the 100RC initiative and hired people to achieve its goals, but did not use its 'expertise and persistence' (Andonova, 2017) to instill change in the initiative afterwards. Rather than strengthening and changing the TMN from within, the Foundation eventually discontinued the programme to support other resilience efforts (Fitzgibbons and Mitchell, 2019; Rockefeller Foundation, 2019c).

Therefore, 100RC looks like a tool that the Rockefeller Foundation built to advance its interests and its vision of the urban resilience agenda (Leitner et al., 2018; Spaans and Waterhout, 2017). The documentary observation clearly shows that the Rockefeller Foundation has sought to be a leader in the subfield of urban resilience governance. In 2009, it indeed set up the Asian Cities Climate Change Resilience Network (ACCCRN) as a pioneering TMN in urban resilience in Asia (Rockefeller Foundation, 2019c). With the United States Agency for International Development (i.e. USAID) and the Swedish International Development Cooperation Agency, it also fostered the Global Resilience Partnership. In addition, after superstorm Sandy hit the United States, the Foundation took part in a commission set up to recommend actions to prepare New York City to better resist shocks. This led to the institutionalisation of Rebuild By Design, which later became a crucial

¹⁰⁸ Other scholars nonetheless seem to see the Rockefeller Foundation and 100RC as two sides of the same coin (Leitner et al. 2018).

100RC partner. Here, Green's distinction between being a governance entrepreneur and developing a governance entrepreneur strategy proves useful. While the Foundation might be seen as a governance entrepreneur for urban resilience, it did not act as such in the 100RC initiative. Consequently, 100RC does not seem to display the presence of a governance entrepreneur pushing for novel governance practices in its structure.

The previous comments lead me to argue that 100RC lacks the presence of a governance entrepreneur to make up for its average relational variable scores and its young age. This explains its average to low novelty rank in contrast with C40's high capacity to generate novelties.

6.4 Concluding remarks: The significance of interactions at different levels

This chapter has presented a comparative case study of C40 and 100RC to test this work's third hypothesis on the causal process linking interactions and the emergence of novelty (H3). It has shown that the two TMNs differ in several ways. They were not created with the same focus and by the same actors. Their private foundation supports are also different. As argued in Chapter 5, the thematic focus and the nature of founders do not seem to influence the emergence of novelty, however. The cases of C40 and 100RC also bear various similarities. They were both launched in the strategic urbanism period. They are therefore rather young and have similar practices, mixing voluntary and compulsory governance mechanisms and integrating a variety of private actors in their activities. They also have vast organisational resources. Besides, they share many members, as well as some partners. They also interact together. Both cases highlight the need for interactions for survival. Interactions bring them diverse resources, among which information and funding. While information leads to social learning processes enabling the emergence of novelties and the adoption of the novelties of other TMNs, money enables TMNs to operate and do more, thus gaining effectiveness and legitimacy. Through a governance entrepreneur's strategy to generate change, they might also generate novelties. All this can help TMNs evolve, and survive. In turn, this might help the system adapt to changes in the environment.

This chapter mentioned the question of the adaptation of the TMNs complex system in relation to the evolution of TMNs. Yet, the results of the empirical analysis can only lead us

to draw conjectures on how the system adapts. More data on the macro-processes at play would be necessary to confirm the ideas presented in that regard. Interviews with more actors present at the beginning of the system might provide us with the information needed.

When asked about the drivers of innovation in an organisation such as C40, an interviewee points to the importance of personal connections and a willingness to experiment as key to change (Interview 12). A closer look at funders earlier in this chapter revealed that these might play a role in the emergence of novelty. It also shows that some funders might act as governance entrepreneurs. These governance entrepreneurs are actors ready to take risks to stay in front of the competition, making their TMN fit when they are not rich in connections. While the study of 100RC does not enable us to identify the presence of such actors inside the managing and functioning of this TMN, that of C40 unmask Michael Bloomberg, former C40 chair and current president of the board of directors of the TMN, as a possible governance entrepreneur. Using his experience, skills, and personal connections, Bloomberg has sought to instill novelty in C40 practices. The chapter has presented some evidence of the possible influence of Bloomberg on the emergence of novel governance instruments. Nevertheless, a deeper analysis including more interviews of C40 staff members working with him would be necessary to confirm this argument. As for now, the presence of a governance entrepreneur in C40 and their absence in 100RC seems to be the most important difference between the two TMNs. 100RC has seen the Rockefeller Foundation, its founder and funder, play a significant role in its development. As mentioned in this chapter, the Rockefeller Foundation's role in 100RC differs from Bloomberg's and Bloomberg Philanthropies'. No individual inside the Rockefeller Foundation, nor the foundation itself, seem to correspond to the concept of governance entrepreneurs as understood by the literature. This chapter argues that this difference between C40 and 100RC is critical to explain the high capacity of the former to generate novelties and the much lower capacity of the latter.

An important question related to the governance entrepreneur variable is related to whether it is sufficient to explain the emergence of novelty. The data collected for this work does not enable us to answer this question; more case studies on the role of governance entrepreneurs in TMNs are necessary. Considering the distinct variables studied here and in the preceding

chapter, it is possible that the presence of a governance entrepreneur and a high amount of organisational resources represent another set of INUS conditions (see Chapter 5). We have already seen the possible significance of organisational resources, although their role remained unclear. The strategy developed by the governance entrepreneur to make novelty emerge might require the work of more actors inside the TMN to make sure it is implemented and leads to novel governance instruments. Having many organisational resources in itself does not enable novelty to emerge. Yet, it might if combined with a driving force pushing for novelty. Numerous organisational resources mean a high number of TMN staff members, and often a higher budget, which can help the novelty process go faster, thus allowing recent TMNs to create novelties. Thus, in the absence of numerous and diverse interactions and of time (i.e. a low age variable), the INUS conditions identified in the previous chapter, the presence of a governance entrepreneur and a high level of organisational resources might enable the rise of novelty. Nevertheless, the data collected for this study does not enable us to confirm this idea.

I should stress that the governance entrepreneur argument does not go against the idea that interactions are significant in the rise of novelty. In the few cases in which centrality, diversity, and age do not seem to play a part in explaining novelty, as in the case of C40, it seems that the presence of a governance entrepreneur might. Furthermore, part of the resources that governance entrepreneurs bring to TMNs is social capital. Governance entrepreneurs help novelty emerge by attracting new actors (especially high-level partners) into the network. Rather than focusing on the interactions of the network, this alternative explanation puts emphasis on the contacts of an individual inside the network. An actor with specific skills might use its contacts to help novelty emerge. In that sense, this chapter shows that interactions play an important role directly in the survival of TMNs, but they can also matter indirectly in the emergence of novelty.

Conclusion

This study has sought to provide an explanation for the emergence of novel governance instruments in TMNs. After synthesising its findings, the next paragraphs mention other theories that seek to account for change in global climate governance. I explain why I favoured a different explanation. I then highlight the contributions of said explanation and findings. Finally, I underline some limitations and present avenues for future research on TMNs.

Why do some TMNs generate more novel governance instruments than others?

TMNs themselves and part of the literature on TMNs have associated them with novelty. It appears that the novelty of TMNs is not in their GHG emission reductions or their adaptation practices. As several studies have shown, there are doubts regarding the capacity of TMNs to drive their member cities to substantial GHG emission cuts and decline in their vulnerability to natural disasters. Neither is TMNs' novelty in their discourse, at least not completely. Since many TMNs now link climate action to economic development and other related issues, they remain embedded in a neoliberal paradigm. Rather than envisioning a new system of production and consumption, TMNs argue in favour of the use of renewable energy sources, clean transportation systems, or carbon-neutral solutions that will allow for continuous economic development. Where their discourse might start to innovate, however, is in the dichotomy they have established between state immobility and city activism. TMNs have participated in creating an image of cities as possible 'saviours of the planet in the face of climate change' (van der Heijden, 2019). While debatable, this image has certainly helped put cities at the fore of climate action.

By helping cities become agents of global climate governance, TMNs have participated in changing the dynamics of global climate governance, showing the importance of involving local actors in traditionally international practices (Hoffmann, 2011). Doing so, they have engaged in blurring classical divides between international and local actors, and between public and private actors (Gordon, 2013).

Building on these comments, this study has argued that TMNs generate novelties in global climate governance through their practices, as transnational entities steering local actors in a global governance system towards climate action. TMNs appeared in global climate governance as a new kind of entity, differing from traditional local government associations. To fulfil their mission, they have had to develop governance arrangements enabling them to orient the behaviour of their member cities. Thus, the novelty of TMNs lies in their governance instruments, understood as combinations of governance characteristics which aim at steering member cities towards specific climate action goals. Using these tools, TMNs also manage to influence other actors, such as their official partners.

The instruments TMNs generate are diverse. While most of them have an information sharing function, many also seek to set norms. 25% of them aim to build the capacities of cities for strengthened climate action. A few also seek to set some rules member cities ought to follow. Most instruments are voluntary, yet some compulsory instruments have emerged too. While TMNs are voluntary and thus cannot officially constrain their member cities to do anything, they have found ways to commit them to certain requirements. Not abiding by the terms set might lead to sanctions.

Not all TMNs were created equal. Some TMNs are better than others at generating new governance instruments. This study's research question has focused on explaining why this is the case. I looked at distinct variables to explain this variation. Some TMNs were created by cities, others by IGOs or NGOs. Some emerged with many organisational resources, others with few. Some were created at a time of scarce climate action based on voluntarism, others at a time of greater general concern and strategic activism. Whereas the first two differences identified do not seem to be significant in the emergence of novelty, this last difference seems to correlate at least with differences in governance styles. The oldest TMNs seem to have mostly soft governance practices. In contrast, new-generation TMNs have a more hybrid approach to steering.

Older TMNs have had more time to generate governance instruments. Thus, they rank higher in terms of the number of instruments they have generated and of the novelties of other TMNs that they have adopted in the period under study. Yet, it is important to add a nuance: although older TMNs have a higher capacity to generate novelties because they have generated more

novel instruments, the frequency of novelty emergence in TMNs is higher in the early years of TMNs.

What appears to matter most in explaining why some TMNs generate more novelties than others is how well they are connected among themselves and with other actors. More specifically, combined with age, centrality and diversity of contacts seem to be significant in the emergence of novelty. The correlation of centrality and the emergence of novelty in the members' subgraph appears to be higher than in the partners' subgraph and the whole network. While partners might matter, their influence on the rise of novelty is probably not as high as that of member cities. Thus, while I consider the diversity of TMN collaborators, it appears that cities remain TMNs' most important contacts. The TMNs that have high centrality degrees and many contacts whom they do not share with other TMNs, or from distinct types or working on distinct issues, tend to generate more novelties. TMNs that were central and had diverse contacts but were young, compared to the other TMNs of the system under study, did not generate as many novelties as those combining high centrality, diversity, and age scores. Thus, it is the combination of centrality, diversity, and age which leads to the emergence of novelty.

The process at play stems from a need of TMNs, as actors, to survive in a resource-constrained system. To attract more resources, such as information and money, they seek to interact with other TMNs, cities, and other types of actors. Through funding and funders, they might change their practices to gain effectiveness, evolve, and eventually help the system adapt to its changing environment. They might also be driven by a governance entrepreneur who will help foster novelties and the evolution of TMNs. By attracting information, TMNs may be involved in social learning processes, which might lead to the emergence of novel governance instruments or the adoption of novel instruments generated by other TMNs. In both cases, this might help TMNs evolve and the system adapt. As structures, TMNs connect a variety of actors together and enable information to flow. The tools generated are diffused, and create opportunities and constrain the actors participating in TMNs.

When centrality, diversity, and age are absent, governance entrepreneurs might help generate novelties. They might need organisational resources to do so. A more comprehensive study, looking at distinct cases, would be necessary to confirm the validity of this argument.

This study has explained the emergence of novelty using a theoretical framework based on network theory, complexity approaches and organisational theories that looks mostly at relational variables, but does not ignore the significance of actor attribute variables. Yet, other theories account for novelty and change. It is important to examine them and see if they might have provided more compelling explanations for the emergence of novel TMN governance instruments.

Rival explanations for the emergence of novel TMN governance instruments?

Other hypotheses might explain why some TMNs generate more novel governance instruments than others in global climate governance. These hypotheses build on different theories that are interested in the question of change in global environmental and climate governance. Some focus more on the network structure, others on the wider system, and others on the agency of certain actors. In the next paragraphs, I examine these hypotheses and theories and show how the network and complex systems framework is a better fit to answer this study's research question.

