

Climate Change Management Approaches of Cities: A Comparative Study Between Globally Leading and Turkish Metropolitan Cities

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Abstract:

Many studies have focused on climate change policies and action at the national level, but few have studied policies and action at the city level, especially cities in emerging economies. To address this gap, the present study analyzes the management strategies globally leading cities have developed to address climate change and related issues and compares them with the city strategies of one rapidly urbanizing emerging economy, Turkey. In the analysis, the strategic plans of five leading global cities are compared with those of sixteen Turkish cities. While the leading global cities have specific managerial approaches to mitigate climate change, none of the Turkish cities exhibits any comprehensive approach. Furthermore, while leading global cities modify urban services to reduce greenhouse gas (GHG) emissions, few Turkish cities adjust any services to address this challenge. Some Turkish cities propose an increased use of renewable energy sources and modification in their transportation system, but the focus in these plans is the current daily needs of their inhabitants. The findings of this study suggest several climate change strategies both for Turkish cities and cities in other developing countries.

Key Words: Climate change, mitigation strategies, leading global cities, Turkish metropolitan cities

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Introduction

Climate change, pollution, water scarcity, and chemical waste are global environmental problems. Since the 1990s, several international organizations led by the UN have expended great effort to build a global initiative to address those problems. However, state-based international efforts, such as The Copenhagen Accord, have not created any solid agreements on future climate challenges. One reason for this could be that only international and state actors are involved in policy development. Although some countries have signed international agreements and taken the initiative in addressing climate change problems, sub-national actors such as cities are seldom involved in the development and management of climate change policy. However, solving those problems requires the involvement of not only international institutions and state level actors but also cities, social organizations, and corporations (de Oliveria 2009; Hattori 2004; Reid and Toffel 2009).

According to the United Nations Framework Convention on Climate Change (UNFCCC, 1992), climate change means "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods." Initially, theoretical and empirical studies on climate change focused on the validity of climate change and its impact on the earth or in specific locations (Barnett, Pierce, and Schnur 2001). In addition, policy studies analyzed the role of international organizations (Dolsak 2009) and countries in climate change policy development and management (Bhatti, Lindschow, and Pedersen 2010; Burström 1999).

With increased awareness of the main causes of climate change, studies have now extended in several directions, to deeper understand factors that may exacerbate or reduce its environmental implications, and to find ways of how best to address them. Since several activities and services in cities contribute to climate change, studies now evaluate climate change effects on cities and the management policies put into practice to address that change (Hattori 2004). Several studies have used case study methodology to demonstrate promising developments in one or a few selected cities' climate change management practices (Alber and Kern 2008; Dubeux and La Rovere 2007; Jo, Golden, and Shin 2009). These studies present best practices in specific countries such as Germany or England, but they fail to show a general picture of the selected countries' cities (Dubeux and La Rovere 2007). In addition, those studies, in large part, reflect the practices or policies of cities in highly developed countries (Alber

and Kern 2008; Jo et al. 2009) and rarely involve cities in emerging economies (de Oliveira 2009).

In Turkey, studies of climate change have followed a similar path. Initially, there was a focus on the impact on locations and countries internationally (Kashima 2002; Tayanç and Toros 1997). Later, the literature reflected a national focus on climate change and environmental management policies in Turkey (Ezber, Sen, Kindap, and Karaca 2006; Şahin 2004; Telli, Voyvoda, and Yeldan 2008). However, there is still a lack of studies that examine the policies and managerial approaches of cities in Turkey. This study seeks to address that gap by examining the management of climate change in metropolitan cities, comparing Turkey to selected global cities.

To provide a broad picture of the management of climate change within cities, this study will address the following questions:

- 1. What management strategies have leading global cities developed to address climate change?*
- 2. How do those cities adjust their municipal services, such as transportation, in order to carry out their future climate change plans?*
- 3. What management strategies have major Turkish cities developed to address climate change?*
- 4. How do major Turkish cities adjust their municipal services in order to address climate change issues?*

The answers to these questions will be the first broad explorative finding in the literature dealing with climate change in the cities of an emerging economy. The findings can help policymakers in cities in similar countries to develop climate change plans and practices. By showing and comparing the efforts of both global and Turkish metropolitan cities, the paper may also contribute to new policy development in Turkish cities.

The paper has the following structure: The first section discusses climate change management strategies of cities and how they adjust their key city services. The second section presents the methodology which used in this study. The third section presents the finding form the analyses of the climate change management approaches of global cities and Turkish metropolitan cities. The forth section discusses the finding of the study. The concluding section examines strategies by which Turkey and other emerging economies can improve the climate change management of their major metropolitan areas.

