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TRANSNATIONAL MUNICIPAL NETWORKS (TMNs) FOR CLIMATE CHANGE RESILIENCE IN SUB-SAHARAN AFRICAN CITIES

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ABSTRACT

With the ever-growing concern and effects of climate change, governance has become a key tool to control, mitigate and stay resilient against the effects. Over time, the nature of governance has also evolved bringing popularity to networked structures of governance such as Trans-Municipal Networks. While these are popular in Europe and North America, the global south, particularly Sub-Saharan Africa remains the most vulnerable region. Climate focused TMNs potentially pave way for a more climate resilient region and in the recent past, Sub-Saharan regions have been joining TMNs. While governance at higher levels such as global treaty or national instruments are important, local activities are the most impactful. TMNs have been seen to cross the multiple levels of governments to connect important stakeholders to effective action. However, their complex nature makes it difficult to analyse TMNs as a group as they have different goals, scope and actions. Overall, despite the difficulties, TMNs have the potential to improve climate governance at local level in the Sub-Saharan region.

Keywords: Transnational Municipal Networks (TMNs), adaptation, resilience, climate change, sub-saharan Africa

Con l'aumentare sempre maggiore della consapevolezza del cambiamento climatico, la governance è diventata uno strumento chiave per controllare e mitigarne gli effetti e mantenere la resilienza contro di essi. Nel corso del tempo, la natura della governance si è anche evoluta diffondendo strutture di governance di rete come le Reti Trans-Municipali (TMNs). Queste sono popolari in Europa e Nord America, mentre sono meno conosciute nel Sud del mondo, in particolare in l'Africa subsahariana nonostante questa rimanga la regione più vulnerabile.Le TMNs che si specializzano sul clima potrebbero aprire la strada a un territorio più resiliente dal punto di vista climatico e in tempi recenti , le regioni subsahariane hanno cominciato ad aderire alle TMNs. Anche se la governance di alto livello come i trattati internazionali o gli strumenti nazionali sono importanti, le attività locali sono le più impattanti. Le TMNs favoriscono la connessione di stakeholder a molteplici livelli di governo per raggiungere soluzioni efficaci. La complessa natura dei TMNs rende tuttavia arduo analizzarle come gruppo omogeneo poiché hanno obiettivi, ambiti e azioni diversi. Nel complesso, nonostante le difficoltà, le TMNs hanno il potenziale per migliorare la governance climatica a livello locale nella regione subsahariana.

PREFACE

In the two years that I have moved from Zimbabwe to Italy, the conversations where I hear the following have been consistent every year, “The heat of this summer is the worst, the national harvest has become worse since you left,” “The cold of this summer is the worst, we have had to dress heavier since you left.” The worst for me is “It has been raining even harder since you left, and the water keeps seeping and flooding into the house.”

My motivation for this topic begins from a personal place and the realisation of the need to have resilience in vulnerable regions. However, it is my education that has given me not just a passion for governance, but a realisation that many forms of it as it stands have not only failed regions like where I am from but can be reformed into becoming solutions.

Already, Transnational Municipal Networks have had a growing popularity in Europe when it comes to climate governance, and this has spread across the world including Sub-Saharan Africa and my study focuses on these two and how they merge. Currently, there is very little literature that can be found on the activities of TMNs working on climate change resilience in Africa,

The research is to explore how TMNs have and can contribute to the climate change adaptation in Sub Saharan African cities as an identified region of high vulnerability. This will be at the global evolution of TMNs globally and assessing their contributions in climate goals in general from when they began.

In the study, I particularly look at adaptation in this region particularly because it is on the other side of climate change, global issues (much focus is put on of contributors of climate change such as low carbon emission contributions) with the highest vulnerability of climate change related disasters. With the growing popularity and effectiveness of TMNs in especially Europe, I would like to find out if they can potentially be just as successful in Sub-Saharan Africa on the problems they have in their cities.

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INTRODUCTION

The importance of governance for climate change

In the context of environmental governance, O'Brien (2000, p. 2) defines governances as "the sum of ways that individuals and institutions, public and private, manage their affairs." As Dryzek et al., (2013) rightfully put it, "governance" is a term that is more elastic than just thinking about the conventional top-down grand government structures. Over time, there has not only been shifts in prioritisation of the various levels of government but also emergence of structures such as the Transnational Municipal Networks that have been seen in the climate change governance arena.

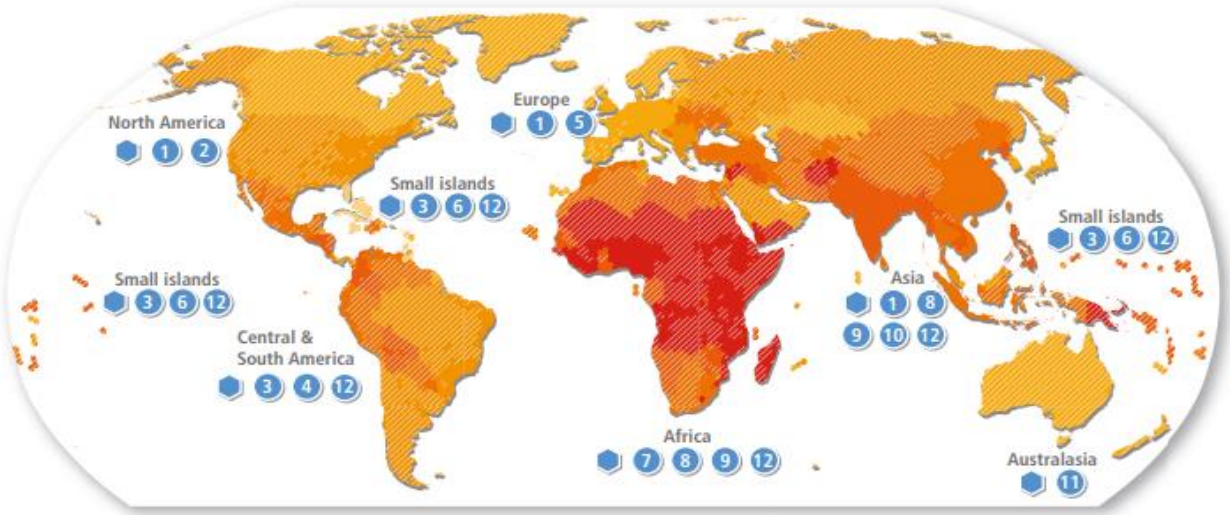
However, there are two main questions regarding governance in climate change. The first is, why is governance important now more than ever in the climate change problem? Climate change is a huge global problem due to mainly high carbon (CO2) emissions. Seemingly obvious as it may be, the CO2 contributions do not geographically equal the vulnerabilities caused by these emissions with Sub-Saharan Africa and small island communities having the highest vulnerabilities (Pörtner et al., 2022) and other regions with the highest emissions (Global Carbon Project, 2022). Governance is therefore imperative for many reasons that include justice, the immediate reduction of CO2 emissions and particularly discussed in this thesis, resilience and or adaption to our climate changed society.

The second one is, how important is the governance structure to the goals relating to climate change? A lot of inaction regarding climate change can be traced to either lack of policy or simply lack of adherence to it (Dryzek et al., 2013). The global regime for climate has been heavily criticised for its lack of effectiveness and for example the infamous Kyoto Protocol with overly ambitious goals and considered unfair to the global south (Young, 2011). When it comes to national governance Dryzek et al., (2013) explains how while some have done better than others in being concerned about the climate, the overall inadequacy of countries leaves a threat to the world.

Under polycentricity, Transnational Municipal Networks (TMNs) are a relatively new form of governance on the climate change scene which has been considerably effective in different parts of the world to achieve climate goals. In Sub-Saharan Africa, its work and effectiveness are relatively unexplored. This thesis will, among other issues relating to TMNs, see the contributions that TMNs have made towards the climate goals of the cities in the geographical context.

Observed human vulnerability differs between and within countries and strongly determines how climate hazards impact people and society

(a) Map of observed human vulnerability based on two comprehensive global indicator-systems using national data, plus examples of selected local vulnerable populations and Indigenous Peoples



Examples of local vulnerable populations | Examples of some aspects of vulnerability | Chapter references

1. **Indigenous Peoples of the Arctic** | health inequality, limited access to subsistence resources and culture | CCP 6.2.3, CCP 6.3.1
2. **Urban ethnic minorities** | structural inequality, marginalisation, exclusion from planning processes | 14.5.9, 14.5.5, 6.3.6
3. **Smallholder coffee producers** | limited market access & stability, single crop dependency, limited institutional support | 5.4.2
4. **Indigenous Peoples in the Amazon** | land degradation, deforestation, poverty, lack of support | 8.2.1, Box 8.6
5. **Older people, especially those poor & socially isolated** | health issues, disability, limited access to support | 8.2.1, 13.7.1, 6.2.3, 7.1.7
6. **Island communities** | limited land, population growth and coastal ecosystem degradation | 15.3.2
7. **Children in rural low-income communities** | food insecurity, sensitivity to undernutrition and disease | 5.12.3
8. **People uprooted by conflict in the Near East and Sahel** | prolonged temporary status, limited mobility | Box 8.1, Box 8.4
9. **Women & non-binary** | limited access to & control over resources, e.g. water, land, credit | Box 9.1, CCB-GENDER, 4.8.3, 5.4.2, 10.3.3
10. **Migrants** | informal status, limited access to health services & shelter, exclusion from decision-making processes | 6.3.6, Box 10.2
11. **Aboriginal and Torres Strait Islander Peoples** | poverty, food & housing insecurity, dislocation from community | 11.4.1
12. **People living in informal settlements** | poverty, limited basic services & often located in areas with high exposure to climate hazards | 6.2.3, Box 9.1, 9.9, 10.4.6, 12.3.2, 12.3.5, 15.3.4

Fig 1. Global Climate Vulnerability Map (Pörtner et al., 2022

Relevance of context

The research was undertaken for three main reasons, the first being to pay attention to the most climate change vulnerable areas. The figure clearly indicates the principal areas with vulnerabilities to climate change in the world and as can be seen, the Sub-Saharan Africa stands out thus needing resilience.

Secondly, to be able to anticipate and respond to the problems, governance is important. According to Folke, (2006, p. 254) governance can respond to change and shocks “away from policies that aspire to control change in systems that are assumed to be stable, towards managing capacity of social ecological systems to cope with and adapt to and shape change”

Finally, as the author I had personal motivation to study this topic. Coming from Sub-Saharan Africa and witnessing the devastating effects of climate change first hand, it seemed imperative to understand a new type of governance from the conventional that can be useful to these current problems.

Adaptation and Resilience

These terms are important as they are referenced in the context of the study. The Merriam Webster Thesaurus defines adaptation as “the act or process of changing something to fit a new use or situation” and resilience as “the ability to withstand or adjust to challenges” (Merriam Webster Thesaurus, 2023). Adaptation is directed at coping with the consequences of climate change though some have thought it is not sufficient to incorporate resource sustainability and the reduction of vulnerabilities (Adger et al., 2011).

The IPCC assessment report defines adaptation as adjustments in ecological, social or economic systems in response to actual or expected climatic stimuli and their effects or impacts (Pörtner et al., 2022).
Academically, adaptation is understood through the term resilience. According to the multinational Resilience Alliance (2013), “A resilient ecosystem can withstand shocks and rebuild itself when necessary. Resilience in social systems has the added capacity of humans to anticipate and plan for the future.”

Considering relation in meaning and different references in scholarship, these two terms will be used interchangeably in this study to encompass all the ideas defined in this section.

Research Objectives

Research Problem

The effects of climate change have left the region of Sub-Saharan African mostly vulnerable in the world. At the same time, a new networked kind of governance has come up, the Transnational Municipal Networks that have been observed to be useful in achieving climate goals as shown in studies by scholars such as Fünfgeld, H. (2015) and Papin (2020). It is important to study the linkage between the activities of these TMNs in the region to understand if they can help achieve the climate resilience objective which is extremely needed in the region.

Research Objectives

Against this background, building on the concept of polycentric governance and the related scholarship, the objective of this study is two-fold. First, it aims to map the existing TMNs that contribute to fighting climate change in Sub-Saharan Africa. Second, it analyses TMNs' structure and functioning, also exploring the way in which they contribute to enhance climate resilience at the local level.

Also, the study looks at how climate policies have been governed in Sub-Saharan cities and investigate the expectations and challenges concerning the participation of cities in TMNs in the sub-Saharan area.

CHAPTER I THE DEMAND FOR GLOBAL CLIMATE GOVERNANCE

In order to understand Transnational Municipal Networks (TMNs) for climate change in Sub-Saharan Africa, there is a range of governance conception that need to be overviewed, as this literature review will illustrate. More specifically, we will unpack the concepts of polycentric governance and policy diffusion, showing their relevance for understanding TMNs functioning. Then, I will discuss how and why TMNs are deemed to be effective in addressing the challenges of climate change. Finally, I will comment on the still limited research done on TMNs in Africa, especially the Sub-Saharan area.