Change in policy learning and networks

A theory that scholars have used to analyse change in climate practices is policy learning. A theory based on change in governing practices might be appropriate to study the emergence of novel governance practices. In addition, policy learning considers the variety of actors that might be involved in policy change and could therefore be relevant to this research, since it looks at interactions. Public policy studies have long been interested in nodality and how well-connected actors receive and diffuse information, a crucial resource for power (Hood, 1986). They have thus stressed the importance of interactions in the public policy process. Sabatier's theoretical framework on policy subsystems, advocacy coalitions and policy-oriented learning is a famous example of this line of work. The policy subsystem, 'i.e. those actors from a variety of public and private organizations who are actively concerned with a policy problem or issue such as air pollution control, mental health, or surface transportation'

(Sabatier, 1988: 131), has a structure similar to that of networks, which makes the use of the theory noteworthy.

Likewise, some policy studies publications have highlighted how policy networks, understood as entanglements of actors coming from the government and civil society, might influence policies (Pal, 2006). They show that public policy making is not a closed process controlled by governments. Many actors intervene in this process. The outcome is a policy resulting from different voices, sources of information and interests. This theory is relevant to the present research in that it analyses structures of interactions between a variety of actors participating in the construction of policies.

Using these theories, one might posit that novel governance instruments emerge out of the debates and negotiations of the actors involved in TMNs and defending their own interests. Coalitions of actors might push the instruments being designed in different directions depending on their own interests and norms, which might lead to the generation of novel instruments. In that context, the TMNs that generate the most novelties might be those that have contacts with the most diverse interests. This hypothesis is similar to H1's diversity argument. Yet, it differs in that it focuses on the diverging interests of actors in a TMN.

Nevertheless, this hypothesis appears unlikely. Actors form advocacy coalitions in the public policy context because these policies will likely affect all the members of a constituency, whether they want it or not. Although TMN governance instruments are likely to apply to all TMN members, being a TMN member is voluntary. Being a member of a network is different from being a citizen of a country, or arguably an actor of international climate governance. Cities join TMNs because they want to strengthen or develop their climate action. The voluntary nature of TMNs, despite its distinct degrees, makes it likely that all the actors involved will have similar interests in the design and implementation of governance instruments. Issues of collaboration are more likely than issues of coordination. In that context, Sabatier's framework is hard to apply to TMNs. Thus, while not irrelevant to the phenomenon studied in this research, this kind of theory is not the most appropriate here.

Multilevel and polycentric governance theories

A number of scholars have referred to multilevel and polycentric governance theories to account for change in environmental and climate governance. The origins of multilevel governance theories relate to European studies and the understanding of European governance as multilevel (Hooghe and Marks, 2003; 2001). These theories show the entanglement of actors and levels upward and downward which has helped TMNs become part of global climate governance. Polycentricity follows the influence of Elinor Ostrom's work on the governance of local systems through polycentric governance arrangements (Jordan et al., 2018; Ostrom, 2010). It highlights the presence of diverse spheres of influence over global commons which go upwards, downward and sideways.

These two sets of theories converge in many aspects. Both consider we need to look at distinct levels and actors to understand how climate governance has evolved and is being or might be led. Both also highlight some self-organisation processes in which actors have acquired specific functions that help the system operate and evolve. Furthermore, the two theories are systemic. They are interested in understanding the functioning and evolution of environmental and climate governance systems.

Polycentricity and multilevel governance theories also bear several differences. First, the polycentric approach argues there might be several centres of power and decision-making at play in environmental and climate governance. For the multilevel approach, one level might influence one or several other levels of action. Yet, there might still be one centre of decision, depending on the type of governance. Some argue that the EU climate governance system is multilevel rather than polycentric, and that the top level still has the strongest influence on lower ones (Jänicke and Wurzel, 2019). Furthermore, polycentricity has been intended as an analytical framework to describe, but also 'improv[e] efforts to reduce the threat of climate change' (Ostrom, 2010: 552; see also Dorsch and Flachslan, 2017). Besides, it seems that the polycentricity framework has focused on traditional common-pool resource arrangements (Heikkilä and Weible, 2018), whereas multilevel governance theories have often had a broader scope. Recent uses of polycentricity nonetheless show an interest in wider systems (Tormos-Aponte and García-López, 2018; Oberthür, 2016).

To my knowledge, few scholars have so far used polycentricity theory to study cities and TMNs (exceptions include van der Heijden, 2018). However, because it considers a variety of actors acting at different levels (Oberthür, 2016), similarly to multilevel governance theories, it has proven fruitful to analyses including transnational actors or systems.

Many scholars studying cities and TMNs engaged in climate action have used the multilevel governance framework to make sense of changes at play (Hughes et al., 2018; Gordon, 2013; Gustavsson et al., 2009; Kern and Bulkeley, 2009; Betsill and Bulkeley, 2006). More generally speaking, scholars have been interested in understanding the recent changes in the managing of climate issues at the global level. Multilevel governance is a valuable approach to analyse the entanglement of actors and levels. It is also useful to reflect on the implications of this diversity on the governing of climate change and, more specifically, on the rise of new actors such as TMNs.

Using these theories, one might argue that the evolution of TMNs is linked to systemic changes, with global climate governance becoming more multilevel (Betsill and Bulkeley, 2006) or more polycentric over time, especially with the Paris Agreement (Oberthür, 2016). As actors of different natures and acting at different levels gain legitimacy to orient the behaviour of others, we might be able to explain why new-generation TMNs appear to be more constraining than older ones. Furthermore, some TMNs might have adapted better than others to systemic change, and generated more novelties.

Yet, looking at the TMNs system only does not help us account for differences in the capacity to generate novelties of entities of a system. This does not allow for an analysis of the specific behaviours of actors and what makes them bring more change to the system than others. To study differences of the capacity to generate novelties, we need to see each TMN as a polycentric or multilevel system, examine its functioning and compare it to the other TMNs. In that context, looking at the internal governing of TMNs might explain why some are more innovative than others. Despite the common idea that TMNs are networks made by cities for cities, not all are actually governed by their members (Nielsen and Papin, 2020). With the exception of GCCP, all the TMNs include member cities in their governance processes, but they do so in varying ways and degrees. Several TMNs (e.g. CNCA, 100RC, CoM, CIVITAS) mostly include cities through a steering committee made of a certain number of

members. 100RC's city leader advisory committee, created four years after the TMN's launch, was made of 11 selected mayors or chief executives of member cities. The criteria for the selection of the members of the committee remain unknown. MUFPP involves cities to a greater degree than the TMNs that only have a steering committee. Indeed, it has a city leading its international secretariat, and also has an assembly of signatory cities. Similarly, C40, besides a steering committee, has an elected chair who is a mayor of a C40 member city (currently Eric Garcetti, mayor of Los Angeles).

Older TMNs, created in the first half of the TMNs system's emergence, tend to have more structured ways to include member cities in their governance structures. From Metropolis to Alliance in the Alps, all TMNs seem to have member cities in their executive body. ICLEI, for instance, has its members vote for nine regional committees, which then vote for the global executive committee. Climate Alliance has an executive board made of member cities and convenes its general assembly once a year to pass resolutions.

It appears that new-generation TMNs include cities to their governance processes less than older ones do. Steering committees are useful to give TMNs directions for their actions, but they do not directly govern them. Their decisions are less constraining than the supervision activities of the executive committees or boards and their effects harder to assess. Cities thus seem to play less of a leadership role in those networks. Recent TMNs might move away from the network ideal type (usually thought to be polycentric, horizontal and inclusive), progressively becoming more centralised and hierarchical (Nielsen and Papin, 2020).

These comments help us perceive differences among TMN internal governance structures across the old-new divide mentioned in the empirical chapters of this study. Yet, these differences do not suffice to explain why some TMNs generate more novelties than others. The first TMN in the novelty ranking is ICLEI, which has an inclusive and polycentric internal governance structure. The second and third ones are C40 and CIVITAS, which appear to include their members to a lesser degree to their internal governance mechanisms and be more hierarchical. Thus, while multilevel and polycentric governance approaches have brought noteworthy insights into the study of change and novelty in global climate governance, they are not the most appropriate theories to answer this study's research question.

Delegation and orchestration theories

Finally, another set of theories studying agents of change in global climate governance lies in delegation and orchestration theories. Delegation and orchestration theories are both interested in indirect modes of steering a population towards a desired behaviour, but they understand the process at play differently (Abbott et al., 2016a). Delegation theory focuses on understanding how principals use their authority and power to have their agents govern their target in a pre-determined way. Scholars have notably used it to show that international institutions acquire some autonomy and develop behaviours that do not correspond to the demands of states (Green, 2008; Hawkins et al., 2006). Orchestration theory emphasises, in the context of multilevel or polycentric governance, how the dominant actors of global governance act as orchestrators to get a target to act in a desired way through the inducement of intermediaries, thus using a softer method (Fuhr et al., 2018; Gordon and Johnson, 2018; Hale and Roger, 2014; Abbott and Snidal, 2010). Whereas delegation theory uses a hierarchical perspective to describe the relations of states and international institutions, orchestration theory considers the increasingly horizontal nature of the relations between global actors.

Both theories account for shifts in global governance, especially regarding the nature of actors. They also look at the influence new actors may have, hence their usefulness to understand the influence of TMNs through novelty. They may thus prove valuable to study TMNs. Indeed, some, such as the GCCP, were created directly by IGOs to steer cities; others, such as ICLEI, are ad hoc arrangements that IGOs may induce to orient cities in a certain way. In addition, these theories pay attention to the interactions of the actors involved in global governance, and are thus in keeping with this study. We might use them in order to show how some IGOs, for instance, drive cities to adopt climate policies through the TMNs they create, fund, or with which they work. The distinct resources IGOs offer those TMNs might help them generate novelties. This argument is close to the governance entrepreneur one developed in Chapter 6. However, governance entrepreneurs, as in the case of the C40 and Michael Bloomberg, seem to work inside TMNs rather than outside of them. IGOs, through delegation or orchestration, are understood as steering TMNs from the outside. Principals or orchestrators might not use the same techniques as governance entrepreneurs to steer TMNs.

Even though they acknowledge transnational actors, delegation and orchestration theories remain quite state-centric. Governors, whether they are principals or orchestrators, are rarely nonstate actors. The focus of the studies using delegation and orchestration arguments is, most often, states and IGOs. They do not appear to pay enough attention to the power of non-traditional actors as principals of other agents, especially delegation theories. In other words, they do not observe the relations between TMNs and other nonstate actors, which, for this project, are essential. Thus, delegation theories might be able to explain why the TMNs launched by or working with IGOs are innovative, but they might be at a loss when seeking to look for the causes of the innovativeness of TMNs that do not have such links with IGOs. Likewise, orchestration theories might have trouble explaining the capacity to generate novelties of TMNs created and led by cities which do not seem to have intermediaries (e.g. cities creating TMNs).

Overall, the other hypotheses drawn, which use network, systemic, or agentic perspectives, do not seem fit to explain the emergence of novel TMN governance tools. A focus on either structure or agency is not convincing. Both the structure and the agent must be considered to account for change. Furthermore, most theories have a linear understanding of phenomena that ignores possible feedback loop and nonlinear processes. This work's network and complex systems approach thus appears more comprehensive. The identification of the causal process at play between interactions and novelty in Chapter 6 has shown the possibility of feedback loops (interactions leading to more interactions) and individual agents helping foster novelty in the absence of centrality and diversity. Thus, it appears to be the most appropriate approach to answer this study's research question.

Contributions of this study

This study makes several contributions to the literature on TMNs and global climate governance.

First, it has built a framework based on network theory, complex systems approaches and organisational theories that has not been used before to study TMNs in global climate governance. Doing so, it has offered a new perspective on TMNs, seeing them as both structures and actors of climate governance. As structures, TMNs foster interactions among cities and other actors evolving in global climate governance. They create both opportunities

and constraints for their members. The interactions they foster might prove useful to them as actors. Indeed, as actors, TMNs use these interactions to attract information and other resources that appear crucial in the generation of novelties and the evolution of TMNs. Besides, they use certain tools to influence cities and other actors towards certain climate actions. TMNs also use their social learnings to evolve and help their system adapt. To be sure, novel governance instruments do not emerge just because TMNs decide to generate them. Novelties are mostly linked to the information TMNs receive, but their agency is at play as well. It appears, for instance, in the decision of TMNs to transform this social learning in a novel instrument, or in the actions of governance entrepreneurs willing to facilitate change. Accordingly, this perspective has brought a new understanding of TMNs as dual entities that generate novelty in governance practices influencing the behaviour of local actors towards climate action in a global governance system.

Second, this study has enabled the unprecedented analysis of the governance tools TMNs engaged in climate action generate in order to steer their members as well as other actors engaged in global climate governance. Doing so, it has offered a detailed account of the ways in which TMNs seek to influence cities. Also, by taking a close look at the governance practices of 15 TMNs, it has enabled to nuance analyses that look more widely at the practices of TMNs, and to draw a bigger picture of TMNs than single case studies. It has shown that TMNs, as transnational actors, use a mix of mainly soft but also sometimes hard governance techniques. This has led me to discuss the authority of those hybrid entities, made of public and private actors. Following Green (2008), and Hickmann (2015), TMNs have a sort of entrepreneurial private authority over their member cities. These choose to join TMNs and follow their rules and standards in exchange of a variety of resources. TMNs offer cities reputational benefits some might not want to give up. Failing to follow TMN rules might endanger those benefits. Although, as networks, TMNs remain voluntary, and cities choose to join or leave them, some of them have developed ways to make entry and exit more or less complicated for cities. Of course, while TMNs resort to what is here called obligation mechanisms, they cannot coerce cities into following their rules. Ultimately, cities always decide whether they want to remain in the network or not. Nevertheless, looking at TMN practices is valuable. Besides allowing us to understand transnational governance

mechanisms, it might help us better assess the effectiveness of these entities that are becoming increasingly important in global climate governance.