Climate Change Management Strategies of Cities & Adjustment of Key City Services

Several researchers point out that major cities are one of the main sources of climate change (Romero-Lankao 2009). The contribution by cities is particularly striking when comparing cities with nations. New York City, for example, emits 63.1 Mt CO₂e to the climate change, which is only 10% lower than the contribution of all of Ireland's greenhouse gas emissions (Kennedy, Steinberger, Gasson, Hansen, Hillman, Havranek, Pataki, Phdungsilp, Ramaswami, and Villalba Mendez, 2009). The real contribution of cities to climate change is even higher "if GHG from power stations and industries are assigned to the location of the person or institution who consumes them, cities would account for a higher proportion of total emissions" (Satterthwaite 2008, p.539).

Although there is strong evidence that cities are contributing to climate change, not all major cities contribute at the same level. First, every city has different energy and transportation systems, waste management, and technology that serve its inhabitants, all of which have an impact on its GHG emissions. In addition to this, each city has a different socioeconomic base, which affects the level and type of energy consumption. Finally, each city uses its land in different ways. All of these factors contribute to the impact a city has on climate change and its total GHG emissions. The evidence that cities contribute greatly to climate change indicates that cities should also be important actors in reducing GHG emissions and addressing climate change. Several researchers also point out that a nation's climate change policies depend on implementation at local levels (Kousky and Scheider 2003; Romero-Lankao 2009). Figure 1 presents an overview of city-related factors which may impact climate change.

In the general debate concerning responses to climate change two basic approaches are discussed: mitigation and adaptation (Alber and Kern, 2008). In the 1990s, several cities, including Zurich, New York, and Barcelona, proposed strategic plans to respond to climate change with mitigation policies that included "measures and strategies to reduce CO₂ and other GHGs emissions" (Hilpert, Mannke, and Schmidt-Thomé 2007, p.4). Each city that proposed a climate change management plan targeted its own GHG emission reduction. Because measuring GHG emissions required extensive knowledge and more complex tools than were available at the time, the cities' plans also included how to measure local level GHG emissions. After realizing the need also to adapt to climate change, city

policymakers have recently suggested ways to prepare cities and stakeholders for the current and future risks of climate change. "Adaptation seeks to moderate negative climate change impacts or exploits beneficial opportunities of climate changes" (Hilpert et al. 2007, p.4). Many of the plans analyzed in this study focused on mitigation rather than adaptation strategies, however. Other studies have also analyzed these approaches separately (see Dubeux and La Rovere, 2007; Jo et al. 2009; Kirshen, Ruth, and Anderson, 2008; Rao, 2009; Sadowski, 2008). Therefore, this study will do likewise and focus on city-based mitigation strategies of cities² rather than adaptation strategies. According to the model proposed by Bulkeley and Kern (2006) city managers need to employ mitigation strategies in four different areas: energy, transportation, waste, and urban planning (Alber and Kern, 2008; Bulkeley and Kern 2006). Kamal-Chaoui and Robert (2009, p.80) extended their model and suggested six urban policy sectors related to climate change management. They created a matrix that shows the impact of those urban policy sectors on climate change and how they intersect with each other (for their matrix, see Appendix A). Six sectors in their matrix are land-use zoning, transportation, natural resources, building, renewable energy, waste and water. However, the current study will use Bulkeley and Kern's (2006) model as a base and observe what policies city managers employ in those four sectors to mitigate the climate change impact of their city since it has more explicit mitigation strategies for the climate change reduction.

The first area concerns energy. Since fossil fuel and other unclean energy sources contribute to climate change, many strategic plans have policies that call for reduced reliance on fossil fuels, encourage the use of renewable energy production and consumption, and suggest designs of energy efficient buildings. In addition, the plans suggest that cities should organize campaigns for energy efficiency and consult with businesses regarding energy use. In some cases, city plans mention the use of legal authority to mandate renewable energy or energy efficient systems (Bulkeley and Kern 2006).

The second area concerns transportation. Since road transport systems use energy extensively and affect the city landscapes, thereby contributing to climate change, several cities seek to encourage their inhabitants to walk, bike, and use public transportation. Some cities, such as Stockholm, have improved their public transportation vehicles by phasing in more "green" buses; other cities, such as Bangkok, also use campaigns to promote energy-efficient transportation, while

² Among all the plans, the climate change plan of New York City is an exception. In addition to the mitigation strategies, this plan defined many adaptation strategies for future climate change impacts.

still other cities, such as New York, might enforce their legal authority and limit the use of cars (Bulkeley and Kern 2006).

Third, waste management can also contribute to or reduce the climate impact of cities; accordingly, cities have attempted to mitigate that effect by preventing the creation of waste in government offices; buying environmentally friendly services or products; and educating citizens to reduce, reuse, and recycle their waste. Some city plans propose producing energy from waste (e.g. biogas) and using it for environmentally friendly transportation.

Finally, land use can also contribute to a city's impact on climate change; therefore, city plans have focused on urban planning that allows maximum green areas which are good both for the climate and the air quality (Bulkeley and Kern 2006). Increased planting and forestation programs can also reduce GHG emissions in cities. Figure 1 shows which sector cities should adjust in order to mitigate to climate change.