Alternative forms of governance in the climate movement have become more attractive due to the relative failures of the conventional forms of government as we know (Dryzek et.al, 2013), hence the rising significance of governance structures as TMNs..

1.1 Global inter-governmental climate regime

As Dryzek et al., (2013) have rightfully pointed out, effects that are felt at local level while there is a somewhat connected dependency on what happens in global governance.

In 1979, there was the first World Climate Conference that first scientifically warned the world about the dangers of global warming (Organization (WMO) & February 1979), n.d.). In 1988, the Intergovernmental Panel on Climate Change (IPCC) was established to provide governments with scientific information they can use to develop climate policies. However, it is only in 2021, decades after the first World Climate Conference, that the IPCC reported one hundred percent certainty of the unequivocal reality of climate change (IPCC, 2021), long after many parts of the world had already started suffering its devastating effects.

Following the approval of the United Nations Framework Convention on Climate Change (UFCCC) in 1992, governments adopted the global action programme Agenda 21 to establish the concrete actions to implement at the different levels to reduce emissions and fight against climate change. An annex with a set of binding

targets was included in the so-called Kyoto Protocol adopted in 1997. However, most of the Annex One signatories, mainly the global north, failed to meet their 2012 targets (Dryzek et al., 2013).

The Paris Agreement, which was approved in 2015, replacing the expired Kyoto Protocol conditions, being considered a landmark agreement to climate change (UNFCC, 2015b). It also aimed to address and solve the problems on which the Kyoto Protocol failed, including limited action by local authorities and the gap between the Global North and Global South climate action.

Since 2015, there have been the continuation of the Conferences of the Parties (COP) meetings every year meant to strengthen the targets and goals, but the effectiveness is again disputed (Bortscheller, (2009). For example, the COP-15 meant to produce a treaty to control emissions but in reality resulted in the Copenhagen Accord, which in theory should have strengthen the climate based targets but the resolutions were not legally binding with “warm” deadlines and no enforcement (Rogelj et al., 2010). This was negotiated headed by the United States of America (USA) and it only lowered the possibility to avoid reaching a global temperature of 3°C increase to only 50% due to the soft handed nature of the negotiations. However, given the impossibility of the USA Senate to ratify anything, this accord was consequently simply “noted” (Rogelj et al., 2010). Therefore, the global intergovernmental climate regime often resulted in failures and steps back from the established goals.

Some trends at the COPs have further derailed the progress towards climate goals. For example the practice of rich countries buying carbon credits from poor countries which Stevenson (2013) clearly demonstrates in explaining some strategies employed at these meetings. He explains that the minority large emitters use their economic profits to buy the rights to further emit from poor countries in need of the financial resources. Carbon offsetting is meant to equalise countries by giving them a chance to be economically productive while maintaining emission reductions, but the rich countries have found the permissible loophole in this method (Stevenson, 2013).

Therefore, the effectiveness of all the global governance attempts has been questioned as since 1992 when there was the first global warning, temperatures due to the emissions continue to rise (see Fig2 below).

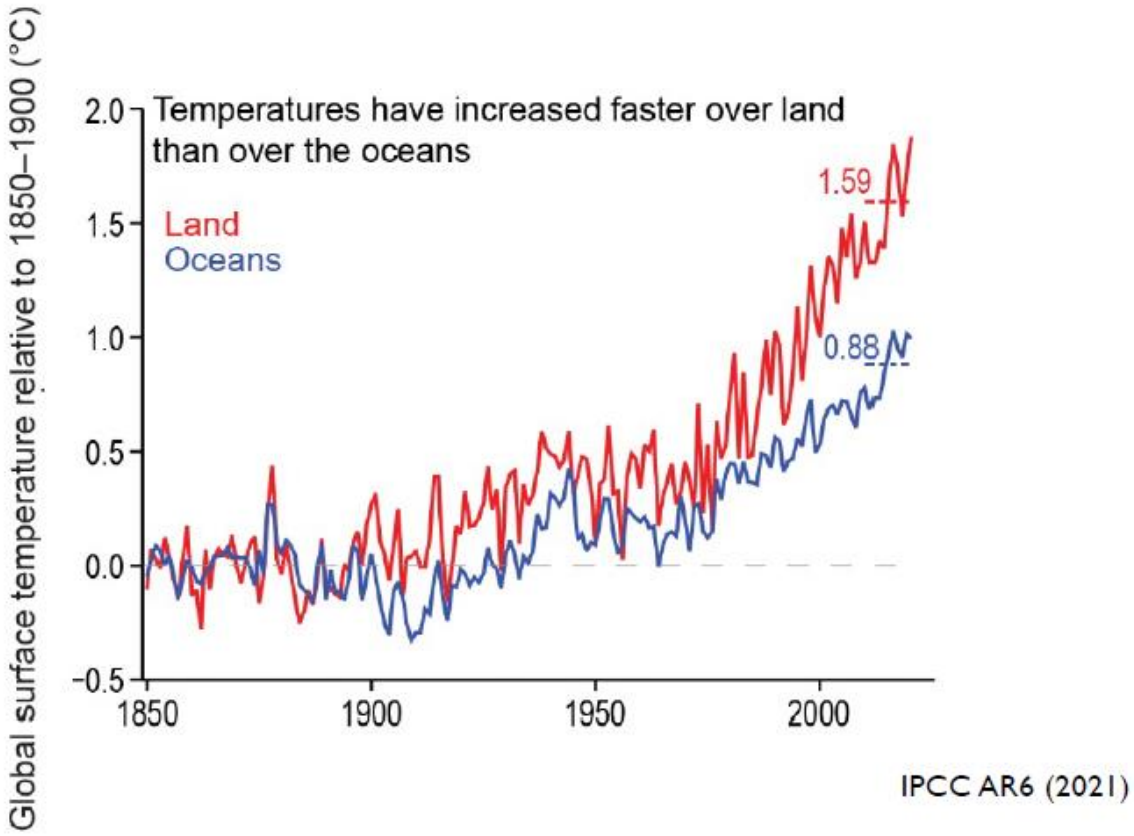


Fig 2 Global Surface temperature from 1850

1.2 National climate governance

The national level of government is the most relevant for climate change being the main level driving action. While Stevenson (2013) highlights the weakness of global governance in the capacity to enforce climate targets, this presents the opportunity for national level governments to create an impact. As Tan et. al (2022) explains, the significance of the Paris Agreement in contrast to the Kyoto Protocol is due to the ability of countries to set their own target they can enforce. Moreover, the actions of top carbon emitter countries, both positive and negative are impactful to the climate regime such as the USA not ratifying the Paris Agreement or China's carbon neutrality pledge of 2020 (Tan, et. al 2022).

Carbon emissions which are the largest driver of climate change are normally measured at national level. As the graph below, the level of emissions has progressively increased.

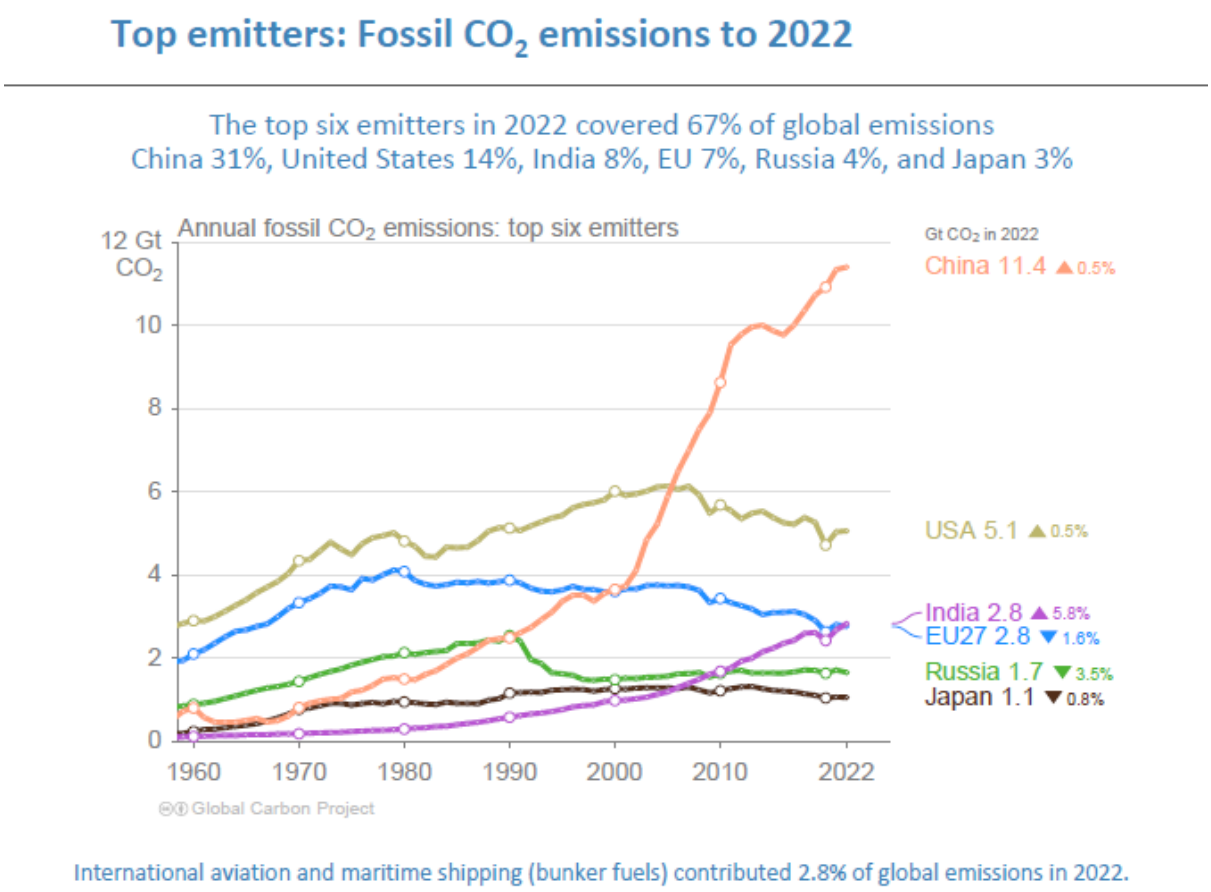


Fig 3 Global Top CO2 Emitters, Source (Friedlingstein et al., 2023) (Global Carbon Project, 2023)

The USA, as seen in the graph, is one of the largest CO2 contributors but also one of the biggest negotiators of emission reduction goals in a negative direction. In the previous section in the example of the Copenhagen Accord, we can see how the motivations of a national government can derail a global problem. As can be seen, the summation of African countries' emissions as a continent do not appear in the top emitter's graph which is indicative of its minimal carbon footprint.

Also pointed out before is how most of the Annex 1 countries that ratified the Kyoto Protocol did not meet their goals. This can be attributed to the collective action problem where countries enjoy the benefits of other countries' work while they

continue to meet their needs at the global climate expense (Dryzek et al., 2013). Dryzek et al., (2013) also points out that the other reason national governments do not deliver climate goals is because for especially the western world, it has been centuries of activities that change would have the countries as we know them "perish."

There are several examples that can be observed and looking at the COP meetings previously referenced, we can see national interests take precedence for economic reasons. Considering national and global governance, we are left with more sub-level governments to steer the climate goals into the right direction,

1.3 Polycentric governance

Polycentric governance is a concept that was expected to offer solutions to the global challenges of climate change, which was conceived of as collective action problem. As Ostrom (2010) explained, to solve collective action problem, some entities will not act to solve any problems, in this context climate, without incentives.

Polycentricity is therefore when multiple individual governments at different levels adopt measures for local benefit and these measures can have global benefits (Ostrom, 2010). A classic example is air pollution. A government can create laws against energy combustion in order to reduce air pollution and this measure reduces the global CO2 emissions which is a global goal.

Individuals are connected as in a globally binding treaty but can be voluntarily linked through elements like learning from or competing.

Also, Biedenkopf (2020b) explains why and or how polycentricity comes about. Why do smaller jurisdiction governments take it upon themselves to contribute to a global problem without being necessarily bound by a global law? The first reason as discussed before is that the solution may have local benefits. Another reason could simply be normative, namely that the local government feels the responsibility to make a contribution to resolving the global environmental problem. Finally, some governments are determined to show leadership and strength as they tackle these problems (Biedenkopf, (2020b).

Among many authors, Milinski & Marotzke (2022) explain and further support the idea that polycentricity is a solution to climate change problems is debatable as it has its shortcomings. Many of these ideas are explained in addition to Ostrom's (2022) foundational ideas on polycentric governance and the limitations of collective action in the context of climate change. One of them is leakage where a problem is simply transferred from one area to another, for example reducing harvest in area A could increase the harvest in area B. Also, because policies are made autonomously at various levels, inconsistent policies may overall result in the global goal not being achieved. More obvious is freeriding, where some jurisdictions will simply take advantage of the solution-based actions of others while they do nothing (Ostrom, 2022) (Biedenkopf, (2020b).