Third, looking at the interactions of TMNs has allowed us to highlight their links to both international and transnational actors, something that had not been done precisely before. Looking at the interactions of TMNs among themselves is valuable. Processes of social learning help TMNs specialise and evolve. Furthermore, looking at TMNs' links to IGOs, is also fruitful. The timeline presented in Chapter 4 highlighted that international events may trigger a response from transnational actors, usually towards more action. The behaviour of international actors may impact transnational initiatives. To a lesser degree, the same can be said about the behaviour of private actors such as private foundations. Their funding might considerably impact how a TMN operates.

Fourth, following prior work (e.g. Andonova, 2017), this study has underlined the possible role of governance entrepreneurs in the emergence of novelty in transnational entities. Some agents, which are not necessarily cities, have a special influence on TMNs. When analysing the roots of novelty, it is important to consider them. Both interactions with non-city actors and the presence of governance entrepreneurs in TMNs show that TMNs are not always city-led. It partly contradicts the fact that TMNs are networks of cities for cities. Since TMNs may influence the climate action of municipalities that represent from a few hundreds to several inhabitants, considering who leads them and what their interests and norms are is crucial.

Finally, looking at how novelty emerges is particularly important in a non 'either, or' global climate governance system, in which state action, even if effective, is unlikely to be sufficient to address the current climate crisis, and in which nonstate and substate actors will need to supplement international action through a diversity of tools and approaches in order to orient the behaviour of the global population.

Limitations of the study and future contributions

To conclude, it is important to underline this study's limitations and the need for following contributions. The next paragraphs look at four limitations and related future contributions.

One limitation lies in the need for a deeper study of the C40 regarding the governance entrepreneur argument. The evidence gathered in Chapter 6 suggests that Michael Bloomberg has indeed acted as such for the C40. Yet, we lack information regarding his strategy. Interviews on this specific aspect would be necessary to strengthen our analysis. More generally, it would be valuable to look at other cases of individuals or institutions taking a role of governance entrepreneurs to facilitate change in TMNs. While this does not appear to be the case of the Rockefeller Foundation, examining the behaviour of other philanthropic foundations in other TMNs might prove fruitful.

Another limitation of this study lies in its representativity considering the current TMNs involved in global climate governance. As argued in Chapter 3, this study's TMNs system reproduces the high concentration of European TMNs and European cities present in current TMNs of global climate governance. As such, it may highlight dominant tendencies thereof. Yet, it might ignore less dominant albeit not unimportant trends, through the exclusion of non-European regional TMNs. For instance, there are several TMNs located in Asia (e.g. ACCCRN). They might have different governance practices or interactions with types of actors that we did not identify in this study. Accordingly, it would be valuable to conduct a wider study, including non-European and non-global TMNs, or to compare the results of the present research with those of a similar study on TMNs from other regions.

A third limitation of this study is the lack of distinction among cities, municipalities, and local governments. TMNs might behave differently according to the nature of their members. Global or capital cities have more resources to participate in TMNs and conduct climate policies. TMNs focusing on these types of cities (e.g. C40) might have distinct practices because of the nature of these cities. Besides, their interactions with non-city actors might differ, since these might find their member cities particularly attractive. It would be beneficial to conduct a study on TMNs that might identify distinct types of TMNs based on these differences. These TMNs and their member cities might also reveal different degrees of influence over global climate governance.

Finally, this research has knowingly focused on TMNs and ignored the study of informal city networks. These networks might be significant, however (Gordon, 2019). Like informal international groups or networks, they might participate in setting norms for urban and

transnational climate governance. Assessing their influence among other city networks and in global climate governance is important. Furthermore, in line with previous comments on the composition of TMNs, understanding who is part of these networks and who drives them appears to an important avenue for future research on city networks in global climate governance.

References

- 100RC. (2016) *Resilience in action. Early insights into how cities are institutionalizing resilience*. Available at: <http://lghhttp.60358.nexcesscdn.net/8046264/images/page/-/100rc/pdfs/Resilience%20in%20Action%20100RC%20Report%20October%2020216.pdf>.
- 100RC. (2017a) #100RCsummit Kicks Off. Available at: <https://twitter.com/i/moments/889278994222387202>.
- 100RC. (2017b) *A Focus on Impact: Evidence from the First Four Years*. Available at: <http://www.100resilientcities.org/focus-impact-evidence-first-four-years/>.
- 100RC. (2019a) *City Strategies*. Available at: <http://100resilientcities.org/strategies/>.
- 100RC. (2019b) *We Focus on Impact*. Available at: <http://100resilientcities.org/our-impact/>.
- 100RC and C40. (2016) 100RC & C40 Cities Announce Partnership to Jointly Advance Climate Change & Resilience Efforts. *Cities Around The World Will Have More Resources To Develop Resilience And Climate Action Plans As A Result Of New Partnership*. Available at: <http://www.100resilientcities.org/100rc-c40-cities-announce-partnership-to-jointly-advance-climate-change-resilience-efforts/#/-/>.
- Abbott K, Genschel P, Snidal D, et al. (2016a) Two Logics of Indirect Governance: Delegation and Orchestration. *British Journal of Political Science* 46: 719-729.
- Abbott KW and Snidal D. (1998) Why States Act Through Formal International Organizations. *Journal of Conflict Resolution* 42: 3-32.
- Abbott KW and Snidal D. (2010) International regulation without international government: Improving IO performance through orchestration. *The Review of International Organizations* 5: 315-344.
- Abbott KW. (2012) The transnational regime complex for climate change. *Environment and Planning C-Government and Policy* 30: 571-590.
- Abbott KW. (2013) Strengthening the Transnational Regime Complex for Climate Change. *Transnational Environmental Law* 3: 57-88.
- Abbott KW, Green JF and Keohane RO. (2016b) Organizational Ecology and Institutional Change in Global Governance. *International Organization* 70: 247-277.
- Acuto M. (2013) The new climate leaders? *Review of International Studies* 39: 835-857.
- Acuto M. (2016) Give cities a seat at the top table. *Nature* 537: 611-613.
- Acuto M and Curtis S. (2018) The Foreign Policy of Cities. *The RUSI Journal*: 8-17.
- Acuto M, Morissette M and Tsouros A. (2017) City Diplomacy: Towards More Strategic Networking? Learning with WHO Healthy Cities. *Global Policy* 8: 14-22.
- Acuto M and Rayner S. (2016) City networks: breaking gridlocks or forging (new) lock-ins? *International Affairs* 92: 1147-1166.
- Allen CR and Holling CS. (2010) Novelty, Adaptive Capacity, and Resilience. *Ecology and Society* 15.
- Alter KJ and Meunier S. (2009) The Politics of International Regime Complexity. *Perspectives on Politics* 7: 13-24.
- America's Pledge. (2017) America's Pledge Phase 1 Report: States, cities, and businesses in the United States are stepping up on climate action. Available at: <https://www.bbhub.io/dotorg/sites/28/2017/11/AmericasPledgePhaseOneReportWeb.pdf>.

- Andonova L, Hale T and Roger C. (2017) National Policy and Transnational Governance of Climate Change: Substitutes or Complements? *International Studies Quarterly* 61: 253-268.
- Andonova LB. (2017) *Governance Entrepreneurs: International Organizations and the Rise of Global Public-Private Partnerships*, Cambridge: Cambridge University Press.
- Andonova LB, Betsill MM and Bulkeley H. (2009) Transnational Climate Governance. *Global Environmental Politics* 9: 52-73.
- Andonova LB and Mitchell RB. (2010) The Rescaling of Global Environmental Politics. *Annual Review of Environment and Resources* 35: 255-282.
- Anguelovski I and Carmin J. (2011) Something Borrowed, Everything New: Innovation and Institutionalization in Urban Climate Governance. *Current Opinion in Environmental Sustainability* 3: 169-175.
- Archer MS. (2010) Morphogenesis versus Structuration: On Combining Structure and Action. *The British Journal of Sociology* 33: 455-483.
- Archive I. (2019) *Wayback Machine*. Available at: <https://archive.org/web/>.
- Auld G, Mallett A, Burlica B, et al. (2014) Evaluating the effects of policy innovations: Lessons from a systematic review of policies promoting low-carbon technology. *Global Environmental Change* 29: 444-458.
- Axelrod R and Cohen MD. (1999) *Harnessing Complexity: Organizational Implications of a Scientific Frontier*, New York: The Free Press.
- Bäckstrand K. (2008) Accountability of Networked Climate Governance: The Rise of Transnational Climate Partnerships. *Global Environmental Politics* 8: 74-102.
- Bajaj V and Thompson SA. (2017) The Green Energy Revolution Will Happen Without Trump. *The New York Times*. Available at: <https://www.nytimes.com/interactive/2017/06/20/opinion/green-energy-revolution-trump.html?action=click&pgtype=Homepage&clickSource=story-heading&module=opinion-c-col-left-region®ion=opinion-c-col-left-region&WT.nav=opinion-c-col-left-region>.
- Bansard J, Widerberg O and Pattberg PH. (2017) Cities to the Rescue? Assessing the Performance of Transnational Municipal Networks in Global Climate Governance. *International Environmental Agreements: Politics, Law and Economics* 17: 229-246.
- Barabási A-L. (2002) *Linked: The New Science of Networks*, Cambridge: Perseus Pub.
- Barabási A-L. (2007) The Architecture of Complexity. From Network Structure to Human Dynamics. *IEEE Control Systems*. 33-42.
- Barbaro M. (2011) Bloomberg and Clinton to Merge Climate Groups. *The New York Times*.
- Barber BR. (2013) *If Mayors Ruled the World: Dysfunctional Nations, Rising Cities*, New Haven; London: Yale University Press.
- Barnett M and Finnemore M. (1999) The Politics, Power and Pathologies of International Organizations. *International Organization* 53: 699-732.
- Barnett M and Finnemore M. (2004) *Rules for the World: International Organizations in Global Politics*, Cornell: Cornell University Press.
- Barnett M and Sikkink K. (2008). From International Relations to Global Society. In Reus-Smit C and Snidal D. (eds) *The Oxford Handbook of International Relations*. Oxford: Oxford University Press, 62-83.
- Barrionuevo A. (2011) World Bank to Help Cities Control Climate Change. *The New York Times*. Available at: <https://www.nytimes.com/2011/06/02/science/earth/02climate.html>.

- Barry A. (2013) The Translation Zone: Between Actor-Network Theory and International Relations. *Millenium: Journal of International Studies* 41: 413-429.
- Baumgartner FR and Jones BD. (2002) Positive and negative Feedback in Politics. In: Baumgartner FR and Jones BD (eds) *Policy Dynamics*. Chicago: University of Chicago Press.
- Bellinson RG. (2018) Connecting the dots: The politics of governing urban climate adaptation innovations through transnational municipal networks. In Hughes S, Chu EK and Mason SG. (eds) *Climate Change in Cities: Innovations in Multi-Level Governance*. Cham: Springer, 183–202.
- Bellinson R and Chu E. (2019) Learning pathways and the governance of innovations in urban climate change resilience and adaptation. *Journal of Environmental Policy & Planning* 21: 76-89.
- Bennett A. (2010) Process Tracing and Causal Inference. In: Brady HE and Collier D (eds) *Rethinking Social Inquiry: Diverse Tools, Shared Standards*. 2nd ed. Lanham, MD: Roman and Littlefields.
- Bernstein S and Hoffmann M. (2018) The politics of decarbonization and the catalytic impact of subnational climate experiments. *Policy Sciences* 51: 189-211.
- Bernstein S, Lebow RN, Gross Stein J, et al. (2000) God Gave Physics the Easy Problems: Adapting Social Science to an Unpredictable World. *European Journal of International Relations* 6: 43-76.
- Berry FS and Berry WD. (2007) Innovation and Diffusion Models in Policy Research. In: Sabatier PA (ed) *Theories of the Policy Process*. 2nd ed. Boulder: Westview Press, 223-260.
- Betsill MM and Bulkeley H. (2004) Transnational Networks and Global Environmental Governance: The Cities for Climate Protection Program. *International Studies Quarterly* 48: 471-493.
- Betsill MM and Bulkeley H. (2006) Cities and the Multilevel Governance of Global Climate Change. *Global Governance* 12: 141-159.
- Betsill MM and Bulkeley H. (2007) Looking Back and Thinking Ahead: A Decade of Cities and Climate Change Research. *Local Environment: The International Journal of Justice and Sustainability* 12: 447-456.
- Bianconi G and Barabási A-L. (2001) Competition and multiscaling in evolving networks. *Europhysics Letters* 54: 436-442.
- Bloomberg. (2019a) *Bloomberg. Where data, people and ideas intersect*. Available at: <https://www.bloomberg.com/company/>.
- Bloomberg M. (2019b) I'm running for president. In: Bloomberg Newsletter Suscribers.
- Bloomberg M and Pope C. (2017) *Climate of Hope: How Cities, Businesses, and Citizens Can Save the Planet*, New York: St Martin's Press.
- Bloomberg M and Winkler M. (1999) *Bloomberg par Bloomberg*, Paris: Village Mondial.
- Bloomberg Philanthropies. (2013) *First Annual Letter on Philanthropy*. Bloomberg Philanthropies. Available at: https://www.who.int/tobacco/mpower/bloomberg_philanthropies_annual_updateL_1_tr_march_2013.pdf?ua=1.
- Boasson EL and Huitema D. (2017) Climate governance entrepreneurship: Emerging findings and a new research agenda. *Environment and Planning C: Politics and Space* 35: 1343-1361.