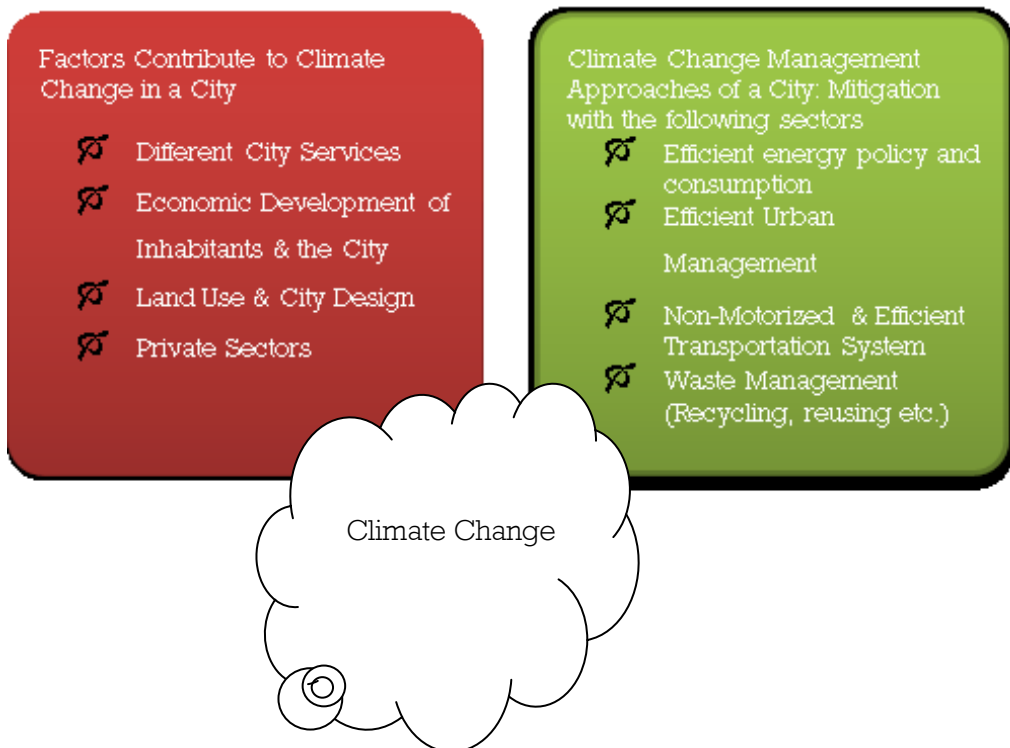


Figure 1: A Conceptual Figure of Factors Contributing to Climate Change in a City and Climate Change Management of a City

Methodology

To find answers to the research questions of this study, the climate change management plans³ of five major international cities were analyzed. Although other major cities also have climate change plans, many of them are difficult to access and were not included in this study. General information about the five cities can be found in Appendix B. Many leading global cities, in both developed and emerging countries, had plans to address climate change, but in Turkey no cities had. Therefore, in this case the strategic plans of Turkish cities were examined, to investigate if those plans included strategies by which climate issues could be addressed and GHG emissions reduced. According to Turkish Metropolitan Law, there are fifteen metropolitan cities in Turkey with together more than 32 million inhabitants, which is approximately 44 % of Turkey's total population. Although these metropolitan cities also have lower-tier municipalities, this paper focuses only on the strategic plans of those fifteen metropolitan cities, which are the main coordinators of the following city services: planning, transportation, waste management, environmental issues, and construction. As the oversight of such services affects climate change, this study focuses only on the fifteen cities responsible for those services (see Büyükşehir Belediyesi Kanunu 2004). Furthermore, limiting the number of city plans in the study allows the researcher to analyze the plans in detail. For further information on Turkish metropolitan cities and source of their plans, see Appendix C. Content analysis has been used to evaluate the management of climate change issues in the strategic plans of these cities. This type of analysis has been used extensively in the climate change management literature (Crocì, Melandri and Molteni 2010). Additionally, the strategic plans were read carefully and classified according to the Bulkeley and Kern (2006) model.

Findings

This study compares leading global cities and Turkish metropolitan cities. Below the findings related to global cities will first be presented, followed by a sub-section on the Turkish cities.

Climate Change Management Approaches of Global Cities

Strategic plans to address climate change first appeared in developed and "climate change committed" countries such as Sweden and England. However, some cities in other developed countries such as the United States and cities in

³ See Appendix B for the source of those plans.

developing countries have now caught up in the planning process and started to lead in climate change management in their countries (Bulkeley and Kern 2006; Kousky and Schneider 2003). Therefore, this section will present the management strategies of cities in both developed and developing countries. Table 2 summarizes the results of the analyses of the global cities' climate change plans.

