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## Shifting Sustainable Mobility Agendas in Graz (Austria) and Hangzhou (China): The Multi-Level Process From Livable to Smart Cities

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## SHIFTING SUSTAINABLE MOBILITY AGENDAS IN GRAZ (AUSTRIA) AND HANGZHOU (CHINA): THE MULTI-LEVEL PROCESS FROM LIVABLE TO SMART CITIES

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### ABSTRACT

Several studies on various urban sustainability projects have observed their conceptual and technological similarity worldwide but also identified significant divergences in their actual local framing and implementation. By analyzing sustainable mobility policies in Hangzhou (China) and Graz (Austria) and changes in their agendas during a period of thirty years, this article contributes to that discussion with new empirical insights. The development trajectories in Hangzhou and Graz will be compared to identify similarities and divergences and to suggest future paths for comparative studies in sustainable urban mobility. The study draws inspiration from multi-level governance theory and places the analysis within critical global urban studies.

*Keywords:* Austria; China; Low-carbon city; Smart city; Sustainable mobility

### 1. INTRODUCTION

Several studies on various urban sustainability projects have observed their conceptual and technological similarity worldwide but also identified significant divergences in their actual local framing and implementation. This paper aims to contribute to these comparative studies by increasing our understanding of policies that aim to achieve sustainable transition in different parts of the world. It analyses the multi-level governance of sustainable mobility policies in Hangzhou (China) and Graz (Austria) and the changes in their agendas from “livability” - traffic that does not deteriorate living conditions - to smart cities. This paper draws inspiration from multi-level governance theory (MLG) and places the analysis within critical global urban studies.

### 2. LITERATURE STUDY

Based on a survey of 178 eco-city initiatives worldwide, Simon Joss and his colleagues concluded that urban sustainability policies have become globally mainstream (Joss et al., 2013). Eco-cities in different parts of the world share global proliferation, international knowledge transfers, the centrality of “carbon discourse”, and smart technologies. Although these initiatives share many common features, localizing the ubiquitous plans within each city’s social, political, economic, and cultural context has led to great diversity between these eco-cities. The survey conducted by Joss and his research group exposed striking diversity in concepts, forms, and practices (Joss et al., 2013). More recently, Tomor et al. (2021) concluded that while smart urban governance initi-

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atives often appear identical, they diverge in their societal goals, collaboration, and use of technology based on context-specific factors. Overall, their study exposed a need to explore the institutional context of urban development projects, as it affects the entire development process from planning to implementation.

One specific aspect of the transition towards sustainability that deserves attention is fluctuations or reversals. As Hysing (2014) has observed in the case of Sweden, “green stars” in environmental policies can also fade. Leaders in green urban development may experience variations between policy areas and over time. For this reason, the assessment of the sustainability of any sustainability policy benefits from attention to a longer time.

A comparison between cities in a developed, democratic European country and in developing authoritarian China is fruitful for two main reasons. Firstly, despite their different developmental stages and political systems, Graz and Hangzhou are intensively engaged in promoting sustainable mobility, and they use largely the same concepts. It brings insights into the impact of the political system in the use of globally shared concepts. Secondly, scholars in several fields have called for more comparative studies between the “developed West” and the “developing South” to re-orientate Western-centered theory-building. (Roy, 2009; Robinson, 2011; Peck, 2015).

Because of this dichotomy, scholars have, according to Robinson, regarded cities in the developed and developing world as incommensurable. However, she maintains that because the “economic and social activities, as well as governance structures in different cities, are linked together through spatially extensive flows of various kinds and intense networks of communication”, the cities share many similar experiences (Robinson, 2011). Leaning on her research, this article considers multi-level governance systems and their approach to sustainable mobility as comparable in their own right.

### 3. METHODS

The selection of Graz and Hangzhou as cases for this study is based on their record of ambitious sustainable traffic policies. They are both leading second-tier cities in their countries. They have launched similar city-branding strategies and are model cities in sustainable mobility development in their respective countries, which makes them comparable at the municipal policy level. While the cities are within the same “class” in their respective countries, their scales are not comparable. In 2020, the population of Graz was less than 350,000, while the permanent population in Hangzhou’s administrative area was close to 12 million. They also differ in size. Graz covers an area of 130 km<sup>2</sup>, whereas Hangzhou spans an area close to 17,000 km<sup>2</sup>. It, without a doubt, creates differences in the scales of traffic flows and the magnitude of traffic-related issues between the two cities. For that reason, to keep the two cases commensurable, this study does not analyze the actual implementation of the policies. Instead, it focuses on the definition of the concepts and the selection of policy measures.

Multi-level governance (MLG) theory allows the examination of actors and impacting factors at several territorial levels. Initially, the concept was developed for the European Union and has served as both a concept of actual governance and an analytical tool. Later, it analyzed other regions and countries, including China. Ongaro et al. (2019) regarded the MLG framework as appropriate for the study of contemporary China because its governance system has transformed from a monolithic party-state into an authoritarian multi-actor network that is globally integrated, embodying essential objects for an MLG analysis.

Based on these considerations, this article explores: (1) how globally shared concepts were localized in Graz and Hangzhou, and (2) how do the various actors in the multi-level governance

system affect localization. Answers to these questions are expected to reveal interesting similarities and divergences concerning the localization of globally shared concepts for sustainable traffic between the two cities. This study does not aim at theory building but provides empirical evidence to help design more theoretically oriented studies in the future.

The study was conducted in two stages. Firstly, the conceptual framework was constructed during the inductive stage, guiding the collection and analysis of the materials during the deductive stage. The analysis is based on official documents from different levels of government in original languages. News reports and research articles have complemented and triangulated the official data.