- Bodansky D. (2001) International law and the design of a climate change regime. In Luterbacher U and Sprinz DF. (eds) *International relations and global climate change*, Cambridge: MIT Press, 201-219.
- Böhmelt T and Spilker G. (2016) The interaction of international institutions from a social network perspective. *International Environmental Agreements: Politics, Law and Economics* 16: 67-89.
- Borgatti SP, Everett MG and Johnson JC. (2013) *Analyzing Social Networks*, London: SAGE Publications.
- Borgatti SP and Halgin DS. (2011) On Network Theory. *Organization Science* 22: 1168-1181.
- Borgatti SP, Mehra A, Brass DJ, et al. (2009) Network Analysis in the Social Sciences. *Science* 323: 892-895.
- Börzel TA and Risse T. (2010) Governance without a state: Can it work? *Regulation & Governance* 4: 113-134.
- Boulton JG, Allen PM and Bowman C. (2015) *Embracing complexity: Strategic perspectives for an age of turbulence*, Oxford: Oxford University Press.
- Bousquet A and Curtis S. (2011) Beyond models and metaphors: complexity theory, systems thinking and international relations. *Cambridge Review of International Affairs* 24.
- Bouteligier S. (2013a) *Cities, Networks, and Global Environmental governance. Spaces of Innovation, Places of Leadership*, New York: Routledge.
- Bouteligier S. (2013b) Inequality in new global governance arrangements: the North-South divide in transnational municipal networks. *Innovation: The European Journal of Social Science Research* 26: 251-267.
- Bouteligier S. (2014) A Networked Urban World. Empowering Cities to Tackle Environmental Challenges. In: Curtis S (ed) *The Power of Cities in International Relations*. London; New York: Routledge, 57-68.
- Brady HE and Collier D. (2010) *Rethinking Social Inquiry*. 2nd ed. Lanham: Rowman & Littlefield Publishers.
- Brandes U. (2016) Network positions. *Methodological Innovations* 9: 1-19.
- Brandes U, Borgatti SP and Freeman LC. (2016) Maintaining the duality of closeness and betweenness centrality. *Social Networks* 44: 153-159.
- Brandes U, Robins G, McCranie A, et al. (2013) What is network science? *Network Science* 1: 1-15.
- Brash J. (2012) The ghost in the machine: the neoliberal urban visions of Michael Bloomberg. *Journal of Cultural Geography* 29: 135-153.
- Brass DJ. (1984) Being in the Right Place: A Structural Analysis of Individual Influence in an Organization. *Administrative Science Quarterly* 29: 518-539.
- Braun B, Schindler S and Wille T. (2018) Rethinking agency in International Relations: performativity, performances and actor-networks. *Journal of International Relations and Development*.
- Bretherton C and Vogler J. (2013) A global actor past its peak? *International Relations* 27: 375-390.
- Brugmann J. (2018) *The 100RC CoLab: Enabling Collaboration and Innovation in Response to Complex Urban Challenges*. Available at: <https://www.100resilientcities.org/the-100rc-colab-enabling-collaboration-and-innovation-in-response-to-complex-urban-challenges/>.
- Bulkeley H. (2013) *Cities and climate change*, London: Routledge.

- Bulkeley H, Andonova L, Bäckstrand K, et al. (2012) Governing climate change transnationally: assessing the evidence from a database of sixty initiatives. *Environment and Planning C: Government and Policy* 30: 591-612.
- Bulkeley H, Andonova LB, Betsill MM, et al. (2014) *Transnational Climate Change Governance*, New York: Cambridge University Press.
- Bulkeley H, Castán-Broto V and Edwards GAS. (2015) *An urban politics of climate change: experimentation and the governing of socio-technical transitions*, New York; Abingdon: Routledge.
- Bulkeley H, Davies A, Evans B, et al. (2003) Environmental Governance and Transnational Municipal Networks in Europe. *Journal of Environmental Policy & Planning* 5: 235-254.
- Bulkeley H and Newell P. (2015) *Governing Climate Change*, New York: Routledge.
- Bulkeley H and Schroeder H. (2008) Governing Climate Change Post-2012: The Role of Global Cities - London. *Tyndall Centre for Climate Change Research Working Paper* 123: 1-20.
- Burch S, Hughes S, Romero-Lankao P, et al. (2018) Governing Urban Sustainability Transformations. In: Elmqvist T, Bai X, Frantzeskaki N, et al. (eds) *Urban Planet*, Cambridge: Cambridge University Press.
- Burt R. (1995) *Structural Holes. The Social Structure of Competition*, Cambridge: Harvard University Press.
- Burt RS. (2004) Holes and Good Ideas. *American Journal of Sociology* 110: 349-399.
- Burt RS. (2008) Structural Holes versus Network Closure as Social Capital. In: Lin N, Cook K and Burt RS (eds) *Social Capital. Theory and Research*. 4th ed. (1st ed.: 2001) New York: Routledge, 31-56.
- Busch H. (2015) Linked for action? An analysis of transnational municipal climate networks in Germany. *International Journal of Urban Sustainable Development* 7: 1-19.
- Busch H, Bendlin L and Fenton P. (2018) Shaping local response - The influence of transnational municipal climate networks on urban climate governance. *Urban Climate* 24: 221-230.
- C40. (2019a) *Networks*. Available at: <https://www.c40.org/networks>.
- C40. (2019b) *Programmes*. Available at: <https://www.c40.org/programmes>.
- Cao X and Ward H. (2017) Transnational Climate Governance Networks and Domestic Regulatory Action. *International Interactions* 43: 76-102.
- Carstensen MB. (2015) Conceptualising Ideational Novelty: A Relational Approach. *The British Journal of Politics & International Relations* 17: 284-297.
- Castells M. (2010) *The Rise of the Network Society*, Cambridge, MA: Blackwell Publishing.
- Chan DK-h. (2016) City diplomacy and "glocal" governance: revitalizing cosmopolitan democracy. *Innovation: The European Journal of Social Science Research* 29: 134-160.
- Chan S, van Asselt H, Hale T, et al. (2015) Reinvigorating International Climate Policy: A Comprehensive Framework for Effective Nonstate Action". *Global Policy*: 1-8.
- Chandler D and Hwang H. (2015) Learning From Learning Theory: A Model of Organizational Adoption Strategies at the Microfoundations of Institutional Theory. *Journal of Management* 41: 1446-1476.
- Charountaki M. (2018) State and non-state interactions in International Relations: an alternative theoretical outlook. *British Journal of Middle Eastern Studies* 45: 528-542.

- Clifton L. (2017) *Changing the world, 100 cities at a time*. Available at: <https://new.siemens.com/global/en/company/stories/infrastructure/how-to-make-cities-more-resilient.html>.
- Climate Mayors. (2017) *407 US Climate Mayors commit to adopt, honor and uphold Paris Climate Agreement goals*. Available at: <https://medium.com/@ClimateMayors/climate-mayors-commit-to-adopt-honor-and-uphold-paris-climate-agreement-goals-ba566e260097>.
- Coleman JS. (1988) Social Capital in the Creation of Human Capital. *American Journal of Sociology* 94: S95-S120.
- Colgan JD, Keohane RO and Van de Graaf T. (2012) Punctuated equilibrium in the energy regime complex. *Review of International Organizations* 7: 117-143.
- Coman R, Crespy A, Louault F, et al. (2016) *Méthodes de la science politique: De la question de départ à l'analyse des données*, Louvain-la-Neuve: De Boeck Supérieur.
- Crossan MM and Apaydin M. (2010) A Multi-Dimensional Framework of Organizational Innovation: A Systemic Review of the Literature. *Journal of Management Studies* 47: 1154-1191.
- Cudworth E and Hobden S. (2011) *Posthuman International Relations: Complexity, Ecologism and Global Politics*, London: Zed.
- Davidson K, Coenen L, Acuto M, et al. (2019) Reconfiguring urban governance in an age of rising city networks: A research agenda. *Urban Studies*: 1-16.
- Davidson K and Gleeson B. (2015) Interrogating Urban Climate Leadership: Toward a Political Ecology of the C40 Network. *Global Environmental Politics* 15: 21-38.
- Davies AR. (2005) Local action for climate change: transnational networks and the Irish experience. *Local Environment: The International Journal of Justice and Sustainability* 10: 21-40.
- Dawson RJ, Khan, MSA, Gornitz, V et al. (2018) Urban Areas in Coastal Zones. In: Rosenzweig, C, Solecki, W, Romero-Lankao, P et al. (eds) *Climate Change and Cities: Second Assessment Report of the Urban Climate Change Research Network*. New York: Cambridge University Press, 319-362.
- Dehon C, Droesbeke J-J and Vermandele C. (2008) *Éléments de statistique*, Bruxelles: Éditions de l'Université de Bruxelles.
- Dellas E, Pattberg P and Betsill MM. (2011) Agency in earth system governance: refining a research agenda. *International Environmental Agreements: Politics, Law and Economics* 11: 85-98.
- DiMaggio PJ and Powell WW. (1983) The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields. *American Sociological Review* 48: 147-160.
- Dolšák N and Prakash A. (2017) Join the Club: How the Domestic NGO Sector Induces Participation in the Covenant of Mayors Program. *International Interactions* 43: 26-47.
- Domorenok E. (2019) Voluntary instruments for ambitious objectives? The experience of the EU Covenant of Mayors. *Environmental Politics* 28: 293-314.
- Dorsch MJ and Flachsland C. (2017) A Polycentric Approach to Global Climate Governance. *Global Environmental Politics* 17: 45-64.
- Dorussen H, Gartzke EA and Westerwinter O. (2016) Networked international politics. *Journal of Peace Research* 53.

- Duit A and Galaz V. (2008) Governance and Complexity-Emerging Issues for Governance Theory. *Governance: An International Journal of Policy, Administration, and Institutions* 21: 311-335.
- Dzebo A and Stripple J. (2015) Transnational adaptation governance: An emerging fourth era of adaptation. *Global Environmental Change* 35: 423-435.
- Earnest DC and Rosenau JN. (2006) Signifying Nothing? Why Complex Systems Theory Tells Us So Little About Global Politics. In Harrison NE. (ed) *Complexity in World Politics: Concepts and Methods for a New Paradigm*. Albany: State University of New York Press, 143-163.
- Eliadis P, Hill MM and Howlett M. (2005) *Designing Government. From Instruments to Governance*, Montreal & Kingston: McGill - Queen's University Press.
- Elkins, Z. (2009). Constitutional Networks. In Kahler, M. (ed) *Networked Politics: Agency, Power, and Governance*, Ithaca: Cornell University Press, 43-63.
- Ellis DC. (2010) The Organizational Turn in International Organization Theory. *Journal of International Organizations Studies* 1: 11-28.
- Everett MG and Valente TW. (2016) Bridging, brokerage and betweenness. *Social Networks* 44: 202-208.
- Finnemore M and Sikkink K. (1998) International Norm Dynamics and Political Change. *International Organization* 52: 887-917
- Fitzgibbons J and Mitchell C. (2019) Just urban futures? Exploring equity in "100 Resilient Cities". *World Development* 122: 648-659.
- Flick U. (2014) *The SAGE Handbook of Qualitative Data Analysis*, London: SAGE.
- Florida R. (2017) The Economic Power of Cities Compared to Nations. *CityLab*. (accessed March 12, 2020). Available at: <https://www.citylab.com/life/2017/03/the-economic-power-of-global-cities-compared-to-nations/519294/>.
- Forbes. (2019) *Billionaires: The Richest People in the World*. Available at: <https://www.forbes.com/billionaires/#44e88a06251c>.
- Foundation Center. (2014) *Fiscal Totals of the 50 Largest Foundations in the U.S. by Total Giving, 2015*. Available at: <http://data.foundationcenter.org/#!/foundations/all/nationwide/top:giving/list/2015>.
- Frigotto ML. (2018) *Understanding Novelty in Organizations*, Cham: Palgrave Macmillan.
- Fuhr H, Hickmann T and Kern K. (2018) The role of cities in multi-level climate governance: local climate policies and the 1.5 °C target. *Current Opinion in Environmental Sustainability* 30: 1-6.
- Fünfgeld H. (2015) Facilitating local climate change adaptation through transnational municipal networks. *Current Opinion in Environmental Sustainability* 12: 67-73.
- Gadinger F and Peters D. (2016) Feedback loops in a world of complexity: a cybernetic approach at the interface of foreign policy analysis and international relations theory. *Cambridge Review of International Affairs* 29: 251-269.
- Gerrits L. (2012) *Punching Clouds: An Introduction to the Complexity of Public Decision-Making*, Litchfield Park: Emergent Publications.
- Giest S and Howlett M. (2013) Comparative Climate Change Governance: Lessons from European Transnational Municipal Network Management Efforts *Environmental Policy and Governance* 23: 341-353.
- Gilpin R. (1983) *War and Change in World Politics*, Cambridge: Cambridge University Press.