Bangkok has more than nine million inhabitants and developed its climate change plan for 2007–2012 in 2006, in which the target is a reduction of GHG emissions by 15% at the end of 2012 (Bangkok 2007). Mexico City's plan set the reduction rate of carbon dioxide (CO₂)-equivalent emissions at seven million tons between 2008 and 2012 (Mexico City 2008; Mexico City 2009). Sao Paulo, Brazil, set a 30% GHG emission reduction by 2012 (Prefeitura Da Cidade De Sao Paulo 2008). In order to achieve their targets these cities set out to improve their transportation systems, energy usage, and waste management systems. The plan of Mexico City calls for numerous activities to reduce GHG of the city, for example, the plan suggests demonstration of eco-houses and renewable energy projects, campaigns for energy efficiency, upgrading of infrastructure to save energy, and similar actions. Details of the city plans in these countries can be found in Table 2.

New York City, which has approximately 8 million inhabitants, published its assessment and corresponding action plan for climate change in 2008. In this plan New York City targets a 30% reduction in GHG emissions between 2005 and 2030. To achieve this, the managers of the city proposed a holistic plan for energy, transportation services, and industries (New York City 2008). London planned its long-term reduction using two intermediate steps: First, the plan calls for a 20% reduction in GHG emissions in 2016, and second, it will reduce its GHG emissions by 60% in 2025 (Greater London Authority 2007). Both New York and London's climate change plans focus mainly on energy services and transportation systems. For example, each city has used its authority to require the use of renewable energy and to create new building standards. Furthermore, each city limits the use of private cars, and provides new walking and cycling infrastructure for its inhabitants. Details of these mitigation strategies can be seen in Table

Table 2. Climate change management approaches of selected leading global cities * a

Areas and services of climate change mitigation	Bangkok	Mexico City	Sao Paulo	London	New York
Energy					
Energy efficiency schemes and use of CHP within municipal buildings	X	X		X	X
Procurement of energy-efficient appliances	X	X		X	X
Purchase of green energy			X		X
Eco-house and renewable energy demonstration projects		X		X	X
Campaigns for energy efficiency	X	X		X	X
Advice on energy efficiency to businesses and citizens	X			X	X
Promotion of renewable energy sources	X		X	X	X
Providing clean energy service			X		X
Establishing energy service companies			X	X	
Provision of incentives and grants for energy-efficiency measures		X	X	X	X
Increased energy conservation through strategic planning				X	X
Establishment of ordinances on the mandatory use of renewable energy		X		X	
Provision of energy efficiency requirements in zoning ordinances			X	X	X
Transportation					

Table 2. Climate change management approaches of selected leading global cities * a

Areas and services of climate change mitigation	Bangkok	Mexico City	Sao Paulo	London	New York
Mobility management for employees			X	X	
Green fleets	X	X		X	
Education campaigns	X			X	X
Green travel plans	X			X	
Quality partnerships with public transportation providers		X		X	
Public transportation service provision	X	X	X	X	X
Provision of infrastructure for alternative forms of transportation	X		X	X	X
Logistics centers for goods transportation		X		X	X
Transportation planning to limit car use and provide walking and cycling infrastructure	X	X	X	X	X
Workplace levies and road-use tolls				X	X
Waste					
Recycling, and reusing the waste within the local authority			X	X	
Procurement of recycled goods	X	X		X	
Campaigns for reducing, reusing, and recycling waste	X	X			
Promotion of the use of recycled products			X		
Waste service provision	X	X			

Table 2. Climate change management approaches of selected leading global cities * a

Areas and services of climate change mitigation	Bangkok	Mexico City	Sao Paulo	London	New York
Installations of recycling, composting and 'waste to energy' facilities	X	X			
Recycling, composting, and reusing schemes	X	X			X
Urban Planning and Land Use					
High energy-efficiency standards and use of CHP in new public buildings			X	X	
Demonstration projects—house or neighborhood scale.				X	
Guidance for architects and developers on energy efficiency and renewable	X			X	
Strategic land use planning to enhance energy efficiency and the utilization of renewable				X	
Planning of sites for renewable installations				X	
Strategic land-use planning to enhance public transportation				X	
Increasing green areas and forests	X		X		X

Sources: The sources of strategic plans can be found in Appendix B.

*The analysis is based on Bulkeley and Kern (2006).

a An 'X' means the plan contains activities or policies to mitigate the effects of climate change.

Climate Change Management Approaches Turkish Metropolitan Cities

Evaluating the strategic plans of the fifteen Turkish metropolitan cities revealed that they contain no explicit provisions to address climate change. Furthermore, there is no available information on how climate change will affect these areas. However, in order to identify implicit plans related to climate change issues, specific key words, such as “climate change” or “global warming,” were analyzed in these strategic plans. These keywords were mentioned as threats in a few plans such as the plans of Istanbul, and Izmir. Table 3 presents an overview of these city plans, classified according to the model of Bulkeley and Kern (2006).