1.4 Policy diffusion

The concept of policy diffusion has expored the functioning of TMNs from a different perspective. It emphasizes that TMNs function from a distinct perspective. These networks play a crucial role in disseminating policy ideas, practices, and norms across borders, leading to mutual learning, emulation, and competition among cities and local governments. The mechanisms of policy diffusion such as learning, competition, emulation, and coercion highlight the interconnectedness of policymaking beyond national boundaries (Blatter et. al 2021). TMNs serve as conduits for the exchange of knowledge and best practices, contributing to the evolution of policies worldwide.

Cities, being 70% contributors of greenhouse gas emissions, are a big part of the problem and can thus become a big part of the solution (Bansard et al., 2017). To be able to learn the right policies for this to happen, policy diffusion can take place. This is the process in which policies are spread among a group of jurisdictions or even at a global level (Maggetti, M., & Gilardi, F. 2016).

The process begins with a pioneering policy from the jurisdiction that starts with the policy which then moves to what we will term the follower policy jurisdiction. For this to happen, actors in the potential follower jurisdiction must or can influence their own

to adopt a similar policy (depending on the background of their jurisdiction) (Biedenkopf, 2020a).

As explained by Blatter et al (2021), building on Ostrom's (2010) ideas, this diffusion takes places in different mechanisms.

- Learning - where the follower policy jurisdiction updates their strategies and behaviours depending on what they have learnt from the pioneering policy.
- Adjustment/ Competition- some jurisdictions may create new policies as a response to the pioneering policy.
- Emulation- in this mechanism, the pioneering policy is considered to be best practice and followed on normative grounds, However, for this to be successful, actors in the follower policy region must be supportive and perceive the policy as good in consideration of their own political background.

While TMNs act more like governments to their committed members, before members join, the policies for climate are seen to spread in these ways highlighted above.

1.5 TMNs in Climate Governance

The role of TMNs in climate governance has been largely studied with some scholars stressing their relevance and potential and others pointing out the complexity of the structures and a lack of knowledge about their effectiveness.

According to Bulkeley et al. (2003), TMNs are a reconfiguration of the political structure to go across various levels of authority and between the private and the public sectors. It is believed that the agency that TMNs have gives them empowerment that strengthens their members' capacity at local level to have policy diffusion. They are also able to initiate and support climate policies (Betsill & Bulkeley, 2004). They also exist for policy learning and importantly, bridging the gap created by the lack of regulatory environments in the cities or regions they operate in (Van Der Heijden et al., 2019).

While some scholars, for example Rosenzweig et al., (2010), have noted the potential of TMNs in helping to achieve the global climate goals, most research focuses on a few case studies and still denotes the complexity in understanding the significance of TMNs in climate goals (Bansard et al., 2017). Moreso, there is very little research of TMNs and climate policy in the Global South (Van Der Heijden et al., 2019). This highlights a critical gap in our understanding of climate governance. While much attention has been devoted to national-level climate policies, the Global South which is home to the majority of the world's population faces unique vulnerabilities due to widespread poverty, income inequality, and heavy reliance on climate-sensitive sectors (Pörtner et, al, 2022). Unfortunately, climate projections informing adaptation policies in the Global South exhibit inconsistency across vulnerable regions, posing challenges for effective policymaking (Mishra et. al, 2023). Mishra et. al (2023) further proposes that to address this, actionable climate projections are essential, necessitating the use of emerging technologies and strengthened international collaborations

In the study by Bansard et al., (2017), they question if there is a geographical bias in the distribution of TMNs that thus affects their perceived effectiveness globally. In a study of thirteen known TMNs with mainly climate goals, very few cities in Africa are seen to have joined as shown in the figure below.

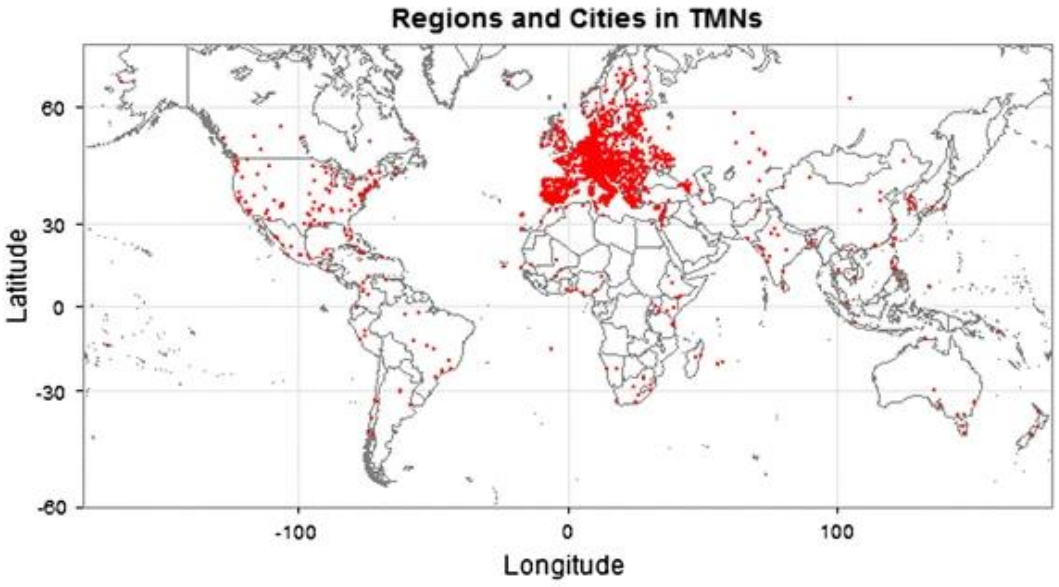


Fig 4.Global Regions and Cities in TMNs (Bansard et al., 2017)

However, some major TMNs such as ICLEI are not included due to the general nature of their sustainable goals. According to Considering the significance of the participation of cities in climate change goals, this distribution could influence the key players and primary players in the implementation of adaptation or mitigation goals.

1.6 Discussion Limitation

There is a lot of discourse pertaining to the direction that must be taken to tackle the climate crisis and this research leans towards mitigation as it seems more relevant to the study area.

'We basically have three choices –mitigation, adaptation, and suffering. We are going to do some of each. The question is what the mix is going to be. The more mitigation we do, the less adaptation will be required, and the less suffering there will be.'

John Holdren

President of the American Association for the Advancement of Science

Mitigation is directed at reducing the greenhouse effect, especially by curbing the CO2 emissions (Dryzek et al., 2013). Considering the main geographical focus of the study, the sub-Sahara and its climate problems that will be later explored in this study, this study is biased towards the solution of adaptation (which is interchangeably used with resilience). This is not to give a one size fits all solution to all parts of the world. The mix referred to in the quote must lean somewhere for each area. However, in general, the world is already in the climate change crises thus resilience is important now more than ever.

1.7 Methodology

Against this backdrop, the objective of this research is to explore the structure and the contribution of Transnational Municipal Networks (TMNs) to climate change adaptation in Sub-Saharan Africa which is a climate change vulnerable region (Pörtner et al., 2022). The study develops in along the stages of answering the three questions.

a) How do TMNs, in general, contribute to climate change goals?
b) How has governance and TMNs worked for climate resilience in the region?

c) How are TMNs connected to the climate adaptation activities in the region?

I mainly adopt a qualitative research method , mostly extensively using results from studies by many scholars in the subject of climate governance and the study of TMNs in different parts of the world, zooming in on Sub-Saharan Africa.
The research mostly used qualitative data as the purpose was exploratory, on a subject with a limited literature. Shank, (2002) defines qualitative research as a form of systematic inquiry into meaning. Inquiry would mean an effort for researchers to understand the subject, which is exactly the aim of the research as it is a subject with limited prior research.
Also, some elements of quantitative analysis have been used to analyse the data on the impact of TMNs in Sub-Saharan Africa, which I used to create a dataset of cities that are a part of specific major TMNs and their populations.

Qualitative Data Collection

The exploratory research qualitatively was of primarily five TMNs that have memberships in Saharan Africa. These are The Global Covenant of Mayors (GCoM), ICLEI, Metropolis, the Resilient Cities Network and C40 Cities. Data to explore their activities and impacts was collected directly from their official websites including periodic reports. We also collected the regional scope of the TMNs, their evolution, their global partnerships and overall, information useful to determine the extent of their impact. This data was limited to the last 5 years (2019-2023) to observe the relevance of the impact over the recent years .

To answer the questions on resilience, it was important to understand the scientific basis of what constitutes resilience and vulnerability. This was noted from the scientific reports of the Intergovernmental Panel for Climate Change (IPCC), a reliable source as it is a convention of climate scientists from around the world (IPCC, 2023).

To explore the evolution and work of TMNs backwards, I included some data from the literature which investigated global TMNs. Literature was also used to discover the existing climate governance in the area of study.

Quantitative Data Collection

For each network I collected all cities that are a part of it and are in sub-saharian Africa. Data were collected from the official website of each network (See table 1).
A python code was used to find cities present in multiple networks. Cities were organised by the number of networks joined as shown in Annex 1.
Demographic data and exact location for each city was acquired merging the information recovered from the dataset of world cities populations (WCD, 2023).
The population data also would become useful when predicting the potential impact of TMNs in the said region.
Annex 2 shows, the city name, its populations and the number of TMNs it has joined.
As a result, a Venn diagram (Figure 8) is provided to show the intersections of cities and membership in the TMNs. The intersections are detailed in Annex 3.
A map that that describes the geographical distribution of cities that have joined TMNs as members in the Sub-Saharan area was obtained using the Geopandas package (https://geopandas.org/) creating the map in Fig 7.

Data Analysis

The map created based on Annex 1 was used to compare the distribution of membership areas in the five studied TMNs with another existing spatial map by (Bansard et al., 2017) in 1.6 which shows the global distribution of TMNs.
The qualitative data was analysed on the basis of existing scholarly discourse as this is exploratory research. The findings were matched against existing schools of thought to arrive at the results. Existing literature played a core part in consolidating the discoveries of this research for analysis,

Problems with the data collection and solutions

In the creation of Annex 2, all members of TMNs are not included due to the difficulty of merging two different datasets (the cities of the world and members of TMNs in the region of study). This is because not all members are cities, some are groups of cities or regions that cannot appear in the dataset. However, this does not affect the results as the Annex is useful to indicate the minimum potentially impacted population by TMNS.

CHAPTER II THE CONTRIBUTION OF TMNS TO CLIMATE CHANGE GOALS

2.1. TMNs key features

According to many scientists, there is no one size fits all solution to the problems of climate change (IPCC, 2018). Of course, the same can be said about any world problem. Transnational Municipal Networks (TMNs) are another experimental way of governance in the climate change governance (Papin, 2020, p. 2). TMNs go beyond the multilateral approach (Hoffmann, 2011) and are characterised by more complex network structures (Papin, 2020). The membership of TMNs studied only by Papin (2020) represent hundreds of millions of people in populations thus should their activities be effective, the impact is across over 10% of the population.

The following key features have been relevant about TMNs organization and functions:

- Complexity

TMNs are characterised by complex networked structure. The network form of organisation that can extend beyond national boundaries is its most common feature (Dryzek et al., 2013, p. 108). Besides the multilateral level connections, some can be with other private partners, such as companies. Another example would be a major TMN, the Global Covenant of Mayors (GCoM) which has alliances with other TMNs such as ICLEI (GCoM, 2023)

.

- Collaborative networking

While giving the precise example of the Covenant of Mayors (COMs), (Domorenok, 2019) explains that TMNs base their participation in collaborative networks with joint action to achieve goals. Capacity building activities are a core part of their work.

- Voluntary Commitment

Membership in these TMNs is voluntary. This is one seen as one of the attractive features of this kind of governance is based on willing members that are in the quest of making up for the shortcomings of the conventional governance (Dryzek et al., 2013, p. 109). When cities or municipalities sign up, they commit to the goals of the TMN for example in the COMs, signatories pledge to prepare local Sustainable Energy Actions Plans among other actions related to climate change reduction (Domorenok, 2019). The voluntary aspect is indicative of the motivation to obtain specific targets and actions. (Bulkeley et al., 2003, p. 237) says where TMNs are concerned “there are significant attempts to renegotiate authority that could be seen to be motivated as much by self-preservation interests as a selfless desire for improvement of democratic systems.”

- Access to knowledge resources

According to Dryzek et al., (2013, p. 109), TMNs have information but not monetary exchange. However, other scholars have found that they share knowledge, information, political and financial resources (Betsill & Bulkeley, 2004).

- A governance instrument.

They are governance instruments that deviate from the conventional government practices that (Papin, 2020, p. 2) refers to as novelties. This means that they steer local actors in a global system. Oftentimes, the measures that are not covered by public governments. An example of this is how COMs extends to sectors that the Emissions Trading Systems do not cover (Domorenok, 2019)

- Innovation Hubs

They are seen to represent a way to innovate and experiment on different policy issues(Bulkeley et al., 2003).