- Goddard SE. (2009) Brokering change: networks and entrepreneurs in international politics. *International Theory* 1: 249-281.
- Gordon D. (2016a) Lament for a network? Cities and networked climate governance in Canada. *Environment and Planning C: Politics and Space* 34: 529-545.
- Gordon D. (2016b) The Politics of Accountability in Networked Urban Climate Governance. *Global Environmental Politics* 16: 82-100.
- Gordon DJ. (2013) Between local innovation and global impact: cities, networks and the governance of climate change. *Canadian Foreign Policy Journal* 19: 288-307.
- Gordon DJ. (2018) Global urban climate governance in three and a half parts: Experimentation, coordination, integration (and contestation). *WIREs Clim Change* 9: 1-15.
- Gordon DJ. (2019) Unpacking Agency in Global Urban Climate Governance: City-Networks as Actors, Agents, and Arenas. In van der Heijden J, Bulkeley H and Certoma C. (eds) *Urban Climate Politics: Agency and Empowerment*, London: Cambridge University Press, 21-38.
- Gordon DJ and Johnson CA. (2017) The orchestration of global urban climate governance: conducting power in the post-Paris climate regime. *Environmental Politics* 26: 694-714.
- Gordon DJ and Johnson CA. (2018) City-networks, global climate governance, and the road to 1.5°C. *Current Opinion in Environmental Sustainability* 30: 35-41.
- Gore CD. (2010) The Limits and Opportunities of Networks: Municipalities and Canadian Climate Change Policy. *Review of Policy Research* 27: 27-46.
- Gould RV and Fernandez RM. (1989) Structures of Mediation: A Formal Approach to Brokerage in Transaction Networks. *Sociological Methodology* 19: 89-126.
- Gourevitch P. (1978) The Second Image Reversed: The International Sources of Domestic Politics. *International Organization* 32: 881-912.
- Granovetter MS. (1973) The Strength of Weak Ties. *American Journal of Sociology* 78: 1360-1380.
- Green JF. (2008) Delegation and Accountability in the Clean Development Mechanism: The New Authority of Non-State Actors. *Journal of International Law and International Relations* 4: 21-56.
- Green JF. (2013) Order out of Chaos: Public and Private Rules for Managing Carbon. *Global Environmental Politics* 13: 1-25.
- Green JF. (2017a) Policy entrepreneurship in climate governance: Toward a comparative approach. *Environment and Planning C: Politics and Space* 35: 1471-1482.
- Green JF. (2017b) The strength of weakness: pseudo-clubs in the climate regime. *Climatic Change* 144: 41-52.
- Greenstein FI and Polsby NW. (1975) *Strategies of Inquiry*, Reading, MA: Addison-Wesley.
- Gunitsky S. (2013) Complexity and theories of change in international politics. *International Theory* 5: 35-63.
- Gupta J. (2014) *The history of Global Climate Governance*, New York: Cambridge University Press.
- Gustavsson E, Elander I and Lundmark M. (2009) Multilevel Governance, Networking Cities, and the Geography of Climate Change Mitigation: Two Swedish Examples. *Environment and Planning C: Government and Policy* 27: 59-74.
- Haas P. (1989) Do regimes matter? Epistemic communities and Mediterranean pollution control. *International Organization* 43: 377-403.

- Haas P. (1992) Epistemic Communities and International Policy Coordination. *International Organization* 46: 1-35.
- Hafner-Burton E, Kahler M and Montgomery AH. (2009) Network Analysis for International Relations. *International Organization* 63: 559-592.
- Hafner-Burton E and Montgomery AH. (2006) Power Positions: International Organizations, Social Networks, and Conflict. *The Journal of Conflict Resolution* 50: 3-27.
- Hakelberg L. (2014) Governance by Diffusion: Transnational Municipal Networks and the Spread of Local Climate Strategies in Europe. *Global Environmental Politics* 14: 107-129.
- Hale T. (2016) "All Hands on Deck": The Paris Agreement and Nonstate Climate Action. *Global Environmental Politics* 16: 12-22.
- Hale T and Held D. (2012) Gridlock and Innovation in Global Governance: The Partial Transnational Solution *Global Policy* 3: 169-181.
- Hale T and Roger C. (2014) Orchestration and transnational climate governance. *The Review of International Organizations* 9: 59-82.
- Hall P. (2018) Wood and 100RC: Partnership Leading to Innovation. Available at: <https://100resilientcities.org/wood-and-100rc-partnership-leading-to-innovation/>.
- Harrison JR and McIntosh P. (1992) Using Social Learning Theory to Manage Organizational Performance. *Journal of Managerial Issues* 4: 84-105.
- Harrison NE and Singer JD. (2006) Complexity is more than systems theory. In Harrison NE. (ed) *Complexity in World Politics: Concepts and Methods of a New Paradigm*. Albany: State University of New York Press, 35-43.
- Haupt W and Coppola A. (2019) Climate governance in transnational municipal networks: advancing a potential agenda for analysis and typology. *International Journal of Urban Sustainable Development* 11: 123-140.
- Hawkins DG, Lake DA, Nielson DL, et al. (2006) *Delegation and Agency in International Organizations*, New York: Cambridge University Press.
- Heikkila T and Weible CM. (2018) A semiautomated approach to analyzing polycentricity. *Environmental Policy and Governance* 28: 308-318.
- Heikkinen M, Karimo A, Klein J, et al. (2020) Transnational municipal networks and climate change adaptation: A study of 377 cities. *Journal of Cleaner Production* 257.
- Heikkinen M, Ylä-Anttila T and Juhola S. (2019) Incremental, reformistic or transformational: what kind of change do C40 cities advocate to deal with climate change? *Journal of Environmental Policy & Planning* 21: 90-103.
- Heyvaert V. (2013) What's in a Name? The Covenant of Mayors as Transnational Environmental Regulation. *Review of European Community & International Environmental Law* 22.
- Hickmann T. (2015) *Rethinking Authority in Global Climate Governance: How transnational climate initiatives relate to the international climate regime*, New York: Routledge.
- Hill PS. (2011) Understanding global health governance as a complex adaptive system. *Global Public Health: An International Journal for Research, Policy and Practice* 6: 593-605.
- Hoffmann MJ. (2005) *Ozone depletion and climate change: constructing a global response*, Albany: State University of New York Press.
- Hoffmann MJ. (2011) *Climate Governance at the Crossroads; Experimenting with a Global Response after Kyoto*, New York: Oxford University Press, Inc.

- Hofstadter D. (2007) *I am A Strange Loop*, New York: Basic Books.
- Holling CS. (2001) Understanding the Complexity of Economic, Ecological, and Social Systems. *Ecosystems* 4: 390-405.
- Hollis M and Smith S. (1990) *Explaining and Understanding International Relations*, Oxford: Clarendon Press.
- Hollway J, Morin J-F and Pauwelyn J. (2020) Structural Conditions for Novelty: The Introduction of New Environmental Clauses to the Trade Regime Complex. *International Environmental Agreements: Politics, Law and Economics* 20: 61-83.
- Hood CC. (1986) *The Tools of Government*, Chatham, New Jersey: Chatham House Publishers, Inc.
- Hooghe L and Marks G. (2001) *Multi-Level Governance and European Integration*, Lanham: Rowman & Littlefield.
- Hooghe L and Marks G. (2003) Unraveling the Central State, but How? Types of Multi-level Governance. *American Political Science Review* 97: 233-243.
- Houston, 100RC and Shell. (2018) City of Houston Selected to Join 100 Resilient Cities Global Network. Available at: <https://100resilientcities.org/city-houston-selected-join-100-resilient-cities-global-network/>.
- Hsu A, Weinfurter A and Xu K. (2017) Aligning subnational climate actions for the new post-Paris climate regime. *Climatic Change* 142: 419-432.
- Hughes S, Chu EK and Mason SG. (2018) Climate Change in Cities: Innovations in Multi-Level Governance. *Urban Book Series*. Cham: Springer.
- Hussein K and Le Galès P. (2010) Exploring Governance in a Multi-Level Polity: A Policy Instruments Approach. *West European Politics* 33: 1-21.
- ICLEI. (2018) *2018 United Nations Climate Change Conference*. Available at: <http://www.cities-and-regions.org/cop24/#1543939201887-8b60e097-fe6d>.
- IPCC. (2018) *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty*.
- James P and Verrest H. (2015) Beyond the Network Effect: Towards an Alternative Understanding of Global Urban Organizations. In: Gupta J, Pfeffer K, Verrest H, et al. (eds) *Geographies of Urban Governance: Advanced Theories, Methods and Practices*. Cham: Springer International Publishing.
- Jänicke M. (2017) The Multi-level System of Global Climate Governance – the Model and its Current State. *Environmental Policy and Governance* 27: 108-121.
- Jänicke M and Wurzel RKW. (2019) Leadership and lesson-drawing in the European Union's multilevel climate governance system. *Environmental Politics* 28: 22-42.
- Jervis R. (1997) *System Effects: Complexity in Political and Social Life*, Princeton: Princeton University Press.
- Johnson C, Toly N and Schroeder H. (2015) *The Urban Climate Challenge: Rethinking the Role of Cities in the Global Climate Regime*. New York: Routledge.
- Johnson T. (2014) *Organizational Progeny: Why Governments are Losing Control over the Proliferating Structures of Global Governance*, Oxford: Oxford University Press.
- Jordan A and Huitema D. (2014) Policy innovation in a changing climate: Sources, patterns and effects. *Global Environmental Change* 29: 387-394.
- Jordan A, Huitema D, van Asselt H, et al. (2018) *Governing Climate Change: Polycentricity in Action?*, Cambridge: Cambridge University Press.

- Juhola S and Westerhoff L. (2011) Challenges of adaptation to climate change across multiple scales: a case study of network governance in two European countries. *Environmental Science & Policy* 14: 239-247.
- Kahler M. (ed) (2009) *Networked Politics: Agency, Power, and Governance*, Ithaca: Cornell University Press.
- Kavalski E. (2007) The fifth debate and the emergence of complex international relations theory: notes on the application of complexity theory to the study of international life. *Cambridge Review of International Affairs* 20: 435-454.
- Kavalski E. (2015) *World politics at the edge of chaos : reflections on complexity and global life*. Albany, NY: State University of New York Press, xi, 289 pages.
- Keck ME and Sikkink K. (1998) *Activists Beyond Borders: Advocacy Networks in International Politics*, Ithaca, NY: Cornell University Press.
- Keck ME and Sikkink K. (1999) Transnational Advocacy Networks in International and Regional Politics. *International Social Science Journal* 51: 89-101.
- Keiner M and Kim A. (2007) Transnational City Networks for Sustainability. *European Planning Studies* 15: 1369-1395
- Keohane RO and Victor DG. (2011) The Regime Complex for Climate Change. *Perspectives on Politics* 9: 7-23.
- Kern K. (2019) Cities as leaders in EU multilevel climate governance: embedded upscaling of local experiments in Europe. *Environmental Politics* 28: 125-145.
- Kern K and Alber G. (2008) Governing climate change in cities: Modes of urban climate governance in multilevel systems. *Proc. Organ. Econ. Co-Op. Dev. Conf. Competitive Cities and Climate Change*. Paris: OECD, 1-30.
- Kern K and Bulkeley H. (2009) Cities, Europeanization and Multi-level Governance: Governing Climate Change through Transnational Municipal Networks. *JCMS-JOURNAL OF COMMON MARKET STUDIES* 47: 309-332.
- Khan J. (2013) What role for network governance in urban low carbon transitions? *Journal of Cleaner Production* 50: 133-139.
- Kim RE. (2019) Is Global Governance Fragmented, Polycentric, or Complex? The State of the Art of the Network Approach. *International Studies Review*: 1-19.
- Kingdon JW. (1984) *Agendas, Alternatives, and Public Policies*, Boston: Little, Brown.
- Kivimaa P, Hildén M, Huitema D, et al. (2015) Experiments in climate governance – lessons from a systematic review of case studies in transition research. *SPRU Working Paper Series* 36.
- Koremenos B, Lipson C and Snidal D. (2001) The Rational Design of International Institutions. *International Organization* 55: 761-799.
- Krasner SD. (1984) Approaches to the State: Alternative Conceptions and Historical Dynamics. *Comparative Politics* 16: 223-246.
- Krause RM. (2011) Policy innovation, intergovernmental relations, and the adoption of climate protection initiatives by U.S. cities. *Journal of Urban Affairs* 33: 45-60.
- Kuyper JW and Bäckstrand K. (2016) Accountability and Representation: Nonstate Actors in UN Climate Diplomacy. *Global Environmental Politics* 16: 61-81.
- Kuyper JW, Bäckstrand K and Schroeder H. (2017) Institutional Accountability of Nonstate Actors in the UNFCCC: Exit, Voice, and Loyalty. *Review of Policy Research* 34: 88-109.
- Labaye A and Sauer T. (2013) *City networks and the socio-ecological transition: A European inventory*. Vienna: WWWforEurope.