Table 3 illustrates that Samsun, Diyarbakır, and Kocaeli have no plan to manage energy in their cities, while Bursa, Mersin, Istanbul, Ankara, and Antalya have some strategies in place in this area. For example, the main tool of cities for solving air pollution is using natural gas for heating. However, without clarifying the quantity, only the İzmir plan suggests using more cleaner energy sources, such as solar, thermal water or wind, for residential heating and lighting of recreational areas. In addition to this unique approach, the plans of Istanbul and Konya plans propose using clean or renewable energy for their transportation systems. Turkey, which has a great deficit between energy supply and demand, purchases 75% of its total energy from abroad. If nothing is done to combat that deficit, there will be a continuing deficit in the future (Satman 2006); none of the analyzed cities' plans includes any major initiative to solve this problem.

Investments in planning, construction, or improvements in existing systems were the main elements in the cities' transportation policies. Several plans mentioned the necessity of improving the public and general transportation system. Eight of the fifteen cities' plans called for improvements in pedestrian walkways, in the form of building additional overpasses or under-ways. Only five of the fifteen plans targeted new bicycle tracks or supported bicycle use in cities; as an aside, the use of bicycles was previously forbidden in some city centers (i.e., Eskişehir).

Finally, the elements of the plans related to waste and the general environment were also studied. In general, the main element of the city plans was to call for an increase in green areas. A few discussed forestation. In addition to this planting strategy, some suggested recycling waste. Almost all plans pointed out the problems of irregular urbanization in their cities. Their only strategy for managing these problems in the future was either to suggest cooperation with the state construction institution (TOKİ) or to build new houses.

Table 3. Climate change management approaches of Turkish metropolitan cities * a b

Areas and services of climate change mitigation	Is	An	Iz	Bu	Ad	Ant	Mr	Ko	Er	Es	Sa	Kn	Ga	K	D	S
Energy																
Energy efficiency schemes and use of CHP within municipal buildings	X	X	X	X						X	X	X	X		X	
Procurement of energy-efficient appliances	X	X			X					X						X
Purchase of green energy	X	X	X	X	X	X				X	X	X	X			
Eco-house and renewable energy demonstration projects																
Campaigns for energy efficiency																
Advice on energy efficiency to businesses and citizens																
Promotion of renewable energy sources	X															
Providing clean energy service	X				X	X									X	
Establishing energy service companies																
Provision of incentives and grants for energy-efficiency measures																
Increased energy conservation through strategic planning	X															

Table 3. Climate change management approaches of Turkish metropolitan cities * a b

Areas and services of climate change mitigation	Is	An	Iz	Bu	Ad	Ant	Mr	Ko	Er	Es	Sa	Kn	Ga	K	D	S
Establishment of ordinances on the mandatory use of renewable energy																
Provision of energy efficiency requirements in zoning ordinances																
Transportation																
Mobility management for employees																
Green fleets																
Education campaigns										X						
Green travel plans																
Quality partnerships with public transportation providers		X	X	X	X	X		X	X	X		X		X		
Public transportation service provision	X	X	X	X	X	X		X	X	X		X		X		X
Provision of infrastructure for alternative forms of transportation	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Logistics centers for goods transportation																
Transportation planning to limit car use and provide walking and cycling infrastructure		X		X	X	X	X	X		X	X			X		

Table 3. Climate change management approaches of Turkish metropolitan cities * a b

Areas and services of climate change mitigation	Is	An	Iz	Bu	Ad	Ant	Mr	Ko	Er	Es	Sa	Kn	Ga	K	D	S
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Workplace levies and road-use tolls

Waste

Recycling, and reusing the waste within the local authority

Procurement of recycled goods

Campaigns for reducing, reusing, and recycling waste

Promotion of the use of recycled products

Waste service provision X X X X X X X X X X X X

Installations for recycling, composting, and 'waste to energy' facilities X X X X X X X X X X X X X

Recycling, composting, and reusing schemes

Urban Planning and Land Use

High energy-efficiency standards and use of CHP in new public buildings

Demonstration projects—house or neighborhood scale

Table 3. Climate change management approaches of Turkish metropolitan cities * a b

Areas and services of climate change mitigation	Is	An	Iz	Bu	Ad	Ant	Mr	Ko	Er	Es	Sa	Kn	Ga	K	D	S
Guidance for architects and developers on energy efficiency and renewable																
Strategic land use planning to enhance energy efficiency and the use of renewable energy																
Planning of sites for renewable installations																
Strategic land-use planning to enhance public transport																
Increasing green areas and forests	X	X	X	X	X		X	X	X	X	X	X	X	X		

Sources: The sources of strategic plans can be found in Appendix C,

* The analysis is based on Bulkeley and Kern (2006).