2.2. The evolution and structure of TMNs in Europe and beyond

Most extant research on the emergence of TMNS is based on the European experience, assuming that this networked form of governance to emerge from there. Over time, the European Union's environmental regulation has gradually moved from traditional to more softer forms of regulation (Jordarn & Adelle, 2013), implying more significance of subnational forms of governance including the TMNs. TMNs emerged in Europe in the 1980s as representation for local governments. However now, they are networks of municipalities with a policy common goal that go beyond the municipal borders and as well as national ones, in some cases continental.

The Strategy Europe 2020 endorsed this trend after the European Union (EU) post crisis as part of the agenda (*European Commission 2020*). Before that, in 2001, the EU's "A white Paper" proposed different governance for purposes of more transparency, inclusivity and accountability (Commission of the European Communities, 2001). A study by Benington & Harvey (1999), it was noticed that TMNs where used as a way to experiment and deliver policy easily and quickly over a large population.

Now, they are also a way that organisations legitimise themselves and access funds allocated to their goals (Bulkeley et al., 2003).

In the arena of environmental governance, the structures are complex going across levels (thus often called just multilevel governance) and institutions from the private, public or non- governmental organisations (Bulkeley et al., 2003) .Networks are determined to be central in dealing with transboundary and complex issues such as the climate and environment.

These structures according to Dryzek et al., (2013) bypass or downplay national or even global governments. They develop a networked form of governance with unconventional connections across multi levels and institutions in the private and public sectors. Bulkeley et al., (2003) notes that though it is arguable, policy and governance is seen to be across supranational governments and other private actors.

Hooghe & Marks, (2003) illustrate the two ways the structure of TMNs can be explained. The first one shown below clearly indicates the conventional hierarchy of governments. TMNs are represented to be able to cut across the different hierarchies but the hierarchical structure and power of the national state is retained. Therefore, while local governments can have a voice all the way up to for example the EU government, their policy making power is still limited,

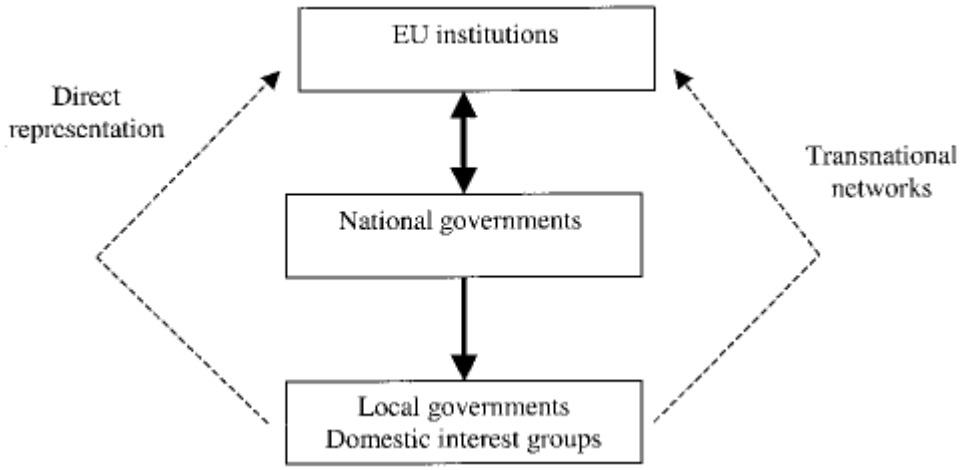


Fig 5 'Type I' (nested) multilevel governance (adapted from (Fairbrass & Jordan, 2001, p. 501))

The second illustration of TMNs below is defined in polycentric terms as "neat scales, or levels, or tiers disappear - they meld into one another. There is no up and under, no lower or higher, no dominant class of actor; rather, a wide range of public and private actors compete or collaborate in shifting coalitions (Hooghe & Marks, 2003, p. 7).

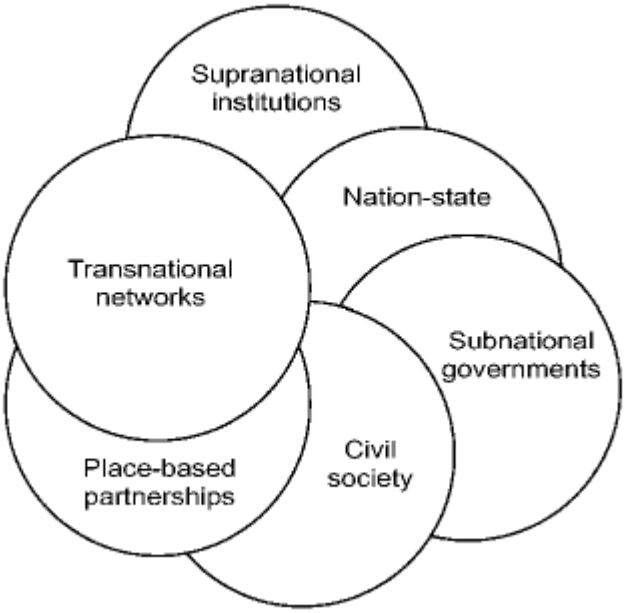


Fig 6 Type II' (polycentric) multilevel governance.(Fairbrass & Jordan, 2001, p. 501)

This second type captures the complexity, interlinkages, and the simultaneous actions of governance of different institutions. It takes note of the intersections of what TMNs have in common with the different institutions (Bulkeley et al., 2003).

Regardless of the illustration, we can observe that with TMNs, there is work that involves multiple levels of governance. It also appears that they maintain a form of stability between actors (Bulkeley et al., 2003). It is however important to note that they do not fall into any theorised form of structure that they will be different though the core characteristic features remain similar across various TMNs,

2.3. The functions and workings of TMNs

The role of TMNs have been classified by (Heikkinen et al., 2020) into these main categories: epistemic communities, transnational advocacy coalitions and global civil society. In their initial activities, TMNs were concentrating on mitigation but now adaptation is seen to be a part of their activities (Heikkinen et al., 2020). The activities of TMNs can be categorised into the emerging themes explained below.

a) Contribution to Policies

As Bulkeley et al., (2003, p. 241) puts it, TMNs “are likely to have a substantial input into the policy process; they may initiate and implement policy.” They are often used, especially in the EU as a means to implement policy. This has been particularly seen in the European Union where some policies have then been fully integrated into their system. It has been seen that a TMN, the European Sustainable Cities and Towns Campaign (ESTC) has been pivotal in supporting and informing policy decisions of the European Commission (EC) in the field of climate governance.

b) Representation and Advocacy

The TMNs represent their members at various levels such national or international governments in order to influence the decisions that affect their goals. Classic example is TMNs for climate change at the COP negotiations (C40 Cities, 2023).

As noted, TMNs have been seen to be transnational advocacy bodies (Keck & Sikkink, 1998). Lobbying as NGOs-style bodies is notable a facet of the networks(Bulkeley et al., 2003). On their social media, C40 is just one of several TMNs lobbying at the current COP28 for climate change solutions(C40 Cities, 2023).

c) Resources

They offer resources as incentives to their members which can range from consultancy training or knowledge transfer. An example is ICLEI that has worldwide offices that serve as training centres and technical assistance for their local government members (Bulkeley et al., 2003). Other tasks of these kind of regional offices such as with the Climate alliance are disseminating good practice to members and initiating joint projects.

d) Innovation

Related to policy, they are innovators of policy through policy initiatives (Bulkeley et al., 2003) As earlier highlighted, they may also be the first point of implementation of experimental and new policies.

It is inaccurate to simply the view of TMNs as non-state actors as their members have the roles and powers of local governments. They continue to stay in good working relations with governmental bodies such as national governments or supranational governments such as the EU. “Quasi-governmental” organisations would be a more appropriate label for them (Bulkeley et al., 2003). This is one of their objectives and strategies for their goals, to involve the various levels of government.

They have structures within themselves and adhere to codes of practices in order to achieve their goals. An example is the International Council for Local Environment Initiatives (ICLEI) whose signatories sign the ICLEI Charter (*Home - ICLEI*, n.d.).

They are usually registered as Associations and subscribe to the laws of the country where their head office is (Bulkeley et al., 2003). As expected, these also have their own hierarchical structures with an executive committee, a secretariat and they also conduct annual meetings.

Membership processes differ as some may have specifications, interviews while others are open to any members. The membership not only grants the members the resources the TMN can provide, but also decision-making participation in their processes. However, it also gives stipulated responsibilities or requirements that may be for example payment of membership fees (Bulkeley et al., 2003).

There is cross-sectoral integration alongside ensuring that there is use of more flexible policy instruments that can be self-regulated and financial incentives are also available (*European Commission 2010*.). The European Union has a strategy for combating climate change, but by allowing these softer forms of governance, tools, and financial incentives, the fusion of the hard and soft policy aims to bring more effectiveness (*European Commission 2011*). However, securing funding is a primary activity for many TMNs that a part of them are dedicated to securing funding to stay alive (Bulkeley et al., 2003).

2.4. TMNs contribution to climate change

Most TMNs have chosen a general approach to their activities and sustainable development, or more specific goals are only one of their overall goals.

Previously, in the literature review section, we have seen how they contribute to climate policy through diffusion, learning, support and taking the place of absent regulatory bodies due to their agency nature.

A study by Heikkinen et al., (2020) that members of TMNs have more awareness of the climate trend, vulnerability and the exposure to effects. Heikkinen et al., (2020), from the study also hypothesised that cities in TMNs are more likely to begin their own climate adaptation processes. It is even more likely with multiple memberships.

2.5. TMNs in Sub Saharan Africa

Several TMNs for climate do not operate in the sub saharan geographical context and these include Eurocities, Net Zero Cities EU, CIVITAS EU, UBC and Carbon Neutral Cities Alliance (CNCA) among many others.
The ones that operate in this region are global with reach there rather than created in the region. This has its own shortcomings as will be explained in a later section of the study.
This study focuses on the TMNs that do not only involve Sub Saharan cities , but also prioritise climate change goals in order to be able to observe adaptation activities. This analyses five large networks, the Global Covenant for Mayors, C40 Cities, Metropolis, ICLEI, and the Resilient Cities Network.

The table 1 below summarises the geographical scope and fraction in Sub-Saharan Africa, briefly illustrates their evolution, mission, membership and activities aimed at fighting climate change in the region.

Table 1 Major TMNs in Africa

TMN	GLOBAL COVENANT FOR MAYORS FOR CLIMATE AND ENERGY (GCoM)	C40 Cities	METROPOLIS	ICLEI	RESILIENT CITIES NETWORK
Scope	Asia Oceania European Union Western and Eastern Europe Middle East and North Africa North America Sub Saharan Africa (1.23 billion people)	Africa Asia Europe North America Latin America Oceania	Africa Asia Pacific Europe Latin America and the Caribbean North America	Africa Asia Europe Mexico, Central America, and the Caribbean North America Oceania South America (20% of Global Population, 25% of Urban Population, 125+ countries)	Latin America and the Caribbean Europe and the Middle East North America Asia Pacific Africa
Sub Saharan Membership/ Total Membership	362/13255	13/96	17/141	110/2500+	9/100

Mission	“We serve cities and local governments to raise the bar on climate by providing a robust agenda for change”	“Mayors united in action to confront the climate crisis”	“A collaborative and caring association, dedicated to transforming our metropolises towards more sustainable, equal and resilient societies”	“Building Sustainable cities, towns, regions and an urban world for all”	“To reduce the vulnerabilities and improve the well-being of over 220 million people around the world”
Evolution	- A merger between EU’s Covenant of Mayors and the Compact of Mayors to demonstrate the global impact of local action	- 2005- started at C20 with 18 megacities - 2011. officially merged with CCI’s Cites Program - 2022 - projected an investment worth more than US$1 Billion in Global South Cities to tackle the climate emergency	- 1985- first world conference with 14 members as the Institution of Metropolis Commissions - 1993- Annual Meeting with the theme “Citizens and Sustainable Development) - 2011 - called Metropolis - 2017 - discussed the implementation of the Paris	- 1990. Founded at the inaugural World Congress of Local Governments for a sustainable future with over 200 LGs and 43 countries - 1992. Delegated by the UN to organise the Local Government session at the Johannesburg	- 2013- started as 100RC as part of the Global Centennial Initiative of the Rockerfeller foundation that invested the necessary resources from different sectors. - 2019- became R-Cities to build a new phase of the resilience