- Lake DA and Powell R. (1999) *Strategic Choice and International Relations*, Princeton: Princeton University Press.
- Landauer M, Juhola S and Klein J. (2018) The role of scale in integrating climate change adaptation and mitigation in cities. *Journal of Environmental Planning and Management* 62: 741-765.
- Laosirihongthong T, Prajogo DI and Adebajo D. (2014) The relationships between firm's strategy, resources and innovation performance: resources-based view perspective. *Production Planning & Control* 24: 1231-1246.
- Lascoumes P. (2007) Les instruments d'action publique, traceurs de changement : l'exemple des transformations de la politique française de lutte contre la pollution atmosphérique (1961-2006). *Politique et Sociétés* 26: 73-89.
- Lascoumes P and Le Galès P. (2004) *Gouverner par les instruments*. Paris: Presses de Sciences Po.
- Latour B. (1996) On actor-network theory. A few clarifications plus more than a few complications. *Soziale Welt* 47: 369-381.
- Latour B. (2005) *Reassembling the Social: An Introduction to Actor-Network-Theory*, Oxford, New York: Oxford University Press.
- Lazer D. (2011) Networks in Political Science: Back to the Future. *PS: Political Science & Politics* 44: 61-68.
- Le Mens G, Hannan MT and Pólos L. (2015) Age-Related Structural Inertia: A Distance-Based Approach. *Organization Science* 26: 756-773.
- Le Prestre P. (2017) *Global Ecopolitics Revisited: Towards a complex governance of global environmental problems*, New York: Routledge.
- Lee RE. (2006) Complexity and the Social Sciences. *Review (Fernand Braudel Center)* 29: 115-134.
- Lee T. (2013) Global Cities and Transnational Climate Change Networks. *Global Environmental Politics* 13: 108-128.
- Lee T. (2015) *Global Cities and Climate Change. The Translocal Relations of Environmental Governance*, New York: Routledge.
- Lee T. (2018) Local energy agencies and cities' participation in translocal climate governance. *Environmental Policy and Governance*: 1-10.
- Lee T and Jung HY. (2018) Mapping city-to-city networks for climate change action: Geographic bases, link modalities, functions, and activity. *Journal of Cleaner Production* 182: 96-104.
- Lee T and Koski C. (2014) Mitigating Global Warming in Global Cities: Comparing Participation and Climate Change Policies of C40 Cities. *Journal of Comparative Policy Analysis: Research and Practice* 16: 475-492.
- Lee T and van de Meene S. (2012) Who teaches and who learns? Policy learning through the C40 cities climate network. *Policy Sciences* 45: 199-220.
- Leitner H, Sheppard E, Webber S, et al. (2018) Globalizing urban resilience. *Urban Geography* 39: 1276-1284.
- Lewis TG. (2009) *Network science: theory and practice*, Hoboken, NJ: Wiley.
- Lin J. (2018) *Governing Climate Change: Global Cities and Transnational Lawmaking*, Cambridge, New York: Cambridge University Press.
- Löblich M and Pfaff-Rüdiger S. (2011) Network analysis: A qualitative approach to empirical studies on communication policy. *International Communication Gazette* 73: 630-647.

- Löfqvist L. (2017) Product Innovation in Small Companies: Managing Resource Scarcity through Financial Bootstrapping. *International Journal of Innovation Management* 21.
- Mace G and Pétry F. (2000) *Guide d'élaboration d'un projet de recherche*, Québec: Presses de l'Université Laval.
- Mackie J. (1974) *The Cement of the Universe*, Oxford: Oxford University Press.
- Mahoney J and Barrenechea R. (2019) The logic of counterfactual analysis in case-study explanation. *The British Journal of Sociology* 70: 306-338.
- Maoz Z. (2011) *Networks of Nations: The Evolution, Structure, and Impact of International Networks, 1816–2001*, Cambridge: Cambridge University Press.
- Maoz Z. (2012) How Network Analysis Can Inform the Study of International Relations. *Conflict Management and Peace Science* 29: 247-256.
- Mathews KM, White MC and Long RG. (1999) Why Study the Complexity Sciences in the Social Sciences? *Human Relations* 52: 493-462.
- Mayer M. (2012) Chaotic Climate Change and Security. *International Political Sociology* 6: 165-185.
- McArdle A. (2014) Lessons for New York: Comparative urban governance and the challenge of climate change. *Fordham Urban Law Journal* 42: 91-122.
- McCarthy DDP, Crandall DD, Whitelaw GS, et al. (2011) A Critical Systems Approach to Social Learning: Building Adaptive Capacity in Social, Ecological, Epistemological (SEE) Systems. *Ecology and Society* 16.
- McGee ZA and Jones BD. (2019) Reconceptualizing the Policy Subsystem: Integration with Complexity Theory and Social Network Analysis. *Policy Studies Journal* 47: S138-S158.
- Miller JH and Page SE. (2007) *Complex adaptive systems : an introduction to computational models of social life*, Princeton, N.J: Princeton University Press.
- Miller TR, Wiek A, Sarewitz D, et al. (2014) The future of sustainability science: a solutions-oriented research agenda. *Sustainability Science* 9.
- Mintrom M. (1997) Policy Entrepreneurs and the Diffusion of Innovation. *American Journal of Political Science* 41: 738-770.
- Mintrom M and Luetjens J. (2017) Policy entrepreneurs and problem framing: The case of climate change. *Environment and Planning C: Politics and Space* 35: 1362-1377.
- Mitchell M. (2009) *Complexity : a guided tour*, New York, N.Y: Oxford University Press.
- Mocca E. (2017) City networks for sustainability in Europe: An urban-level analysis. *Journal of Urban Affairs* 39: 691-710.
- Moran D, Kanemoto K, Jiborn M, et al. (2018) Carbon footprints of 13,000 cities. *Environmental Research Letters* 13: 064041.
- Morçöl G. (2001) What Is Complexity Science? Postmodernist or Postpositivist? *Emergence: A Journal of Complexity Issues in Organizations and Management* 3: 104-119.
- Morçöl G. (2012) *A Complexity Theory for Public Policy*, New York: Routledge.
- Morçöl G and Wachhaus A. (2009) Network and Complexity Theories: A Comparison and Prospects for a Synthesis. *Administrative Theory & Praxis* 31: 44-58.
- Morin J-F and Orsini A. (2015) *Politique internationale de l'environnement*, Paris: Presses de Sciences Po.
- Morin J-F, Pauwelyn J and Hollway J. (2017) The Trade Regime as a Complex Adaptive System: Exploration and exploitation of environmental norms in trade agreements. *Journal of International Economic Law* 20: 365-390.

- Nasiritousi N, Hjerpe M and Linnér B-O. (2016) The roles of non-state actors in climate change governance: understanding agency through governance profiles. *International Environmental Agreements: Politics, Law and Economics* 16: 109-126.
- Newman M. (2010) *Networks: An Introduction*, New York: Oxford University Press.
- Nexon DH and Pouliot V. (2013) "Things of Networks": Situating ANT in International Relations. *International Political Sociology* 7: 342-345.
- Nielsen AB. (2019) Governing the transnational: Exploring the governance tools of 100 Resilient Cities. In Hoff J, Gausset Q and Lex S. (eds) *The Role of Non-State Actors in the Green Transition: Building a Sustainable Future*. New York: Routledge, 230-246.
- Nielsen AB and Papin M. (2020) The Hybrid Governance of Transnational Municipal Networks: Lessons from 100 Resilient Cities. *Environment and Planning C: Politics and Space*.
- Nieto MJ and Santamaría L. (2007) The importance of diverse collaborative networks for the novelty of product innovation. *Technovation* 27: 367-377.
- Nijman J. (2016) Renaissance of the City as Global Actor The role of foreign policy and international law practices in the construction of cities as global actors. *ASSER research paper*. ASSER Institute, 1-35.
- Oberthür S. (2016) Reflections on Global Climate Politics Post Paris: Power, Interests and Polycentricity. *The International Spectator: Italian Journal of International Affairs* 51: 80-94.
- Oberthür S and Stokke OS. (2011) *Managing Institutional Complexity: Regime Interplay and Global Environmental Change*, Cambridge: MIT Press.
- Ognyanova K. (2016) Network Analysis and Visualization with R and igraph: NetSci X Tutorial. Available at: <https://kateto.net/networks-r-igraph>.
- Orsini A, Le Prestre P, Haas PM, et al. (2019) Forum: Complex Systems and International Governance. *International Studies Review*: 1-31.
- Orsini A, Morin J-F and Young OR. (2013) Regime Complexes: A Buzz, a Boom or a Boost for Global Governance? *Global Governance* 19: 27-39.
- Ostrom E. (2010) Polycentric systems for coping with collective action and global environmental change. *Global Environmental Change* 20: 550-557.
- Padgett JF and McLean PD. (2006) Organizational Invention and Elite Transformation: The Birth of Partnership Systems in Renaissance Florence. *American Journal of Sociology* 111: 1463–1568.
- Padgett JF and Powell WW. (2012) *The Emergence of Organizations and Markets*, Princeton: Princeton University Press.
- Pahl-Wostl C. (2007) The implications of complexity for integrated resources management. *Environmental Modelling & Software* 22: 561-569.
- Pal LA. (2006) *Beyond Policy Analysis. Public Issue Management in Turbulent Times*, Toronto: Nelson Education.
- Papin M. (2019) Transnational Municipal Networks: Harbingers of Innovation for Global Adaptation Governance? *International Environmental Agreements: Politics, Law and Economics* 19: 467-483.
- Papin M. (2020) Where Do Novelties Come From? A Social Network Analysis of Transnational Municipal Networks in Global Climate Governance. *Earth System Governance*.

- Parvez M, Hazelton J and Guthrie J. (2019) Greenhouse gas emissions disclosure by cities: the expectation gap. *Sustainability Accounting, Management and Policy Journal* 10: 685-709.
- Paterson M, Hoffmann M, Betsill MM, et al. (2014) The Micro Foundations of Policy Diffusion Toward Complex Global Governance: An Analysis of the Transnational Carbon Emission Trading Network. *Comparative Political Studies* 47: 420-449.
- Pattberg P. (2017) The emergence of carbon disclosure: Exploring the role of governance entrepreneurs. *Environment and Planning C: Politics and Space* 0: 1-19.
- Pattberg P. (2010). The role and relevance of networked climate governance. In Biermann F, Pattberg P and Zelli F. (eds) *Global Climate Governance Beyond 2012; Architecture, Agency and Adaptation*. Cambridge: Cambridge University Press, 146-164.
- Pattberg P and Widerberg O. (2019) Smart Mixes and the Challenge of Complexity: Lessons from Global Climate Governance. In van Erp J, Faure M, Nollkaemper A, et al. (eds) *Smart Mixes for Transboundary Environmental Harm*. Cambridge: Cambridge University Press, 49-68.
- Payre R. (2010) The Importance of Being Connected. City Networks and Urban Government: Lyon and Eurocities (1990-2005). *International Journal of Urban and Regional Research* 34: 260-280.
- Perry BL, Pescosolido BA and Borgatti SP. (2018) *Egocentric Network Analysis: Foundations, Methods, and Models*, Cambridge: Cambridge University Press.
- Peters BG and Pierre J. (2015) Governance and policy problems: instruments as unitary and mixed modes of policy intervention. *Asia Pacific Journal of Public Administration* 37: 224-235.
- Pina e Cunha M, Rego A, Oliveira P, et al. (2013) Product Innovation in Resource-Poor Environments: Three Research Streams. *The Journal of Product Innovation Management* 31: 202-210.
- Pouliot V. (2010) The materials of practice: Nuclear warheads, rhetorical commonplaces and committee meetings in Russian–Atlantic relations. *Cooperation and Conflict* 45: 294-311.
- Powell WW. (1990) Neither Market nor Hierarchy: Network Forms of Organization. *Research in Organizational Behavior* 12: 295-336.
- Powell WW. (2017) A sociologist looks at crowds: Innovation or invention? *Strategic Organization* 15: 289-297.
- Powell WW, Koput KW and Smith-Doerr L. (1996) Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology. *Administrative Science Quarterly* 41: 116-145.
- Rabe BG. (2007) Beyond Kyoto: Climate Change Policy in Multilevel Governance Systems. *Governance: An International Journal of Policy, Administration, and Institutions* 20: 423-444.
- Rashidi K and Patt A. (2018) Subsistence over symbolism: the role of transnational municipal networks on cities' climate policy innovation and adoption. *Mitigation and Adaptation Strategies for Global Change* 23: 507-523.
- Raustiala K and Victor DG. (2004) The Regime Complex for Plant Genetic Resources. *International Organization* 58: 277-309.
- Reus-Smit C and Snidal D. (eds) *The Oxford Handbook of International Relations*, Oxford: Oxford University Press.