a An 'X' means the plan contains activities or policies to mitigate the effects of climate change.

b (the abbreviation): Is=Istanbul, An=Ankara, Iz=İzmir, Bu=Bursa, Ad=Adana, Ant=Antalya, Mr=Mersin, Ko=Kocaeli, Er=Erzurum, Es=Eskişehir, Sa=Sakarya, Kn=Konya, Ga=Gaziantep, K=Kayseri, D=Diyarbakır, S=Samsun

Discussion

This study has provided insight into the plans either adopted or proposed by leading global cities and by cities in Turkey. The approaches of leading global cities to address climate change are evolving, however. In the plans discussed above the focus was solely on measuring and reducing GHG emissions. After realizing that reducing GHG emissions is not enough to manage climate change, the cities are now also developing adaptation strategies in order to sustain their existence in the future (Ekelund and Sigurdson 2007, p.5-6). In order to create realistic plans, the leading global cities develop action plans designed for both mitigating and adapting to climate change, focusing on their own services such as energy use, transportation, waste management and urban planning. These cities have proposed climate change plans according to the level of their GHG emissions and the rate at which they want those emissions reduced. For example, since London determined that its energy use, transportation system, and urban planning contribute to GHG emissions, its plan aims to reduce the GHG emissions from those services. Similarly, New York City determined that its energy use and transportation services contributed extensively to GHG emissions and then proposed mitigation strategies, which can reduce emissions in those areas. Similarly, Bangkok, Mexico City, and Sao Paulo have set mitigation strategies to deal with the emissions from their energy use, transportation systems, and waste management system.

Comparing the strategies to deal with climate change in developed countries with the approaches of cities in developing countries, shows that cities in developed countries tend to have generally well-functioning waste management systems, and as a result, these cities now focus primarily on energy, efficiency and green energy sources, as well as building standards. The three cities in from emerging economies in this overview are more reluctant to require energy efficiency in new houses or making existing energy cleaner. However, these cities do put strong emphasis on their transportation and waste management systems. Regardless of the differences between the cities in developed countries and those in emerging economies in an effort to reduce GHG emissions, cities from each sector developed plans targeting those services that were perceived as the highest contributors to GHG emissions.

What are the general approaches to climate change management of metropolitan Turkish cities? As mentioned previously, unlike the cities in

developed countries, none of these Turkish cities has any explicit plan to deal with climate change challenges plan. Furthermore, the study found been no efforts to disclose information how climate change will affect those cities. Therefore, Turkish cities lack both mitigation plans to address climate change. Furthermore, content analyses of the strategic plans show that these cities suggest few services that could directly or indirectly help manage the environment. Further, the Turkish cities' transportation policies primarily focus on building new roads and providing additional parking. Plan managers also want to build or expand public transportation, such as buses and the light-rail system, in order to improve transportation efficiency. Some plans suggest building new pedestrian overpasses, but with scant evidence that they will actually be used. The plans do not suggest any policies to educate people about the environmental benefits of walking or using environmentally friendly transportation systems. Instead, the cities are still designed and planned for the use of cars (Andırınlı 2008). Thus these cities have limited strategies for their transportation services, and are far from establishing or developing environmentally friendly, non-motorized transportation policies, which are needed in order to address climate change and other environmental issues.

In addition to these transportation policies, an analysis of policies for waste management shows that cities plan to recycle waste, yet still have the problem of separating waste at its source and then recycling it. Overall, the plans suggest improving green areas as many cities have poor green environment structures. However, none of those plans addresses climate-appropriate planting, or using drought-resistant plants although several cities, such as Ankara, Konya, in the middle of Turkey experience drought during the summer. Furthermore, none of the plans contains any citywide forestation strategy.

In summary, the comparison of the strategic plans of Turkish cities' with the equivalent efforts in cities such as Bangkok, Mexico City, and Sao Paulo, display a low awareness in the Turkish metropolitan cities of their own GHG emission levels, and a lack of comprehensive planning of explicit or implicit actions to mitigate or adapt to climate change. In this regard the Turkish cities are probably representative for most major cities in the emerging economies such as India's (Revi, 2008).

Conclusions and Implications

This study shows that there are gaps between policy and management strategies between metropolitan cities in Turkey and leading global cities. Several studies indicate that several regions, including the Mediterranean area and Turkey, has already been affected by climate change and these effects, such as extended heat waves, fires and droughts will become more serious in coming years (Demir 2009; Türkes 2008; Türkes and Erlat 2008). However, this study shows that while leading global cities are already in their second round of planning, Turkish cities do not have plans to measure their amount of GHG emissions, and lack plans on how to manage climate change and its possible impact on their cities. Moreover, while leading global cities attempt to use their city services, such as transportation, in order to mitigate climate change, the Turkish cities have a far way to go. In fact, their general policies for these services do not contain any holistic and sustainable approaches for climate change and other environmental issues. Broadly speaking, the 'Turkish cities' plans tend to be in reaction to the short-term needs of their inhabitants regarding energy use, transportation, and general environmental and waste management.