			Agreement at the Annual Meeting	World Summit on Sustainable Development	movement after successful impactful projects in initial stages - 2020- official network launch
Current Activities	Initiatives under the groups - Invest 4 Cities - Data 4 Cities - Innovate 4 Cities	A range of activities to - Raise climate ambition. - Influence the global agenda. - Build a movement. - Scale up climate action	General Sustainable pilot projects - Metropolis Motion - Sustainable Cities Collaboratory - Metropolis Energy Governance	Ongoing Initiatives - 100% Renewables Cities Regions - City Food - Climate Neutrality Framework - Climate Resilience for Communities - Data driven climate action. - ecologistics	A range of activities related to - Resilient planning with cities - Climate resilience - Circularity - Equitable cities
Impact	- 2019 - 22% of projects	Sustainable Projects done	Completed pilot projects	Previous Completed	52 resilience projects

	resulted in adaptation measures - 2021- 11 million jobs created from climate action - 2022- one fifth of members executed adaptation efforts and 8% of projects resulted in adaptation/ resilience - Over 20 000 adaptation actions, 140% increase in adaptation plans compared to 2022	in Sub Saharan Africa include - Addis Ababa, Sub Saharan Africa's first light rail train - Training and Good practice Guides in several cities - Johannesburg, Trash for Cash Project - Tshwane, funding for recycling park and green jobs	include - Metropolis in Action - Metropolis energy Governance - Sustainable Cities Collaboratory	Projects - Eco mobility Alliance - Urban Transitions Alliance - Circular Turku - Urban- LEDS	supported
Global Partnerships	100+ Global Partners including; - European Commission - EuroCities - ICLEI - C40 Cities - UN HABITAT	52 Global Partner Institutions categorised as - Strategic Funders - Major Funders - Funders - City Network Partners (including ICLEI, GCoM)	60+ in the following categories of alliances - Granting - Strategic - Knowledge - Sponsors - Collaborators - Internship Program	Include - Frontline Cities and Islands - GCoM - Local Governments and Municipal Authorities	44 partners

	- Climate Alliance	- Partners		Constituency (LGMA)	
Source	https://www.globalcovenantofmayors.org/	https://www.c40.org/cities/	https://www.metropolis.org/	https://iclei.org/	https://resilientcitiesnetwork.org/

CHAPTER III CLIMATE CHANGE GOVERNANCE AND TMNS IN SUB SAHARAN AFRICA?

3.1. Climate change in Sub Saharan Africa

Climate Change in Sub Saharan Africa: the main trends

The Intergovernmental Panel on Climate Change's (IPCC) Working Group 2 report of 2022 provides the latest comprehensive analysis of data on the existing vulnerabilities and adaptations across regions of the world. It is in this report that fully explained the high level of vulnerability in Sub-Saharan Africa (Pörtner et al., 2022).

There have been observed impacts on the ecosystems highly attributed to climate change.

The effects of climate change in human systems in general includes the following (SPM pg.10):
(aga= confidence that this is due to climate change here is above global the average)

- Water scarcity (aga)
- Crop Production (aga)
- Fisheries yields.
- Infectious diseases (aga)
- Heat and malnutrition
- Displacement
- Inland flooding and associated damages
- Flood storms and the damage in coastal areas
- Infrastructure damage
- Damage to key economic sectors (aga)

(SPM pg. 11) Particularly in urban settings and cities, climate change impacts are observed and often exacerbate the non-climate change causes for more drastic effects. These include:

a) Hot temperature extremes as heatwaves
b) Aggravated air pollution events
c) Infrastructure damage from flooding
d) Economic sector losses

The last two have further resulted in limited functionality of these infrastructures particularly-

- Disrupted energy systems.
- Poor water and sanitation systems
- Poor transportation

Indicators of resilience

Considering the vulnerabilities, we can use the following indicators of resilience or adaptation, as suggested by IPCC, to cross check if the work of the TMNs contribute to the noted needs of the regions. The IPCC report indicates different adaptation options applicable to cities and resilience development (IPCC, 2023).

- Growing public and political awareness of climate impacts and risks
- Including adaptation in cities climate policies and planning processes
- Decision support tools and climate services being used
- Pilot projects and local experiments being implemented in different sectors
- For inland flooding, combinations of non-structural measures like early warning systems and structural measures
- land use planning such as no build zones
- urban agriculture
- buffering of temperature extremes
- strategies which reduce food loss and waste or support balanced diets
- Cooperation, and inclusive decision making, with local communities
- Green Infrastructure and ecosystem services
- Sustainable land use and urban planning
- Sustainable urban water management
- Resilient power systems for reliable energy
- Disaster risk management

- Planned relocation and migration (human settlement)

3.2. Climate Governance in Sub Saharan Africa

National and sub-national climate governance

All Sub-Saharan African countries have ratified the Paris agreement (Martin, 2016) meaning they are obligated to present adaptations plans that are part of the mandatory Nationally Determined Contributions (NDCs) (UNFCC, 2015a). It is therefore up to the internal governance of the countries to establish their priorities and have governance systems in place for implementation. However, there is a distinct lack of institutional action and coordination in sub Saharan Africa.

Mwiturubani, (2009) notes the collective action between formal and informal institutions working in climate change resource management in for example, Tanzania. Some of these have been established under customary rules for the governance of local areas. However, the challenge lies where there is limited knowledge by these informal institutions of the formal legislation as they rely on informal rules of governance. This means there is a lack of uniformity or symbiosis between governance structures which can derail the objective,
Another problem noted is that African local governments often lack the human and technological resources to implement adaptation actions (Habtezion, 2009). This could be solved if there existed coordination between various levels of institutions and their policies including the UNFCCC and regional governments. As in 2009, there was no climate adaptation legislation or policy in Eritrea (Habtezion, 2009)

Mwebaza, (2009) explains how it is easier to produce climate adaptation plans when there is consideration of human rights. Unlike mitigation actions, there is no clear path to creating adaptation plans. Sub-Saharan Africa, facing a variety of climate vulnerabilities must pay attention to local context and deliver the basic human rights in the plight of climate disasters. Moreover, importance should be given to public participation when creating adaptation policies in order to deliver the needs of the citizens. Leadership towards the goals is now more important than ever considering the rising vulnerabilities.

CHAPTER IV TMNS IN SUB SAHARAN AFRICA

4.1. Mapping Transnational Municipal Networks in Sub-Saharan Africa

A study by Stehle et al., (2019) on TMNs in the global south gives an indication of how they influence climate policy outcomes and activities. Though it focuses on cities in South Africa that are a part of ICLEI and C40, Johannesburg, Durban, and Cape Town, we can have an idea of how they have worked in Sub-Saharan Africa as the literature on this is limited.

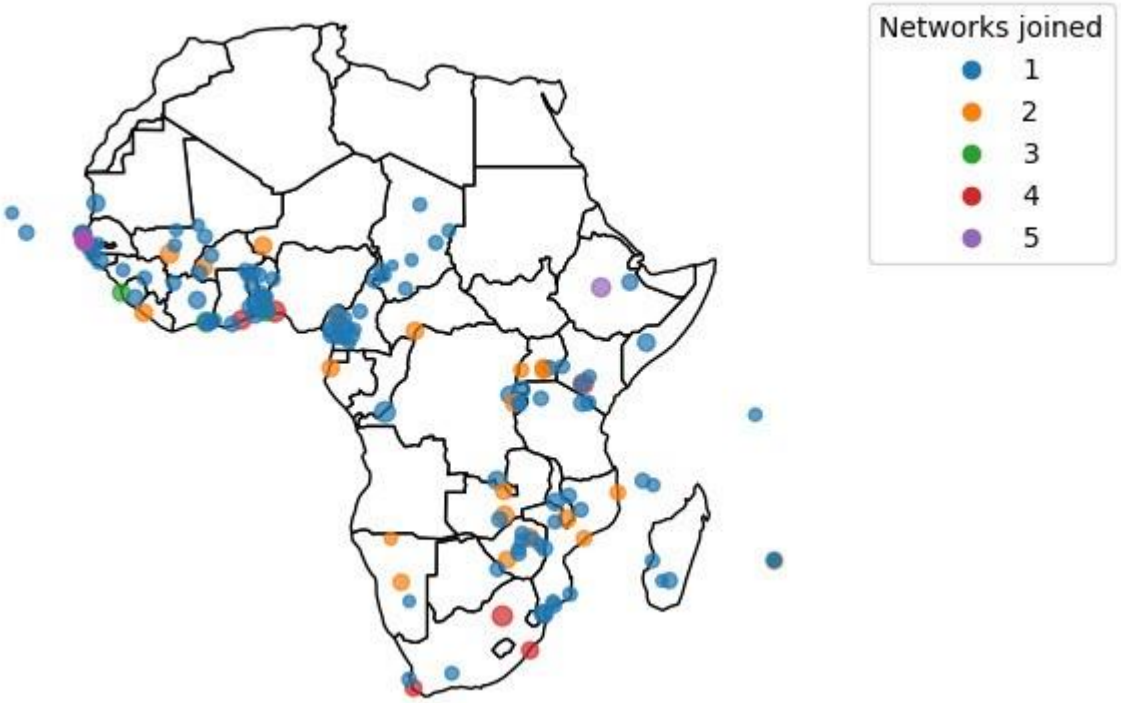
The TMNs have been seen to facilitate engagement with political leadership and diplomatic involvement. In 2011, the mayors of Durban were vice presidents of ICLEI and therefore worked closely with the TMN in preparation for the COP23. C40 is also known to engage with political leaders for climate goals. In Cape Town, it increased the prioritisation of the climate agenda with the city's mayor.

TMNs also serve as finance brokers of climate needs in the region. C40 helped the city of Johannesburg to obtain a loan from the Global Environmental Facility (GEF) and Agence Française de Développement (AFD) to fund their densification development project, Corridors of Freedom. Moreover, ICLEI's Climate Protection Program incentivised the way cities approached climate change.

Though it is not noticeably clear that organisational change is attributable to TMNs, it has been seen to be increasing during the operations of the TMNs in Durban and Cape Town. An example is the extension of the Energy and Climate Change Unit in Cape Town.

Compared to previous studies shown in Fig. 4 earlier, the map below identifies more member in TMNs of Sub-Saharan areas due to the recent increased membership as asserted by Grant et, al (2023) . A significant majority has joined only one TMN which is GCoM (refer to Annex 1).

Fig 7 Map showing the geographical distribution of sub saharan African TMN members of GCoM, C40, Metropolis, ICLEI, and Resilient Cities Network. Refer to Annex 2 for details.



4.2. The cases of Dakar and Addis Ababa

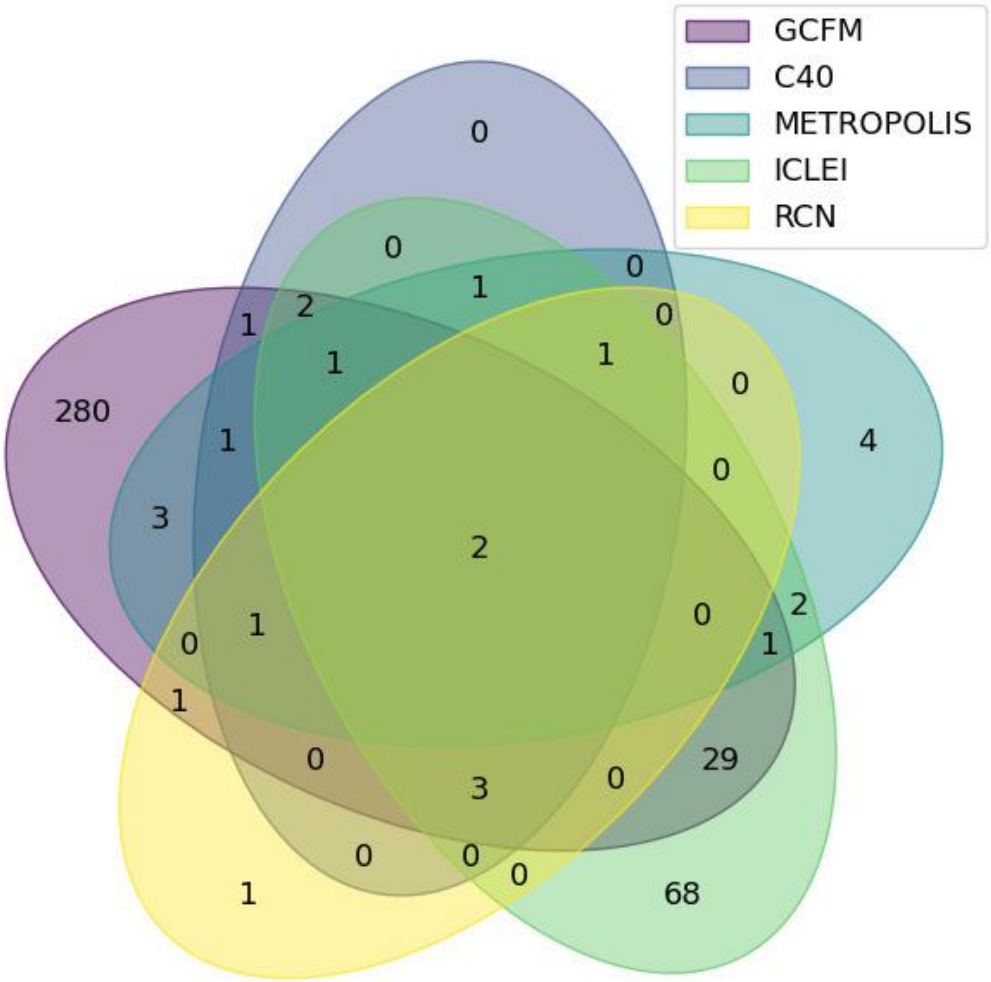


Fig 8 Venn Diagram showing the number of cities in each network in the study. Refer to Annex 3 Intersections for details.