- Reckien D, Flacke J, Olazabal M, et al. (2015) The Influence of Drivers and Barriers on Urban Adaptation and Mitigation Plans—An Empirical Analysis of European Cities *PLoS ONE* 10: 1-21.
- Risse-Kappen T. (1995) *Bringing Transnational Relations Back In: Non-State Actors, Domestic Structures and International Institutions*, Cambridge: Cambridge University Press.
- Rissman AR, Burke KD, Canfield Kramer HA, et al. (2018) Forest management for novelty, persistence, and restoration influenced by policy and society. *Frontiers in Ecology and the Environment* 16: 454-462.
- Rockefeller Foundation. (2019a) *The Bellagio Center Conference Program*. Available at: <https://www.rockefellerfoundation.org/our-work/bellagio-center/conferences/>.
- Rockefeller Foundation. (2019b) *Climate and Resilience*. Available at: <https://www.rockefellerfoundation.org/our-work/topics/climate-resilience/>.
- Rockefeller Foundation. (2019c) *The Rockefeller Foundation Launches New Climate and Resilience Initiative; Commits An Initial \$8 Million To Continue Supporting Global Network Of Cities And Chief Resilience Officers*. Available at: <https://www.rockefellerfoundation.org/about-us/news-media/rockefeller-foundation-launches-new-climate-resilience-initiative-commits-initial-8-million-continue-supporting-global-network-cities-chief-resilience-officers/>.
- Rogers EM. (2003) *Diffusion of Innovations*, New York; Toronto: Free Press.
- Román M. (2010) Governing from the middle: the C40 Cities Leadership Group. *Corporate Governance: The international journal of business in society* 10: 73-84.
- Romero-Lankao P, Hardoy J, Hughes S, et al. (2015) Multilevel Governance and Institutional Capacity for Climate Change Responses in Latin American Cities. In: Johnson C, Toly N and Schroeder H (eds) *The Urban Climate Challenge: Rethinking the Role of Cities in the Global Climate Regime*. New York: Routledge, 181-204.
- Rosenau J. (1995) Governance in the Twenty-first Century. *Global Governance* 1: 13-43.
- Rosenau J. (2003) *Distant proximities: dynamics beyond globalization*, Princeton: Princeton University Press.
- Rosenau JN. (1990) *Turbulence in World Politics: A Theory of Change and Continuity*, Princeton: Princeton University Press.
- Ruggie J. (1993) Territoriality and Beyond: Problematizing Modernity in International Relations. *International Organization* 47: 139-174.
- Sabatier PA. (1988) An advocacy coalition framework of policy change and the role of policy-oriented learning therein. *Policy Sciences* 21: 129-168.
- Saito K, Kimura M, Ohara K, et al. (2016) Super mediator – A new centrality measure of node importance for information diffusion over social network. *Information Sciences* 329: 985-1000.
- Sartori G. (1970) Concept Misformation in Comparative Politics. *The American Political Science Review* 64: 1033-1053.
- Sassen S. (1991) *The Global City: New York, London, Tokyo*, Princeton, N.J: Princeton University Press.
- Scherer M. (2019) Former New York mayor Mike Bloomberg files papers to join Democratic race for president. *The Washington Post*. Available at: https://www.washingtonpost.com/politics/former-new-york-mayor-mike-bloomberg-files-papers-to-join-democratic-race-for-president/2019/11/21/80300b16-0a38-11ea-bd9d-c628fd48b3a0_story.html.

- Scott J and Carrington PJ. (2011) *The SAGE Handbook of Social Network Analysis*. Los Angeles: SAGE.
- Selin H and VanDeveer SD. (2009) *Changing Climates in North American Politics: Institutions, Policymaking and Multilevel Governance*. Cambridge, MA: MIT Press.
- Sherman G. (2012) *The Mayor of Mayors*. *New York Magazine*. New York.
- Sikkink, K. (2009) The Power of Networks in International Politics. In Kahler, M. (ed) *Networked Politics: Agency, Power, and Governance*. Ithaca: Cornell University Press, 228–47.
- Simon HA. (1962) The Architecture of Complexity. *Proceedings of the American Philosophical Society* 106, 467-482.
- Slaughter A-M. (2004) Disaggregated sovereignty: Towards the Public Accountability of Global Government Networks. *Government and Opposition* 39: 159-190.
- Smeds E and Acuto M. (2018) Networking Cities after Paris: Weighing the Ambition of Urban Climate Change Experimentation. *Global Policy* 9: 549-559.
- Smith A, Voß J-P and Grin J. (2010) Innovation studies and sustainability transitions: The allure of the multi-level perspective and its challenges. *Research Policy* 39: 435-448.
- Somekh B and Lewin C. (2011) *Theory and Methods in Social Research*. 2nd ed. London: SAGE.
- Spaans M and Waterhout B. (2017) Building up resilience in cities worldwide – Rotterdam as participant in the 100 Resilient Cities Programme. *Cities* 61: 109-116.
- Statista. (2020) *Euro (EUR) to U.S. dollar (USD) annual average exchange rate from 1999 to 2019*. Available at: <https://www.statista.com/statistics/412794/euro-to-u-s-dollar-annual-average-exchange-rate/>.
- Steinbruner JD. (1974) *The Cybernetic Theory of Decision*, Princeton: Princeton University Press.
- Steinhauer J. (2006) Twins, Not Really. But Not Far Off. *The New York Times*. Available at: <https://www.nytimes.com/2006/10/15/weekinreview/15stein.html>.
- Stevenson H. (2018) *Global Environmental Politics: Problems, Policy and Practice*, Cambridge: Cambridge University Press.
- Strang D and Soule SA. (1998) Diffusion in Organizations and Social Movements: From Hybrid Corn to Poison Pills. *American Review of Sociology* 24: 265-290.
- Strumsky D and Lobo J. (2015) Identifying the sources of technological novelty in the process of invention. *Research Policy* 44: 1445-1461.
- Tan J, Shao Y and Li W. (2013) To be different, or to be the same? An exploratory study of isomorphism in the cluster. *Journal of Business Venturing* 28: 83-97.
- Tan J, Zhang H and Wang L. (2015) Network Closure or Structural Hole? The Conditioning Effects of Network-Level Social Capital on Innovation Performance. *Entrepreneurship Theory and Practice* 39: 1189-1212.
- Termeer CJAM, Dewulf A and van Lieshout M. (2010) Disentangling Scale Approaches in Governance Research: Comparing Monocentric, Multilevel, and Adaptive Governance. *Ecology and Society* 15: online.
- Toly NJ. (2008) Transnational Municipal Networks in Climate Politics: From Global Governance to Global Politics. *Globalizations* 5: 341-356.
- Tormos-Aponte F and García-López GA. (2018) Polycentric struggles: The experience of the global climate justice movement. *Environmental Policy and Governance* 28: 284-294.

- Tosun J and Leopold L. (2019) Aligning Climate Governance with Urban Water Management: Insights from Transnational City Networks. *Water* 11.
- Tozer L and Klenk N. (2019) Urban configurations of carbon neutrality: Insights from the Carbon Neutral Cities Alliance. *Environment & Planning C-Politics and Space* 37: 539-557.
- UNFCCC. (2017) *Initiatives in the area of human settlements and adaptation*. Bonn: UNFCCC, 29.
- UN-Habitat. (2020) *Climate Change*. Available at: <https://unhabitat.org/topic/climate-change>.
- United Nations. (2018) *The World's Cities in 2018—Data Booklet*. United Nations, Department of Economic and Social Affairs.
- Valente TW and Fujimoto K. (2010) Bridging: Locating critical connectors in a network. *Social Networks* 32: 212-220.
- van der Heijden J. (2018) City and Subnational governance: High Ambitions, Innovative Instruments and Polycentric Collaborations? In Jordan A, Huitema D, van Asselt H, et al. (eds) *Governing Climate Change: Polycentricity in Action?*, Cambridge: Cambridge University Press, 81-96.
- van der Heijden J. (2019) Studying urban climate governance: Where to begin, what to look for, and how to make a meaningful contribution to scholarship and practice. *Earth System Governance*, 1.
- van der Heijden J, Bulkeley H and Certomà C. (2019) *Urban Climate Politics: Agency and Empowerment*, Cambridge: Cambridge University Press.
- van der Ven H, Bernstein S and Hoffmann M. (2017) Valuing the Contributions of Non-State and Subnational Actors to Climate Governance. *Global Environmental Politics* 17: 1:20.
- Voß J-P. (2007) Innovation processes in governance: the development of 'emissions trading' as a new policy instrument. *Science and Public Policy* 34: 329-343.
- Voß J-P and Simons A. (2014) Instrument constituencies and the supply side of policy innovation: the social life of emissions trading. *Environmental Politics* 23: 735-754.
- Waldrop MM. (1992) *Complexity. The Emerging Science at the Edge of Order and Chaos*, New York: Simon & Schuster Paperbacks.
- Walker JL. (1969) The Diffusion of Innovations among the American States. *The American Political Science Review* 63: 880-899.
- Wallerstein I. (2004) *World-Systems Analysis: An Introduction*, Durham, London: Duke University Press.
- Waltz KN. (1979) *Theory of International Politics*, Reading: Addison-Wesley.
- Ward MD, Stovel K and Sacks A. (2011) Network Analysis and Political Science. *Annual Review of Political Science* 14: 245-264.
- Wasserman S and Faust K. (1994) *Social Network Analysis: Methods and Applications*, Cambridge, New York, Melbourne: Cambridge University Press.
- Watts DJ. (2004) The "New" Science of Networks. *Annual Review of Sociology* 30: 243-270.
- Watts M. (2015) It's Not Where You're From, It's Where You're At. *Architectural Design* 85: 56-61.
- Watts M and van Begin G. (2016) The Global Covenant of Mayors for Climate & Energy: the next frontier for cities and towns leading the way. *CityTalk*. Available at: <https://talkofthecities.iclei.org/the-global-covenant-of-mayors-for-climate-energy-the-next-frontier-for-cities-and-towns-leading-the-way/>.

- Wendt A. (1987) The Agent-Structure Problem in International Relations Theory. *International Organization* 41: 335-370.
- Wendt A. (1992) Anarchy is What States Make of It: The Social Construction of Power Politics. *International Organization* 46: 391-425.
- Widerberg, OE. (2016). Mapping institutional complexity in the Anthropocene: A network approach. In Pattberg P and Zelli F. (2016) *Environmental Politics and Governance in the Anthropocene: Institutions and legitimacy in a complex world*. New York: Routledge.
- Wight C. (2006) *Agents, Structures and International Relations: Politics as Ontology*, New York: Cambridge University Press.
- Wight, C. (2013) Philosophy of Social Science and International Relations. In Carlsnaes W, Risse T and Simmons BA. (eds) *Handbook of International Relations*. London: SAGE, 29-56.
- WorldAtlas. (2018) *The 150 Largest Cities In The World*. Available at: <https://www.worldatlas.com/citypops.htm>.
- Yin RK. (2009) *Case Study Research: Design and Methods*, Thousand Oaks: CA: SAGE.
- Youatt R. (2014) Interspecies Relations, International Relations: Rethinking Anthropocentric Politics. *Millenium* 43: 207-223.
- Youatt R. (2017) Personhood and the Rights of Nature: The New Subjects of Contemporary Earth Politics. *International Political Sociology* 11: 39-54.
- Young OR. (2017) *Governing Complex Systems: Social Capital for the Anthropocene*, Cambridge: The MIT Press.
- Zhukov YM and Stewart BM. (2013) Choosing Your Neighbors: Networks of Diffusion in International Relations. *International Studies Quarterly* 57: 271-287.