A comprehensive policy to reduce GHG emissions will be necessary both in Turkish cities and other developing countries' cities. Therefore, before it becomes too difficult to manage, all major cities need to develop strategies to mitigate and adapt to climate change. For effective climate change planning to occur, a city should first measure the level of GHG emissions with one of several suggested measurement techniques, such as material flow analysis (Burström 1999). Then the city needs to determine which of its services or activities have the most effect on the total GHG emissions (Kennedy, Steinberger, Gasson, Hansen, Hillman, Havranek, Pataki, Phdungsilp, Ramaswami, and Villalba Mendez 2010). After this measurement and priority analysis, the city should carefully plan strategies for its services and activities and then manage those plans. With the planning and managing of those services, the city can create a more human-centered city environment, giving high priority to the use of bicycles and developing a superior public transportation system. Creating human-centered cities will also develop a sustainable, healthy, and cost-effective environment for their inhabitants.

How a city can be motivated to develop climate change policies is an important issue of these findings and discussions. Existing studies of other cities in developed and developing countries point out that cities can be motivated to do

so in two ways: First, city managers can be motivated by receiving support from their states, as described in a German Study by de Oliveria (2009).

Second, cities can become entrepreneurial, relying on local initiatives to propose their own plans and then managing them (Kousky and Schneider 2003). Bulkeley and Kern (2006) point out that both the UK and Germany are highly committed to managing climate change and reducing GHG emissions. However, while some of their cities, such as Leicester, Heidelberg, Munich, and Frankfurt, lead in managing climate change, relying on local initiatives in order to develop and implement climate change policies, others do not. The role of cities in managing climate change has become evident even in the USA, which has hesitated to adopt climate change policies at the federal level. Instead cities such as Chicago and New York use their own initiatives and develop their own strategies and action plans in response to future climate change and global warming in their regions (Alber and Kern 2008; Kousky and Scheider 2003).

Therefore, this study suggests that there is a great need for major cities in Turkey and in other emerging economies to learn from these example and develop their own entrepreneurial mitigation initiatives. Such entrepreneurial cities may motivate not only their own inhabitants and actors but also managers of other cities and states to take the initiative for establishing and implementing climate change policies in their own countries.

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Appendix A

Table 1. Matrix of interdependence of urban policy sectors*

Impact	Land-use Zoning	Transportation	Natural Resources	Building	Renewable Energy	Waste and Water
Land-use Zoning Land-use zoning determines the density, height of buildings, and proportion of undeveloped land on each property.		Segregation of land uses impacts travel distances and frequency; transit-oriented development zones encourage use of mass transportation.	Zoning designates natural resource areas	Zoning impacts placement and density of buildings, which in turn impacts building energy efficiency and vulnerability to flooding and urban heat effects.	Zoning density can constrain on-site renewable energy production but can also increase efficiency of service delivery.	Zoning density can determine the efficacy of delivery of waste, recycling and composting services; and the energy required and efficacy of delivery of water services
Transportation Transportation policies determine the development and extension of road and mass transportation networks.	Transportation infrastructure policies shape demand land and acceptance of density increases.		Transportation systems impact natural resource and preserved zones.		Transportation policies can require renewable energy sources for mass transportation systems.	
Natural Resources Natural resource policies determine which areas are preserved from development and what uses are acceptable on them.	Natural resource policies determine the limits of developed land use zones and can improve quality of high density zones	Natural resource policies affect the placement of road and mass transportation infrastructure.			Natural resources endowment makes certain renewable energies possible.	

Table 1. Matrix of interdependence of urban policy sectors*

Impact	Land-use Zoning	Transportation	Natural Resources	Building	Renewable Energy	Waste and Water
Building	Building codes can increase acceptability of high-density zones by requiring design features to improve quality of high-density structures.				Building codes can require the on-site generation of renewable energy.	Building codes can require design and building materials that produce less construction waste.
Renewable Energy						Renewable energy production can involve high water consumption
Renewable energy policies can increase on-site renewable energy production and share of energy produced by renewable sources.						
Waste and Water						
Waste policies determine the means and extent of waste disposal.						
Water policies determine service extent, pricing, and water sources						

Adapted from Kamal-Chaoui and Robert (2009, p.80)

*Empty space in the table shows that there are not strong interactions between the sectors.