Dakar and Addis Ababa take a leading role being the only cities in all networks in the study. The goal is to show whether this has an impact and advantage towards the cities' climate adaptation activities by noting where there is a connection between the cities and the TMNs in line with the resilience indicators noted earlier in the research.

Table 2 Impact of TMNS in Addis Ababa and Dakar

City Network	Addis Ababa	Dakar
GCoM	- Access to the Gap Fund (funding low carbon resilient projects) - Access to TMN's data	- Access to the Gap Fund (funding low carbon resilient projects) - Access to TMN's data
C40	- Part of the Air quality Network - Part of the Food systems network	- 2020, Civic engagement in climate governance action - Part of the Food Systems Network - Part of the Land use Planning Network
Metropolis	- Micro and Small to Medium Enterprise Development Program - The Atlas of the Human Planet access	- 2025 goal, Seeds for Cities Project - 2023, Mayor of Dakar first African President - 2020, Funding for Metropolitan Governance of the Energy Transition project - 2019, Micro-gardens Pilot Project - 2019, Building Sustainable Employment Pilot project - Congresses for knowledge and collaboration on metropolitan resilience
ICLEI	- Active - Building resilience through	- Active - Transforming Africa's Food Systems

	urban natural assets - Active - African Cities Research Consortium - Active - One Planet City Challenge - Active - Urban Natural Assets Programme - Completed 2019 - Protecting rivers as urban natural assets. - Completed - Urban natural asset protection in Africa	Project - Active - Networking for Water and Sanitation in Africa Project - Active - Building resilience through our Fortitude Initiative - Active - One Planet City Challenge
Resilience Cities Network	- Addis Ababa Resilience Project - Urban Resilience Water Africa	- Urban Resilience Water Africa
Sources	TMNs projects websites	TMNs projects websites

Climate Resilient Projects outside the TMNs in the last 5 years

Addis Ababa	Dakar
- 2019- Shegole and Kality Climate-Smart Bus Depots	- 2019, Micro Gardening with recycled materials Project

4.3. TMNs activities and existing local climate adaption solutions

ICLEI AFRICA

With over a hundred subnational level governments as members, the main goal of ICLEI Africa is to build a sustainable urban world (ICLEI, 2023). The TMN facilitates useful different level linkages for example, municipal to global network. In terms of how it works, it has five pathway strategies but of interest is the Resilient Development Pathway which is core to its work. A part of this pathway anticipates, prevents, absorbs and recovers shocks brought by different changes including environmental changes (*Our Approach*, n.d.). With more events and other changes, the basic response improves. Currently, there are three active projects particular to climate change resilience, mainly focusing on research and training cities on disaster response (‘Projects’, n.d.).

RESILIENT CITY NETWORKS

With a global membership of 100 countries spread out through the world, the TMN currently has 9 sub-Saharan member cities(*Member Cities - Resilient Cities Network*, 2022). While the main goal is to build safer resilient cities, this is done through empowering decision makers, implementing solutions at local level and mobilising vulnerable communities and peer-peer learning and networking is emphasised (*What We Do - Resilient Cities Network*, 2022).Climate Resilience is one out of five points of actions in this TMN that aims to respond to the impacts of climate change while acknowledging the most vulnerable communities. Its main Program is the Resilience 4 Climate change which so far is not implemented in any of the Sub-Saharan cities (*Resilience for Communities R4C - Resilient Cities Network*, 2022) However, there are projects to become energy resilient and through partnerships, extend to other Sub-Saharan African Cities outside its memberships. There is also currently the Water Resilience Program Africa active in 6 cities responding to the water vulnerability as a result of climate change(*Urban Water Resilience Africa - Resilient Cities Network*, 2022).

METROPOLIS

With 150 members, the TMN has 16 sub-Saharan member metropolises (*Home - METROPOLIS*, 2022). Its work is finding sustainable solutions to future large cities and metropolitans' problems.

C40

The TMN has city members spread all over the world with thirteen members in the Sub-Sahara. Through mayoral contact, C40 cities particularly take on urgent climate action for more resilient, sustainable and equitable cities (C40 Cities, 2023).The TMN appears to present a number of actions against climate change. However, the majority of their action lean towards carbon reduction but there is also adaptation for water, global diplomacy and advocacy and research related to resilience needs.

GLOBAL COVENANT OF MAYORS

It is the largest global alliance for climate leadership across the globe. Out of 13 255 member cities, 362 are sub-Saharan with note of this region and strategies dedicated to its particular problems (GCoM, 2023) thus has a dedicated sub-TMN Covenant of Mayors Sub-Saharan Africa (CMSSA) as with different regions of the world. TMN also sees the interlinkages between climate change and other problems that cities face.

Covenant of Mayors Sub-Saharan Africa (CMSSA)'s general strategy is to have alliances and partners at different jurisdiction levels including C40 and ICLEI. It is concerned mainly with the funding of electrical energy in the region and ensuring climate funds are distributed equitably as the region faces the worst effects of climate change ('GCM Sub Saharan Africa', n.d.). The sub-TMN has three main pillars of action which are planning support for projects, project development and knowledge exchange and partnerships at different governmental levels,

4.4. TMNs membership

Memberships into TMNs by cities or regions is another way that shows the complexity of their structure as each is different. It is therefore inaccurate to generalise a description of TMNs since the membership structure varies with each one.
One similarity that goes across TMNs is that members must commit to the goals of the TMN. ICLEI has the ICLEI Charter that members must sign while GCoM has a GCoM Charter, just to give examples.

There are also differences in the selection of members. Firstly, some have only cities such as C40 cities while others like GCoM have members of different local sizes. Secondly the selection criteria are also different as some have higher standards than others. In this study, the Resilient Cities Network has the least number of members in Sub Saharan Africa. Unsurprisingly, it has an objectively stricter selection process. Between 2020 and 2022, the network only had a limit of ten new members globally. Prospective cities apply and the selection process is carried out by the existing cohort of network members. Inversely, GCoM has the highest number of members and as can be expected, a less strict membership acceptance. Any city or local government can join provided they sign a commitment document to the conditions of the network. Once that is done, the network supports the new member in communicating to its jurisdiction the new commitment to the network.

Finances are also a key part of memberships. ICLEI is an example of a network with membership fees, but these are calculated based on the context of the member organisation. Others such as GCoM or the Resilient Cities Network do not require any membership fees from their members.

4.5. The main strength and weaknesses of TMNs in Africa

The complexity of TMNs

TMNs are complex to understand as they go beyond basic polycentricity. There is no uniformity in their structures such that Lee & Jung, (2018) uses three different frameworks to map them. These are on a geographic basis (regional, global, or domestic), on modality (multilateral or institution led) and on the basis of their function, each typology with its own strengths and weaknesses. Also, the wider the geographic reach of the TMN, the more diverse the members become which does affect the modality or functioning of the network.

Previously mentioned that adds to the complexity is the differences in difficulty of membership in a TMN. With differing positions on the admission process, application, membership fees among other factors, it is difficult to view them as a homogenous group.

TMNs do not involve finance and trading which are often good indicators of success. Without good success indicators, the stance that TMNs perform better than conventional forms of government is without evidence (Dryzek et al., 2013). However, the emerging popularity of TMNs for climate change goals is indicative of some success even though judging it quantitatively is complex.

The impact of TMNS

As highlighted in a good part of this research, the impact of TMNs is difficult to judge. However, in many cases, the success or lack of can be observed and explained.

A study of 24 TMNs by (Lee & Jung, 2018) indicated that the networks thrived when focused on the functions of Information sharing, networking and when they have a clear target. Inversely, there was observed deficient performance in the functions of lobbying, funding, research, planning, and monitoring. The successful functions are especially useful in increasing contact with governments and institutions for influence to change policies.

In the same light, some networks have proved their success and some their failures. In observing the cases of EUROCITIES and The Climate Registry networks, (Lee & Jung, 2018) note success in the impact of influencing higher level functions for activation of their climate goals. GCoM and SlimCity Initiatives are examples of networks that proved to be ineffective in terms of overbearing members with information during meetings and less action.

In this study, we have seen the impact of TMNs in Saharan Africa particularly in the projects done. However, it is difficult to sometimes ascertain whether it is an activity of the city or the network, especially with GCoM. Moreover, in the observation of Addis Ababa and Dakar who are a part of the five, the highest number of networks, the impact directly observed relating to the TMNs over the last five years is considerably low. However, as they are the two of the most developed cities in the region, the corelation with TMNs remains unclear.

In conclusion, the impact of TMNs is not only dependent on the structure and design of the network (Lee & Jung, 2018). This is important but the commitment and context of the member cities or regions is also important as they need to actively participate in achieving the climate goals.

Weaknesses of TMNs

Firstly, Heikkinen et al., (2020) notes that there is not either a lot of evidence or study indicative of these networks making progress at climate policy making at city level particularly with adaptation. This makes it difficult to conclusively ascertain that this proposed solution of governance is better than the notable failures of the global and national conventional governance in climate policies.

In the study by Heikkinen et al., (2020) there is a difference between the effectiveness of TMNs in adaptation dependant on the dates joined, After studying the TMNs ICLEI, C40 Cities and GCoM, it appears that memberships before 2014 have better adaptation policies an processes and nearly little for those that joined after that. As highlighted before, TMNs are a popular form of governance in Europe and relatively new in Sub-Saharan Africa. Therefore, we can, by this study, assume

a disadvantage in this region when having TMNs effective for them, unless they are to create new geographically specific ones.

There is a big question of whether TMNs can live up to the expectations set for them to be able to have efficient climate adaptation solutions (Woodruff & Stults, 2016). It is clear that they are good at providing information and guidelines. However, Betsill & Bulkeley, (2004) state that the incapacity of local governments comes not from a lack of these, but rather the lack of resources to implement the solutions. Therefore, unless the TMN id doing beyond learning as a solution, the impact could be minimal.

They currently have no capacity to enforce polluters (Dryzek et al., 2013).This problem is the same as the one criticising the ineffectiveness of global governance in enforcing the policies they make. While major cities in South Africa for example are members of major TMNs, the electrical energy of the country is 90% coal based (Stehle et al., 2019).

The wealth of cities and regions seems to have a great impact on the activities in the TMNs with a bias towards weather cities (Heikkinen et al., 2020). The weather cities also have more capacity to join more networks thus more benefits can be derived from the multiple memberships.

Less wealthy countries therefore tend to take a more passive role which makes their membership rather more symbolic than beneficial to their adaptation goals (Kern & Bulkeley, 2009). This does not just appley to the wealthy, but it also appears the founding members tend to take the active roles with the others that joined after, neighbours and collaborators are found playing a passive role in the activities of the TMNs.

The dependence of TMNs work on the context of the cities they operate in can be barriers to their work thus insignificant impact. In South Africa, ICLEI had to move out of the city government offices from which they operated due to lack of cooperation and conflict (Stehle et al., 2019). C40 has also seen similar problems.

The gaps to fill in TMNs in Sub-Saharan Africa

Bansard et al., (2017) acknowledges that the memberships of TMNs are mainly consistent with North American and European cities. This is a critique to the lack of ambition of the TMNs to not be representative when tackling a global problem. Without inclusion, the climate change vulnerabilities, which are the highest, are ignored and consequently remain unresolved with respect to member regions.

The TMN case studies in this study are also indicative of the generalisation of climate goals in the TMNs with only the Resilience City Network focused on climate resilience. Even though this is the biggest need of sub saharan Africa, the membership of this region is incredibly low at 9%. When the goals are distributed across different climate needs such as CO2 reduction, less focus is on adaptation in the TMNs that have sub saharan membership.

This, however, does not take away from the importance of CO2 reduction. To be equitable, as the SDGs means to recognise areas of vulnerabilities, in this case, sub-Saharan Africa facing the worst impacts of climate change while having the least CO2 contribution.

However, there is immense potential when it comes to TMNs in the regions. With medium confidence, the IPCC agrees that horizontal learning through networks can be helpful to the urban adaptation of cities against climate change effects (IPCC, 2014). Assuming the success of all the TMNs studied, this would result in an adequate resilience impact of at least one hundred million people (see Annex 2)

4.6 Best Practice Examples

Impact, Reach and Effectiveness

We can however look at ICLEI as best practice, with its sub-network ICLEI AFRICA that is more focused on the needs of sub-Saharan cities based on research and data. The Resilient Cities Network is the best when it comes to goes targeted to the region but lacks in ambition to recruit the members. However, there is also social media, important to consider in this digital age.