Appendix A Presentation of interviews

#	Organisation	Role	TMNs to which it is related (according to 2016-18 data)	Date	Place
1	Covenant of Mayors	TMN	Energy Cities, Climate Alliance, Eurocities	Nov. 8, 2017	Skype
2	ICLEI	TMN	C40, Metropolis, 100RC, Eurocities, Polis, Covenant of Mayors	Nov. 9, 2017	COP23, Bonn (Germany)
3	ICLEI	TMN	C40, Metropolis, 100RC, Eurocities, Polis, Covenant of Mayors	Dic. 22, 2017	Skype
4	Global Covenant of Mayors	TMN Partner	Covenant of Mayors, Energy Cities, Climate Alliance, Eurocities	Dic. 22, 2017	Skype
5	100RC	TMN	ICLEI, C40	Jan. 18, 2018	Skype
6	Agencia de Resiliencia de la Ciudad de México	TMN Member	ICLEI, C40, Metropolis, MUFPP, GCCP	Jul. 16, 2018	Mexico City
7	Climate Alliance	TMN	Covenant of Mayors, Eurocities	Dic. 1, 2018	Skype
8	Climate Alliance	TMN	Covenant of Mayors, Eurocities	Dic. 7, 2018	COP24, Katowice (Poland)
9	City of Mannheim	TMN member	ICLEI, Climate Alliance, Eurocities, Covenant of Mayors	Dic. 12, 2018	COP24, Katowice (Poland)
10	Eurocities	TMN	Polis, Covenant of Mayors	Dic. 19, 2018	Skype
11	Climate Alliance	TMN	Covenant of Mayors, Eurocities	Dic. 21, 2018	Skype
12	C40	TMN	CNCA, Metropolis, MUFPP, ICLEI, 100RC	Jan. 9, 2019	Skype

13	C40	TMN	CNCA, Metropolis, MUFPP, ICLEI, 100RC	Jan. 10, 2019	Skype
14	nrg4sd	TMN partner	ICLEI	Jan. 16, 2019	Skype
15	100RC	TMN	ICLEI, C40	Feb. 7, 2019	Skype
16	Bureau de la transition écologique et de la résilience de Montréal	TMN member	100RC, C40, ICLEI, Metropolis, MUFPP	Jun. 20, 2018	Montréal
17	Bureau des relations internationales de Montréal	TMN member	100RC, C40, ICLEI, Metropolis, MUFPP	Jul. 9, 2019	Montréal
18	Maison de l'innovation sociale	TMN partner	100RC	Jul. 9, 2019	Montréal

Appendix B Data collection strategy for missing data

Interactions dataset

TMN	Information on cities	Information on partners
CNCA	2018 Website	Website and Wayback Machine
MUFPP	2018 Website	Website and Wayback Machine
100RC	2018 Website	Website and Wayback Machine
CoM	2018 Website	Website, Wayback Machine and Twitter because of a lack of information on the website
C40	2018 Website	Website and Wayback Machine
CIVITAS	2018 Website	Website and Wayback Machine
GCCP	2018 Website	Website, Wayback Machine and Twitter because of a lack of information on the website
AllAlps	2018 Website	Website and Wayback Machine
ICLEI	2018 Website	Website, Wayback Machine and Twitter because of a lack of information on the website created in 2018
UBC	2018 Website	Website and Wayback Machine
EnCit	2018 Website	Website and Wayback Machine
ClimA	2018 Website	Website, Wayback Machine and Twitter because of a lack of information on the website
Polis	2018 Website	Website, Wayback Machine and Twitter because of a lack of information on the website
EuCit	2018 Website	Website, Wayback Machine and Twitter because of a lack of information on the website
Metropolis	2018 Website	Website, Wayback Machine and Twitter because of a lack of information on the website

Governance tools dataset

TMN	Governance tools data collection
CNCA	2018 Website, annual reports, and general Internet search for more information.
MUFPP	2018 Website, and general Internet search for more information. Twitter search because of a lack of information on the website and annual reports.
100RC	2018 Website, and general Internet search. Few annual reports.
CoM	2019 Website, and general Internet search for more information. Few annual reports. Wayback Machine.
C40	2018 Website, and general Internet search for more information. Few annual reports. Wayback Machine.
CIVITAS	2019 Website, and general Internet search for more information. No annual report. Wayback Machine.
GCCP	2019 Website, and general Internet search for more information. Few annual reports. Wayback Machine.
AllAlps	2019 Website, and general Internet search for more information. No annual report. Wayback Machine. No Twitter page, but use of a Facebook page. Wayback Machine.
ICLEI	2018 Website. Annual reports. Wayback Machine.
UBC	2019 Website and website of the sustainability commission. No annual report. Wayback Machine.
EnCit	2019 Website, and general Internet search for more information. Few annual reports. Wayback Machine.
ClimA	2019 Website, and general Internet search for more information. Few annual reports. Wayback Machine.
Polis	2019 Website, and general Internet search for more information. No annual report. Wayback Machine.
EuCit	2019 Website, and general Internet search for more information. Few annual reports. Wayback Machine.
Metropolis	2019 Website and prior website. Twitter search because of a lack of information on the website. Annual reports. Wayback Machine.

Appendix C Novel TMN governance instruments¹⁰⁹

TMN	Tool's name	Year	Main issue	Form	RS	Fund	Act	NS	CB	IS	Oblig	Commit	Direct	Non-mb
Metrop	Statutes	1985	urb. issues	agreem.	1	0	0	0	0	1	1	1	1	0
Metrop	Annual meeting/ world congress	1985	urb, issues	event	0	0	0	1	0	1	0	0	1	1
Metrop	Standing commissions	1990	urb. issues	comm.	0	0	0	0	0	1	0	1	0	0
ICLEI	World Congress	1990	sustain.	event	0	0	0	1	0	1	0	0	1	0
ICLEI	ICLEI charter	1990	sustain.	agreem.	1	0	0	0	0	1	1	1	1	1
ClimA	Climate Alliance Manifesto	1990	CC	agreem.	1	0	0	1	0	1	1	1	1	0
ICLEI	Urban CO2 Reduction Project	1991	CC	progr.	0	0	0	1	0	1	0	1	0	0
ICLEI	International Training Center	1992	sustain.	comm.	0	0	0	1	1	1	0	0	1	1
ICLEI	CCP campaign	1993	CC	progr.	0	0	0	1	1	1	0	1	0	1
ICLEI	ICLEI meeting	1993	sustain.	event	0	0	0	0	0	1	0	0	1	0
ICLEI	Municipal Leaders' Summit on Climate Change and the Urban Environment	1993	CC	event	0	0	0	0	0	1	0	0	1	1
ICLEI	Local Agenda 21 Model Communities Program	1994	sustain.	progr.	0	0	0	1	0	1	0	1	0	1
ICLEI	Green Fleets initiative	1994	transport.	progr.	0	0	0	1	1	1	0	1	0	0
ICLEI	Nagoya Declaration	1997	CC	agreem.	0	0	0	1	0	1	0	1	1	1
ICLEI	Sustainable Santiago training	1997	sustain.	work.	0	0	0	1	1	1	0	1	1	0
ICLEI	LA 21 Charters Project	1997	sustain.	progr.	0	1	0	1	1	1	0	1	0	1
ICLEI	LA 21 Charter	1997	sustain.	agreem.	1	0	0	0	0	0	0	1	1	1
ICLEI	ICLEI Members on Stage	1998	sustain.	progr.	0	0	0	0	0	1	0	0	0	0
UBC	Turku statement	1998	sustain.	agreem.	1	0	0	1	0	1	0	1	1	1

¹⁰⁹ The binary code (0, 1) indicates whether the instrument has (1) or not (0) a governance characteristic. The concatenation of zeros and ones allowed the identification of the 62 novelties. RS stands for rule-setting, fund for funding, act for direct action, NS for norm-setting, CB for capacity building, IS for information sharing, oblig for obligation, commit for commitment, direct for directness, non-mb for non-members, sustain. sustainability, CC for climate change, urb. for urban, transport. for transportation, bio. div. for biological diversity, transform. for transformational, secu. for security, progr. for programme, netw. for network, comm. for committee, work. for workshop, guide. for guidelines, platf. for platform, agreem. for agreements, compet. for competition, and camp. for campaign.

UBC	Best City Practices workshop	2000	sustain.	work.	0	0	0	1	0	1	0	1	1	0
AllAlps	Concours commune de l'avenir	2001	sustain.	award	0	1	0	1	0	1	0	0	1	1
UBC	INTEGAIRE	2002	air quality	netw.	0	0	0	0	0	1	0	0	0	1
CIVITAS	CIVITAS annual meeting	2002	transport.	event	0	0	0	1	0	1	1	0	1	0
UBC	Baltic University Urban Forum	2003	sustain.	netw.	0	0	0	0	0	1	0	1	0	1
AllAlps	DYNALP project	2003	sustain.	progr.	0	1	0	0	0	1	0	1	0	1
EnCit	Display	2003	energy	camp.	1	0	0	1	0	1	0	1	0	1
C40	C40 Summit	2005	CC	event	0	0	0	0	0	1	1	0	1	1
GCCP	Projects framework	2005	sustain.	guide.	0	0	0	1	0	0	1	0	0	0
GCCP	Local secretariat	2005	sustain.	comm.	0	0	0	1	0	1	1	0	0	0
ClimA	Climate Compass	2006	CC	platf.	0	0	0	1	0	1	0	0	0	1
EnCit	Energy and climate discussion list	2007	CC	netw.	0	0	0	0	0	1	0	1	1	1
EnCit	Action workshops	2007	CC	work.	0	0	0	1	1	1	0	1	1	1
CIVITAS	CIVITAS Caravel Telematics Workshop	2007	transport.	work.	0	0	0	1	1	1	0	0	1	0
CIVITAS	Civitas Thematic Leadership	2007	sustain.	label	1	0	0	1	0	1	0	1	1	0
ClimA	ECOREgion	2008	CC	guide.	0	0	0	1	0	0	0	0	0	1
CoM	Action plan	2008	CC	plan	0	0	0	1	0	1	1	1	0	0
C40	Workshop on airports and climate	2008	transport.	work.	0	0	0	1	1	1	1	0	1	0
CoM	Covenant of Mayors Technical Workshops	2009	CC	work.	0	0	0	0	1	1	0	0	1	1
CoM	Template for Sustainable Energy Action Plans	2009	CC	guide.	0	0	0	1	0	1	1	0	0	1
CoM	Benchmark of Excellence	2010	CC	label	0	0	0	1	0	1	0	0	0	0
ClimA	Coaching Kommunalen Klimaschutz consultations	2010	CC	progr.	0	0	0	0	1	1	0	0	1	0
C40	Networks	2011	CC	netw.	0	0	0	1	0	1	1	1	0	1
C40	Hybrid and electric bus program	2011	transport.	progr.	0	0	1	1	0	1	0	1	0	0

AllAlps	DynAlp-Climate project	2011	sustain.	progr.	0	1	0	0	0	1	0	0	1	1
UBC	PURE investments	2011	water	grant	0	1	0	1	0	1	0	1	0	1
C40	Global Protocol for Community-scale GHG Emission Inventories (cf ICLEI)	2012	CC	guide.	0	0	0	1	0	0	1	0	0	1
C40	City Climate Leadership Awards	2013	CC	award	0	0	0	1	0	0	0	0	1	0
EnCit	Assessment grid	2013	energy	guide.	0	0	0	1	0	0	0	1	1	1
ICLEI	EcoMobility Festival	2013	transport.	event	0	0	1	1	0	0	0	0	0	1
100RC	Platform of Partners	2013	resilience	netw.	0	1	0	0	0	1	0	0	0	0
100RC	Chief Resilience Officer	2013	resilience	position	0	1	0	1	0	0	1	1	0	0
Metrop	Urban Innovation Community	2014	urb. issues	progr.	0	0	0	0	1	1	0	0	0	1
AllAlps	Shaping Alpine Future	2014	sustain.	guide.	0	1	0	0	0	1	0	0	0	1
ClimA	CITYNVEST Self-assessment tool	2015	CC	guide.	0	0	0	1	0	0	0	0	1	1
ICLEI	Transformative Action Program	2015	transform. change	compet.	0	0	0	1	1	1	0	0	0	1
MUFPP	Milan Pact Awards	2016	food secu.	award	0	1	0	1	0	1	0	0	1	0
ClimA	Climate-friendly investments	2018	CC	netw.	0	0	0	0	1	1	0	0	0	0
CIVITAS	Metamorphosis vision building action	2018	sustain.	action	0	0	1	0	0	1	0	0	1	1
CIVITAS	Sunrise Take-up Cities group	2018	transport.	netw.	0	0	0	0	1	1	0	1	0	1
CIVITAS	GreenCharge	2018	transport.	progr.	0	0	1	0	1	1	0	0	1	1
AllAlps	BeeAware	2018	bio. diversity	progr.	0	0	0	1	1	1	0	0	0	0
ICLEI	Urban Transitions forum	2018	sustain.	event	0	0	0	1	1	1	1	0	1	1