Appendix B

Table 4. Comparison of GHG emission of selected leading global cities

Cities	Measurement Year	Total GHG Emissions (million tones CO ₂ equivalent)	GHG Emissions Per capita (tones of CO ₂ equivalent)
1 London	2006	44.3	6.18
2 New York City	2005	58.3	7.1
3 Bangkok	2007	42.65	7.1
4 Mexico City	2007	60	2.84
5 Sao Paulo	2000	14.22	1.4

Source:

¹Greater London Authority, 2007, Action Today to Protect Tomorrow – The Mayor's Climate Change Action Plan, http://www.london.gov.uk/mayor/environment/climate-change/docs/ccap_fullreport.pdf [Accessed 31 July 2010]

²New York (2007). Inventory of New York City Greenhouse Gas Emissions, http://www.nyc.gov/html/planyc2030/downloads/pdf/inventory_nyc_ghg_emissions_2008_-_feb09update_web.pdf [Accessed 31 July 2010]

³Bangkok, 2007, Metropolitan Administration Action Plan on Global Warming Mitigation 2007 - 2012, <http://www.baq2008.org/system/files/BMA+Plan.pdf> [Accessed 31 July 2010]

⁴Mexico City, 2009, Mexico City Government, Cities, Climate Change, and Carbon Finance Presentation. Available at <http://siteresources.worldbank.org/INTCARFINASS/Resources/VazquezCitiesClimateChangeandFinance.pdf>. [Accessed 31 July 2010].

⁵Prefeitura Da Cidade De Sao Paulo 2008. Municipal act on Climate change, Accessed July 31, 2010. <http://www.c40cities.org/docs/ccap-sao-paulo.pdf>

Appendix C

Table 5. General Information of the Cities and the Sources of Strategic Plans

City	Population	Cities and Plans	Sources
1 Istanbul	11.174.257	The 2 nd strategic plan of the Istanbul Metropolis Municipality	http://www.sp.gov.tr/documents/planlar/IstanbulBuyuksehirBelediyesiSP1014.rar
2 Ankara	4.140.890	The 2 nd strategic plan of the Ankara Metropolis Municipality	http://www.sp.gov.tr/documents/planlar/AnkaraBuyuksehirBelediyesiSP1014.rar
3 Izmir	3.175.133	The strategic plan of the Izmir Metropolis Municipality	http://www.sp.gov.tr/documents/planlar/IzmirBuyuksehirSP20062017_1.pdf
4 Bursa	1.979.999	The 2 nd strategic plan of the Bursa Metropolis Municipality	http://www.sp.gov.tr/documents/planlar/BursaBuyuksehirBelediyesiSP1014.pdf
5 Adana	1.611.262	The 2 nd strategic plan of the Adana Metropolis Municipality	http://www.adana-bld.gov.tr/pdf/stratejikplan.pdf
6 Antalya	1.127.634	The 2 nd strategic plan of the Antalya Metropolis Municipality	http://www.sp.gov.tr/documents/planlar/AntalyaBuyuksehirBelediyesiSP1014.pdf
7 Mersin	1.056.331	The 2 nd strategic plan of the Mersin Metropolis Municipality	http://www.sp.gov.tr/documents/planlar/MersinBuyuksehirBelediyesiSP1014.pdf
8 Kocaeli	894.242	The 2 nd strategic plan of the Kocaeli Metropolis Municipality	http://www.sp.gov.tr/documents/planlar/KocaeliBuyuksehirBelediyesiSP1014.pdf
9 Erzurum	485.563	The 1 st strategic plan of the Erzurum Metropolis Municipality	http://www.erkurum.bel.tr/documents/stratejik_planlama-erkurum.pdf

Table 5. General Information of the Cities and the Sources of Strategic Plans

City	Population	Cities and Plans	Sources
10 Eskişehir	625.453	The 1 st strategic plan of the Eskişehir Metropolis Municipality	http://www.eskisehir-bld.gov.tr/2010/2010faliyet.zip
11 Sakarya	594.114	The 1 st strategic plan of the Sakarya Metropolis Municipality	http://www.sp.gov.tr/documents/planlar/SakaryaBuyuksehirBelediyesiSP1014.pdf
12 Konya	1.412.343	The 1 st strategic plan of the Konya Metropolis Municipality	http://www.sp.gov.tr/documents/planlar/KonyaBuyuksehirSP0711.pdf
13 Gaziantep	1.342.518	The 1 st strategic plan of the Gaziantep Metropolis Municipality	http://www.sp.gov.tr/documents/planlar/GaziantepBuyuksehirSP0711.pdf
14 Kayseri	895.253	The 1 st strategic plan of the Kayseri Metropolis Municipality	http://www.sp.gov.tr/documents/planlar/MersinBuyuksehirBelediyesiSP1014.pdf
15 Diyarbakır	855.389	The 1 st strategic plan of the Diyarbakır Metropolis Municipality	http://www.sp.gov.tr/documents/planlar/DiyarbakirBuyuksehirSP0609.pdf
16 Samsun	725.111	The 2 nd strategic plan of the Samsun Metropolis Municipality	http://www.sp.gov.tr/documents/planlar/SamsunBuyuksehirBelediyesiSP1014.PDF
Total	32,095,492		