Social Media

A study by (León et al., 2023) indicated that social media is a powerful accessible tool to engage people, those aware and new people, in climate debates, news, action and social action. Environmental goals can be spread through diverse ways and social media is a way that climate action organisations such as TMNs have used to develop community and promote awareness about climate issues and their action.

Below is a table(3) that indicates the subscriptions of the TMNs in this study, indicating how many people follow their work on the most popular social media channels for these types of organisations.

Table 3 Social Media Subscriptions to TMNs

	ICLEI	C40 Cities	GCoM	Resilient Cities Network	Metropolis
LinkedIn	56 589	122 000+	9 000+	42 295	8 831
Facebook	7 500+	44 000+	8 000+	0	0
X (former Twitter)	41 300+	118 600+	29 000+	7 100+	25 700+
YouTube	2 330+	4 380+	217	533	559
Instagram	0*	51 600+	1 273	2 724	0
Total Subscriptions	107 719+	**340 580+**	47 490+	52 652+	35 090+

As seen, C40 has the highest following and their social media platforms range from putting out their work and updating people on the news of for example the important COP28. However, it is important to note that while awareness is important, engagement in debate must still take a further step to motivate people into climate goals action.

4.7 Climate Policy Recommendations in Sub Sahara

In a study of climate change in Africa, Besada et al., (2009) suggests a variety of policy recommendations Sub-Saharan African governments can make in order to better deal with climate change vulnerabilities.

A core recommendation according to Besada et al., (2009), policies should prioritise indigenous knowledge and handling of climate change. Indigenous institutions must be involved, and, together with scientific knowledge, should improve climate management.

Besada et al., (2009) also recommend the protection of climate adaptation, resilience, and disaster response policies so that they are immune to conflict that may arise within the territories.

Creation of institutions that are dedicated to adaptation and disaster response are useful. One of them is a plan to produce plans for climate-induced migration for disaster management..

Governments must adopt a participatory approach that respects and treats everyone equally. This involves various stakeholders of different organisational levels to engage fully to tackle the challenges faced by everyone, particularly the vulnerable.

Governments must also build and construct socially, culturally, and institutionally compelling capacities for adaptive response. They must also focus on prioritising knowledge and that opportunities can arise from climate change such as jobs, adaptation plans.

CONCLUSION

In general TMNs have the potential to support urban adaptation (Heikkinen et al., 2020). As they have been successful especially in Europe, there is potential to be impactful with the growing Sub-Saharan memberships. Overall, there is a lot of improvement required in the works of the TMNs as we have seen that wealth and the dates of memberships are directly positively linked to the benefits derived from the TMNs (Heikkinen et al., 2020). Moreover, it is even difficult for megacities, the current and future, as the problems are larger to include not just mitigation but adaptation as well in their higher vulnerabilities. TMNs should rather be more inclined towards empowering cities to be able to have their own solutions that are contextually applicable (Heikkinen et al., 2020). There is no uniformity in the operations of TMNs in cities. Their effectiveness is dependent on the administrative, political and economic contexts of the cities that they operate in and these can be barriers or facilitators of their work (Stehle et al., 2019). They are an alternative form of climate governance with potential but still needs better functionality and improvement as with others.

Further Research Recommendations

In general, many scholars including Woodruff & Stults, (2016) question the validity of the claims of the benefits of TMNs due to little studies having been conducted to conclusively prove their benefits.

While some scholars for example Rosenzweig et al., (2010) have noted the potential of TMNs in aiding achieving the global climate goals, most research focuses of a few case studies and still denotes the complexity in understanding the significance of TMNs in climate goals(Bansard et al., 2017).

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ANNEXES

ANNEX 1

	GLOBAL COVENANT FOR MAYORS	C40	METROPOLIS	ICLEI	RESILIENT CITIES NETWORK
0	Bakata	Abidjan	Durban	Addis Ababa	Accra
1	Meguet	Accra	Johannesburg	Cape Town	Addis Ababa
2	Dedougou	Addis Ababa	Tswane	Durban	Cape Town
3	Laye	Cape Town	Harare	Jinja	Dakar
4	Guiaro	Dakar	Brazaville	Entebbe	Durban
5	Banfora	Dar Es Salaam	Libreville	Bulawayo	Kigali
6	Bujumbura	Durban	Yaounde	Gweru	Lagos
7	Buyengero	Ekurhuleni	Douala	Chegutu	Nairobi
8	Mabayi	Freetown	Bangui	Tswane	Paynesville
9	Gitega	Johannesburg	Cotonou	Mutare	
10	Cotonou	Lagos	Accra	Windhoek	
11	Copargo	Nairobi	Abidjan	Chinhoyi	
12	Come	Tswane	Niamey	Medina-Mary	
13	Communaute Des Communes De Zou (Ccz)		Bamako	Moshi	
14	Bante		Dakar	Redcliff	
15	Glazoue		Nouakcho	Rusape	
16	Ouesse		Addis Ababa	Ruwa	
17	Savalou			Nakuru County	
18	Save			Riviere du Rempart	
19	Kinshasa			Ekurhulerni	
20	Lubumbashi			NALAG	
21	Bangui			Walvis Bay	
22	M'Baiki			Capricorn	
23	Abidjan			Isoko South	
24	Grand-Bassam			Pamplemousses	
25	Bouake			Sol Plaatje	
26	Tiassale			Johannesburg	
27	Aboisso			Mangaung	
28	Odienne			Nelson Mandela Bay	
29	Cocody			Flacq	
30	Douala			Moka	
31	Bamenda II			Chongwe	
32	Yaounde			Arusha	
33	Bangangte			Fongo-Tongo	
34	Foumban			Kasese	
35	Bafut			Menji	
36	Mbengwi			Sedibeng	
37	Angossas			RALGA	
38	Yaounde			BALA	
39	Yaounde			Beaufort West	
40	Tibati			Dar Es Salaam	
41	Gobo			Geita	
42	Mbe			Ido (Oyo State)	
43	Bamenda			Nioro du Rip	
44	Praia			Steve Tshwete	
45	Addis Ababa			Curepipe	
46	Dire Dawa			Vacoas-Phoenix	
47	Arba Minch			Buffalo City	
48	Libreville			Lichinga	
49	Accra			Mariental	
50	Ningo-Prampram			Port Louis	
51	Sekondi-Takoradi Metropolitan			Sabce	
52	Awutu Senya East			Swakopmund	
53	Agona East			Lagos	
54	Akatsi North			Kampala	
55	Telimele			Kitwe	
56	Bissau			Lilongwe	
57	Nairobi			Temeke	
58	Kisumu County			Ajeromi-Ifelodun	
59	Moroni			KwaDukuza	
60	Mutsamudu			Amuwo-Odofin	
61	Monrovia			Bafut	
62	Tenenkou			Dakar	
63	Mopti			Matsapha	
64	Pelengana			Mushin	
65	Nouakchott			Ondangwa	
66	Association Mauritanienne Des Communes Du Sud (Amcs)			Savanne	
67	Vacoas			Bujumbura	

68	Curepipe	Kinondoni
69	Blantyre	Mbombela
70	Nacala	Quelimane
71	Quelimane	Monrovia
72	Gurue	Grand-Lahou
73	Chibuto	Kigamboni
74	Cuamba	Ubungo
75	Mandlakazi	Blantyre
76	Massinga	AoDC
77	Milange	Cape Agulhas
78	Moatize	Francistown
79	Monapo	iLembe
80	Mueda	Lusaka
81	Xai-Xai	Modimokke-Mookgophong
82	Inhambane	Nacala
83	Boane	Nairobi
84	Pemba	Pemba
85	Windhoek	uMhlathuze
86	Walvis Bay	Saldanha
87	Ondangwa	Cape Winelands
88	Lagos	Commune of Rachid
89	Isoko South	Lome
90	Koidu New Sembehun	Mogale
91	Dakar	Msunduzi
92	Ziguinchor	Overberg
93	Latmingue	Bamako
94	Nioro Du Rip	Chefchaouen
95	Dioudoubou	Amathole
96	Labgar	GIC
97	Pikine	Younde III
98	Bambey	Niamey
99	Pikine Nord	Golfe
100	Baidoa	Cotonou
101	Matsapha	Porto Novo
102	Massenya	Bobo-Dioulasso
103	Abeche	Kebbi
104	Bitkine	Bo
105	Koumra	Freetown
106	Iriba	Cape Coast
107	Lere	Nansana
108	Faya	Tswelopele
109	Zio (Tsevie)	Quatre Bornes
110	Kpalime	
111	Tabligbo	
112	Lacs (Aneho)	
113	Haho (Notse)	
114	Dar Es Salaam	
115	Morogoro District Council	
116	Kampala	
117	Kasese	
118	Johannesburg	
119	Cape Town	
120	Durban	
121	Ekurhuleni	
122	Tshwane	
123	Nelson Mandela Bay	
124	Mangaung	
125	Eden	
126	Umhlathuze	
127	KwaDukuza	
128	Steve Tshwete	
129	Kheis	
130	Msunduzi	
131	Lusaka	
132	Kitwe	
133	Mazabuka	
134	Harare	
135	Bulawayo	

136	Association Des Municipalites Du Burkina Faso / Section Du Centre-Est
137	Ouo
138	Dassa-Zoume
139	Bukavu
140	Kumba
141	Limbe
142	Mindif
143	Wina
144	Bamenda I
145	Commune Urbaine De Douala
146	Kar-Hay
147	Meri
148	Logone-Birni
149	Mengang
150	Yagoua
151	Datcheka
152	Fokoue
153	Cidade Velha (Riberia Grande Santiago)
154	Sagnarigu Municipal Assembly
155	Banjul
156	Basse
157	Brikama
158	Janjangbureh
159	Kerewan
160	Kanifing
161	Kuntaur
162	Mansakonko
163	Paynesville
164	Ankily
165	Ranohira
166	Ihosy
167	Morondava
168	Bamako III
169	Ndiob
170	Makambako
171	Makindye
172	Entebbe
173	Kira Municipal Council
174	Nansana
175	District de Bamako
176	Garoua
177	Tokoumbere
178	Touloum
179	Dikome Balue Council
180	Tchatibali
181	Kante
182	Bassar
183	Vogan
184	Kara (Kozah)
185	Dapaong
186	Atakpame
187	Sansanne-Mango
188	Tchaoudjo (Sokode)
189	Isangele
190	Wum
191	Akom II
192	Andeke Council
193	Garoua
194	Martap
195	Ebebda
196	Madingring
197	Esse
198	Makary
199	Belel
200	Bafia
201	Golfe
202	Yoto
203	Ngong

204	Commune Urbaine d'Antsirabe
205	Doume
206	FERKESSEDOUGOU
207	N'Gara
208	Commune Urbaine de Goundam
209	Commune Urbaine de Segou
210	Grand-Yoff
211	Dangol-Bore
212	So-Ava
213	Diafounou-Diongaga
214	Bobo-Dioulasso
215	Commune Urbaine de Toamasina
216	Bamendjou
217	Bassar
218	Akebou
219	Abuja Municipal Area Council (AMAC)
220	Maroua
221	Nara
222	Maputo
223	Cobly
224	Pehunco
225	Materi
226	Kouande
227	Kpomasse
228	Avrankou
229	Nikki
230	Yoto
231	Yoto
232	Tchamba
233	Nakuru County
234	Agou
235	Region de Dakhlet-Nouadhibou
236	Matola
237	Bassar
238	Banamba
239	Say
240	Ouro Gueladjo
241	Kirtachi
242	Mayo Darle
243	Commune Urbaine de Dire
244	Ogou
245	Zio (Kovie)
246	Kloto
247	Abong-Mbang
248	Commune de Yoko
249	Tchamba
250	Agoe-Nyive
251	Tchaoudjo
252	Kozah
253	Wawa
254	Makalondi
255	Zio
256	Ngoulemakong
257	Zio
258	Kpele
259	Embu
260	Ave
261	Danyi
262	Tchaoudjo
263	Kloto - Lavie
264	Tchaoudjo
265	Lacs
266	Ogou
267	Chipinge Town Council
268	Wawa
269	Amou
270	Kpendjal
271	Sotouboua

