

Transnational cities: climate change and the strategic use of European networks

1 Introduction

As the effects of climate change intensify across Europe, local authorities (LAs) have emerged as frontline actors in the development and implementation of adaptation strategies. Urban areas, home to over 75% of the European Union's population, face heightened exposure to a range of climate risks—from coastal and pluvial flooding to intensified heat waves exacerbated by the urban heat island effect. Consequently, local authorities are called to put in place mechanisms to manage the context-specific risks climate change bears on citizens, businesses and infrastructures. However, cities' ability to plan and coordinate adaptation varies considerably from place to place, with wealthier municipalities generally performing better than their less-resourced counterparts. In this context, the transnational exchange of knowledge and experience between cities is critical, as it may bridge the capacity gap through diffusion of best practices.

This article investigates the ways in which cities use existing networks to advance their agenda in terms of climate adaptation policy. Two main types of networks currently exist: i) Transnational Municipal Networks (TMNs), which are non-hierarchical networks where municipalities exchange knowledge and experiences; and ii) research and innovation projects connecting knowledge creation on the part of Universities and Institutes, to knowledge circulation with and among cities. Research on transnational cooperation among European cities has left two research gaps that this article aims to bridge. First, while significant research has taken TMNs as their object, studies rarely adopt the cities' perspective—yet the constitutive part of these networks—or explore the usages they have of these networks. Second, research eludes other forms of cooperation beyond TMNs, leaving research and innovation projects out of their scope, despite their fundamental importance in terms of knowledge creation and diffusion.

This article investigates cities' strategic usages of networked governance in the transnational knowledge ecosystem with a view to simulate alternative scenarios for the betterment of knowledge circulation in Europe. This article draws on original data, Social Network Analysis, semi-structured interviews, and inferential statistics to inform an Agent Based Model that simulates the circulation of knowledge as a result of cities' pursuance of their strategic interests.

2 Research phase and state of affairs

Research is divided into 5 phases: collecting data, mapping the knowledge ecosystem, understanding cities' usages of networks, inferring cities' network centrality from their

structural properties, and designing an ABM to simulate circulation of knowledge under different circumstances. **1.** Collecting data consists in identifying cities participation in networks on the one hand; and collecting structural data on these cities (e.g. local GDP/capita, population size, etc.). The identification of cities is complete, resulting in the creation of two datasets: ca. 1000 cities in Europe contributing to ca. 460 research initiatives on climate change; ca. 14,000 cities invested in 12 TMNs. The collection of structural data is ongoing. **2.** Mapping the knowledge ecosystem and calculating SNA metrics is completed. **3.** Understanding cities' usages of these networks implies conducting semi-structured interviews. So far, a total of 13 civil servants across 10 cities were interviewed. Phases **4.** and **5.** have not started yet.

3 Preliminary findings

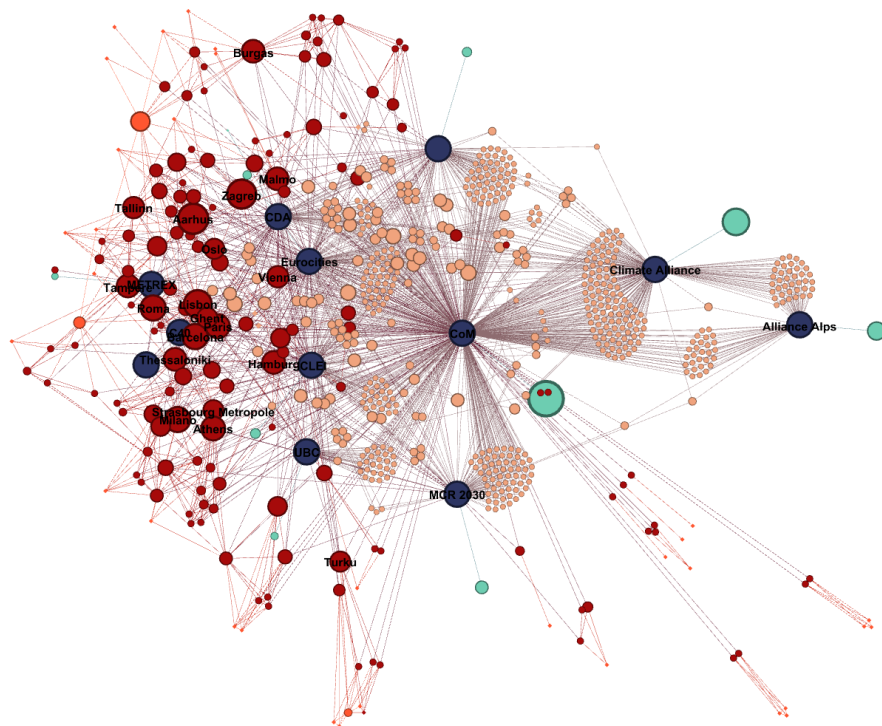


Fig. 1. Cities' participation in TMNs and research projects.

Figure 1 is a partial depiction of the knowledge ecosystem in which cities participate; elaborated in phase **2**. The burgundy nodes represent cities active in TMNs and research projects; the orange nodes the cities only active in projects; the pink nodes the cities only active in TMNs; the purple nodes the TMNs themselves; and the turquoise nodes

Fig. 2. TMNs participation in research projects, together with cities.

4 Using ABM to improve inter-city connections

The final stage of this research will use the results of the four previous phases to calibrate an ABM that simulates the dynamics of knowledge exchange among European cities. The aim is to better understand—and ultimately improve—the circulation of knowledge.

Cities are central actors of innovative adaptation policies and are likely to share their experiences with other cities in need of such knowledge. Accumulation of knowledge is likely shaped by their **structural endowments** (capacity, resources, motivation). Depending on their level of **connectedness** (none, single, multiple connections), cities can share their knowledge through TMNs/projects, which bring together both knowledge holders and potential recipients. The ability of a potential recipient to learn from others depends on its connections (none, single, or multiple) and on its own structural endowments (capacity, resources, motivation). Not all knowledge-holding cities are equally motivated to share, and not all potential recipients are willing or able to acquire knowledge.

In the model, each agent—between 4000 and 15000 cities—will have capacity (ability) and preference (will) features. On the capacity side, a city has a propensity to **possess knowledge** (through participation in research initiatives), to **propagate knowledge** (connections) and to **receive knowledge** (connections, capacity, resources). On the preference side, agents have a will to **share knowledge** (motivation), and to **seek knowledge** (motivation). In addition to cities, TMN secretariats will be modelled as a distinct type of agent. Acting as facilitators, they help connecting cities with one another, and their effectiveness in doing so depends on their own characteristics.

The model will simulate interactions among these diverse actors on the international stage. From an initial state of inactivity, agents are triggered into action by one of three stimuli: **1.** an agent seeks knowledge from another; **2.** an agent attempts to share knowledge; or **3.** a TMN secretariat fosters exchange by creating opportunities for interaction. A key feature of the model will be its ability to test how different network configurations and behavioural rules influence the circulation of knowledge. First, the model, informed by empirical data, will reveal whether certain cities are systematically included in, or excluded from, knowledge exchange. Second, it will explore alternative scenarios to assess how highly connected cities can accelerate the diffusion of complex information. Ultimately, the ABM will generate counterfactual and "what-if" analyses to assess how knowledge exchange might be enhanced—for example, by strengthening the role of boundary actors, incentivizing brokerage behaviour, or reconfiguring network ties. This simulation-based approach will offer an experimental platform to understand, and potentially improve, the mechanisms through which cities learn from each other in the face of a common climate challenge and its varying manifestations at the local level.