272	Tone
273	Tchamba
274	Anie
275	Golfe
276	Doufelgou
277	Agoe-Nyive
278	Region de Brakna
279	Keran
280	Kozah
281	Garoua
282	Bas-Mono
283	Commune de Soa
284	Communaute Urbaine d'Ebolowa
285	MO
286	Doufelgou
287	Binah
288	MO
289	Nyandarua County
290	Ogou
291	Assoli
292	Doufelgou
293	Vo
294	Lacs
295	Tone
296	Sangalkam
297	Kribi
298	Eseka
299	Oti-sud (Takpamba)
300	Mbombela
301	Yaounde
302	Yene
303	Freetown
304	Mombasa County
305	Yaounde
306	Tone
307	Bambilor
308	Kpendjal
309	Danyi
310	Agou
311	Kozah
312	Est-Mono
313	Bassar
314	Kpele
315	Maga
316	Ave
317	Vo (Togoville)
318	Victoria
319	Nkoteng
320	Mboma
321	Faranah
322	Sotouboua
323	Cinkasse
324	Blitta
325	Limbe City Council
326	Dankpen
327	Sotouboua
328	Commune de Yoff
329	Akono
330	Bikok
331	Bonalea
332	Edea
333	Mbankomo
334	Tswelopele Local Municipality
335	Afanloum
336	Ntui
337	Commune de Pata
338	Est-Mono
339	Haho

340	Boa Vista
341	Nitoukou
342	Guediawaye
343	Commune de Mokolo
344	Bangou
345	Blitta
346	Santo Antao
347	Tsumeb Municipality
348	Commune de Rufisque Est
349	Bungoma
350	Dzeng
351	Tema Metropolitan Assembly
352	County Government of Laikipia
353	Keur Massar
354	Nkangala District Municipality
355	Commune Rurale Ambondromamy
356	Rundu Town Council
357	Oti
358	Nkolafamba
359	Commune de Bana
360	Commune de Dimani Ngazidja
361	Sotouboua

ANNEX 2

City	Country	Population	networks joined
Kinshasa	COD	12836000	1
Douala	CMR	5768400	1
Yaounde	CMR	2440462	1
Bamenda	CMR	2000000	1
Lubumbashi	COD	1786397	1
Maputo	MOZ	1191613	1
Pikine	SEN	1170791	1
Kigali	RWA	1156663	1
Bukavu	COD	1133000	1
Nouakchott	MRT	1077169	1
Matola	MOZ	1032197	1
Lilongwe	MWI	989318	1
Lome	TGO	837437	1
Bissau	GNB	492004	1
Banjul	GMB	413397	1
Port Louis	MUS	149194	1
Gitega	BDI	135467	1
Praia	CPV	127832	1
Moroni	COM	111329	1
Victoria	SYC	26450	1
Baidoa	SOM	950000	1
Cocody	CIV	692583	1
Bouake	CIV	659233	1
Arusha	TZA	416442	1
Guediawaye	SEN	329659	1
Ihosy	MDG	283047	1
Dire Dawa	ETH	277000	1
Bo	SLE	233684	1
Mutare	ZWE	224802	1
Ziguinchor	SEN	205294	1
Mazabuka	ZMB	203219	1
Brikama	GMB	195136	1
Cape Coast	GHA	169894	1
Moshi	TZA	144739	1
Kumba	CMR	144268	1
Lichinga	MOZ	142253	1
Gweru	ZWE	141260	1
Avrankou	BEN	128050	1
Glazoue	BEN	124431	1
Edea	CMR	122300	1
Xai-Xai	MOZ	116343	1
Banfora	BFA	117200	1
Materi	BEN	113958	1
Mopti	MLI	108456	1
Dassa-Zoume	BEN	112118	1
Kouande	BEN	112014	1
Bante	BEN	106945	1
Ngong	KEN	102323	1
Francistown	BWA	103417	1
Aboisso	CIV	100903	1
Kpalime	TGO	100479	1
Geita	TZA	99795	1
Odienne	CIV	86279	1

Atakpame	TGO	84979	1
Quatre Bornes	MUS	77308	1
Faranah	GIN	78108	1
Abeche	TCD	76492	1
Jinja	UGA	72931	1
Inhambane	MOZ	63837	1
Dedougou	BFA	63617	1
Bungoma	KEN	55857	1
Dapaong	TGO	58071	1
Chinhoyi	ZWE	56794	1
Faya	TCD	48090	1
Embu	KEN	41092	1
Koumra	TCD	39852	1
Savalou	BEN	35433	1
Mutsamudu	COM	30000	1
Porto Novo	CPV	18028	1
Mariental	NAM	12478	1
Kanifing	GMB		1
Massenya	TCD	3680	1
Kerewan	GMB	2751	1
Foumban	CMR	92673	1
Lere	TCD	89237	1
Maga	CMR	85100	1
Eseka	CMR	79500	1
Cuamba	MOZ	79013	1
Grand-Bassam	CIV	73772	1
Tibati	CMR	72081	1
Nikki	BEN	69970	1
Saldanha	ZAF	68284	1
Bafia	CMR	69270	1
Wum	CMR	68836	1
Chegutu	ZWE	65800	1
Chibuto	MOZ	58012	1
Morondava	MDG	53510	1
Beaufort West	ZAF	44737	1
Sansanne-Mango	TGO	42626	1
Yagoua	CMR	41957	1
Moatize	MOZ	42000	1
Rusape	ZWE	37906	1
Bamendjou	CMR	37547	1
Come	BEN	33507	1
Iriba	TCD	33572	1
Redcliff	ZWE	32346	1
Save	BEN	31444	1
Banamba	MLI	30591	1
Telimele	GIN	30311	1
Gitega	BDI	23167	1
Ruwa	ZWE	22038	1
Bassar	TGO	23181	1
Nkoteng	CMR	20100	1
Bitkine	TCD	18495	1
Nara	MLI	18459	1
Lere	MLI	16072	1

Ranohira	MDG	16041	1
Nioro du Rip	SEN	15643	1
Ngoulemakong	CMR	14675	1
Doume	BEN	13592	1
Moka	MUS	8846	1
Lusaka	ZMB	2467563	2
Harare	ZWE	2150000	2
Bamako	MLI	2009109	2
Blantyre	MWI	1895973	2
Kampala	UGA	1680600	2
Bujumbura	BDI	1075000	2
Niamey	NER	1026848	2
Monrovia	LBR	1021762	2
Bangui	CAF	889231	2
Libreville	GAB	797003	2
Windhoek	NAM	322500	2
Bobo-Dioulasso	BFA	903887	2
Bulawayo	ZWE	653337	2
Nansana	UGA	532800	2
Kitwe	ZMB	504194	2
Curepipe	MUS	299975	2
Quelimane	MOZ	192876	2
Pemba	MOZ	141316	2
Kasese	UGA	115400	2
Bafut	CMR	80305	2
Entebbe	UGA	69958	2
Ondangwa	NAM	22822	2
Abidjan	CIV	4980000	3
Freetown	SLE	951000	3
Cotonou	BEN	762000	3
Lagos	NGA	16637000	4
Johannesburg	ZAF	8000000	4
Nairobi	KEN	5545000	4
Accra	GHA	2388000	4
Cape Town	ZAF	433688	4
Durban	ZAF	595061	4
Addis Ababa	ETH	3041002	5
Dakar	SEN	1438725	5
Total Population		**108259888**	

- intersection between GCFM , C40 and METROPOLIS

N 5, {'Dakar', 'Johannesburg', 'Abidjan', 'Addis Ababa', 'Accra'}

- intersection between GCFM , C40 and ICLEI

N 8, {'Dakar', 'Dar Es Salaam', 'Nairobi', 'Lagos', 'Johannesburg', 'Addis Ababa', 'Freetown', 'Cape Town'}

- intersection between GCFM , C40 and RCN

N 6, {'Dakar', 'Cape Town', 'Nairobi', 'Lagos', 'Addis Ababa', 'Accra'}

- intersection between GCFM , METROPOLIS and C40

N 5, {'Dakar', 'Johannesburg', 'Abidjan', 'Addis Ababa', 'Accra'}

- intersection between GCFM , METROPOLIS and ICLEI

N 4, {'Dakar', 'Cotonou', 'Addis Ababa', 'Johannesburg'}

- intersection between GCFM , METROPOLIS and RCN

N 3, {'Dakar', 'Accra', 'Addis Ababa'}

- intersection between GCFM , ICLEI and C40

N 8, {'Dakar', 'Dar Es Salaam', 'Nairobi', 'Lagos', 'Johannesburg', 'Addis Ababa', 'Freetown', 'Cape Town'}

- intersection between GCFM , ICLEI and METROPOLIS

N 4, {'Dakar', 'Cotonou', 'Addis Ababa', 'Johannesburg'}

- intersection between GCFM , ICLEI and RCN

N 5, {'Dakar', 'Nairobi', 'Lagos', 'Addis Ababa', 'Cape Town'}

- intersection between GCFM , RCN and C40

N 6, {'Dakar', 'Accra', 'Nairobi', 'Lagos', 'Addis Ababa', 'Cape Town'}

- intersection between GCFM , RCN and METROPOLIS

N 3, {'Dakar', 'Accra', 'Addis Ababa'}

- intersection between GCFM , RCN and ICLEI

N 5, {'Dakar', 'Nairobi', 'Lagos', 'Addis Ababa', 'Cape Town'}

- intersection between C40 , METROPOLIS and GCFM

N 5, {'Dakar', 'Johannesburg', 'Abidjan', 'Addis Ababa', 'Accra'}

- intersection between C40 , METROPOLIS and ICLEI

N 5, {'Dakar', 'Johannesburg', 'Tswane', 'Addis Ababa', nan}

- intersection between C40 , METROPOLIS and RCN

N 4, {'Dakar', nan, 'Accra', 'Addis Ababa'}

1. intersection between C40 , ICLEI and GCFM

N 8, {'Dakar', 'Dar Es Salaam', 'Nairobi', 'Lagos', 'Johannesburg', 'Addis Ababa', 'Freetown', 'Cape Town'}

- intersection between C40 , ICLEI and METROPOLIS

N 5, {'Dakar', 'Johannesburg', 'Tswane', 'Addis Ababa', nan}

- intersection between C40 , ICLEI and RCN

N 6, {'Dakar', 'Nairobi', 'Lagos', 'Addis Ababa', nan, 'Cape Town'}

- intersection between C40 , RCN and GCFM

N 6, {'Dakar', 'Accra', 'Nairobi', 'Lagos', 'Addis Ababa', 'Cape Town'}

- intersection between C40 , RCN and METROPOLIS

N 4, {'Dakar', nan, 'Accra', 'Addis Ababa'}

- intersection between C40 , RCN and ICLEI

N 6, {'Dakar', 'Nairobi', 'Lagos', 'Addis Ababa', nan, 'Cape Town'}

- intersection between METROPOLIS , ICLEI and GCFM

N 4, {'Dakar', 'Cotonou', 'Addis Ababa', 'Johannesburg'}

- intersection between METROPOLIS , ICLEI and C40

N 5, {'Dakar', 'Johannesburg', 'Tswane', 'Addis Ababa', nan}

- intersection between METROPOLIS , ICLEI and RCN

N 4, {'Dakar', nan, 'Durban', 'Addis Ababa'}

- intersection between METROPOLIS , RCN and GCFM

N 3, {'Dakar', 'Accra', 'Addis Ababa'}

- intersection between METROPOLIS , RCN and C40

N 4, {'Dakar', nan, 'Accra', 'Addis Ababa'}

- intersection between METROPOLIS , RCN and ICLEI

N 4, {'Dakar', nan, 'Durban', 'Addis Ababa'}

- intersection between ICLEI , RCN and GCFM

N 5, {'Dakar', 'Nairobi', 'Lagos', 'Addis Ababa', 'Cape Town'}

- intersection between ICLEI , RCN and C40

N 6, {'Dakar', 'Nairobi', 'Lagos', 'Addis Ababa', nan, 'Cape Town'}

- intersection between ICLEI , RCN and METROPOLIS

N 4, {'Dakar', nan, 'Durban', 'Addis Ababa'}

- intersection between GCFM , C40 , METROPOLIS and ICLEI

N 3, {'Dakar', 'Addis Ababa', 'Johannesburg'}

- intersection between GCFM , C40 , METROPOLIS and RCN

N 3, {'Dakar', 'Accra', 'Addis Ababa'}

- intersection between GCFM , C40 , ICLEI and METROPOLIS

N 3, {'Dakar', 'Addis Ababa', 'Johannesburg'}

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N 3, {'Dakar', 'Addis Ababa', 'Johannesburg'}

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N 3, {'Dakar', 'Accra', 'Addis Ababa'}

- intersection between GCFM , METROPOLIS , ICLEI and C40

N 3, {'Dakar', 'Johannesburg', 'Addis Ababa'}

- intersection between GCFM , METROPOLIS , ICLEI and RCN

N 2, {'Dakar', 'Addis Ababa'}

- intersection between GCFM , METROPOLIS , RCN and C40

N 3, {'Dakar', 'Accra', 'Addis Ababa'}

- intersection between GCFM , METROPOLIS , RCN and ICLEI

N 2, {'Dakar', 'Addis Ababa'}

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N 3, {'Dakar', 'Addis Ababa', 'Johannesburg'}

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N 5, {'Dakar', 'Nairobi', 'Lagos', 'Addis Ababa', 'Cape Town'}

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N 3, {'Dakar', nan, 'Addis Ababa'}

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- intersection between C40 , METROPOLIS , RCN and ICLEI

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