This study traces the emergence of sustainable traffic policies from the end of the 1980s until 2020. This period covers the first initiatives to improve public transport, promote non-motorized mobility, and the subsequent waves of sustainable, low-carbon, and smart traffic policies. The year 2020 marks the end of one period in the case of both cities, so it fits well as the ending year of the period under scrutiny. The analysis of this timeframe enables the observation of shifts from one policy agenda to another and the changes in influential actors behind these shifts on various levels of governance.

In the following section, developments in Graz and Hangzhou will be described as narratives to highlight the local dynamics. In both cases, the trajectory can be divided into three phases: the emergence of the “livability” agenda, the shift to a low-carbon agenda, and finally, the launch of smart city initiatives. The discussion section will compare the MLG systems and development trajectories in Hangzhou and Graz to identify similarities and divergences and suggest future paths for studies in sustainable urban mobility.

## **4. RESULTS AND DISCUSSION**

### **4.1. Graz: “Green Ebb and Flow”**

#### *4.1.1 A Multi-level Government System Emerges and Wanes (ca 1986-2000)*

Erich Edeger, the strongman of the conservative People’s Party in Graz, was a devoted cyclist. On his initiative, Graz started to create space for cycling lines and pedestrians in the historical city center in 1986 (Graz, 2015). Hence, contrary to the norm, the initiative for non-motorized mobility in Graz did not come from the green movement but from the conservative “car party.” However, this policy certainly found support in the two Austrian green parties, which experienced an upswing in popularity in the mid-1980s.

An additional step towards environmentally friendly traffic practices occurred during the winter of 1988-89. After smog plagued the valley around Graz, the city was forced by the provincial government to take action to purify the air. Hence, in the late 1980s, efforts toward more sustainable traffic were also pushed forward by higher-level government units.

In the late 1980s, traffic prognosis predicted a rapid rise in motorized traffic in Graz, prompting city leaders to prepare the city for traffic development scenarios. Of the three potential plans, Graz’s leaders selected the “soft mobility” vision that became the basis for the “Integrated Traffic Concept for Graz” in 1987. Since then, “soft mobility” has been Graz’s guiding slogan for traffic policies. The “softness” refers to environmentally and socially sustainable means of mobility, such as cycling, walking, and public transportation. This alternative was expected to improve citizens’ quality of life and make mobility smoother in the city. Guidelines towards this goal were passed in the city parliament in 1992, and they were developed within the framework of the

“Austrian Integrated Traffic Concept 1991” and the provincial equivalent. (Graz, 2015) These were Austria's first comprehensive traffic plans, and they aimed to promote environmentally friendly and non-motorized transport (Emberger, 2017). A strong emphasis on cycling encouraged Graz to claim the title of the Austrian capital of cycling (Graz, 2015).

In the early 1990s, the environmental initiatives in Graz were also linked to global developments and brand-making efforts. Graz had already joined the Climate Alliance for European Cities in 1991, and it was among the first European cities to implement Agenda 21 by issuing an Eco-city 2000 strategy in 1995 (Späth & Rohracher, 2011). As a result of the developments that had taken place since 1986, Graz emerged in its size class as a sustainable urban governance leader in Europe. The city was granted the Greenpeace Climate Action Award in 1993 and several other European awards during the following years.

Hence, a multi-level governance system on green mobility emerged during this first period in Graz. Local, regional, and global initiatives pushed forward actions toward sustainable mobility. City leaders actively collected European-level nominations to create an international green brand for the city. A comprehensive local network of enthusiastic civil servants, research institutes, and civil society groups was critical in the localization and implementation of the plans. (Späth & Rohracher, 2011)

However, local interest in developing sustainable modes of mobility waned over time in Graz. In general, there was decreasing public interest in environmental issues in Europe. (Späth & Rohracher, 2011). The shift was also visible in the national transport route plans that Austria published in the late 1990s, which emphasized economic development more than the environment (Emberger, 2017). The city government shifted its brand-building agenda toward culture and pursued nomination as a European Cultural Capital. Graz was awarded the title in 2003. The City Council did not prioritize the green agenda and sustainable mobility for a decade. In their study on the social dynamics of eco-city governance in Graz, Späth & Rohracher (2011) concluded that the lack of institutionalization of the local actor networks could explain the dilution of the green agenda. The transformation toward a more environmental and climate-friendly mobility system weakened when the networks disintegrated.

#### *4.1.2 A More Comprehensive and Stronger Framework with EU Support (ca 2000-2010)*

While environmental issues were sidelined in the City Council at the turn of the millennium, some actors in the city administration took new initiatives to promote low-carbon mobility. In particular, since the 2000 launch of the “European Climate Change Program” and the 2001 issuance of the “White Paper on European Transport Policy for 2010”, several EU-funded projects served as frameworks for traffic-related governance actions in Graz.

Austria became an EU member in 1995 and actively began to participate in various EU programs for regional development and climate change mitigation. The first EU project in Graz that specifically focused on mobility was the CIVITAS Trendsetter, which ran from 2002 to 2006 and aimed to improve the availability and efficiency of public transport in Graz (Graz, 2020). Next, during 2005-2008, Graz participated in an EU-funded project called “Astute” to promote low-carbon traffic development. The project steered the administration's activities from infrastructure projects towards awareness-building to change the traffic behavior of city residents. Other outcomes included campaigns promoting non-motorized mobility, for example, through “car-free days” (Astute, 2009). These persistent efforts were awarded in 2008 when Graz was nominated as the Civitas City of the Year for its long-term commitment to “soft mobility” through a broad-portfolio sustainable transport policy. Due to the support from various EU-funded programs, the city could maintain its agenda of soft mobility despite waning political interest in low-carbon

mobility. The EU programs also increased the administration's awareness of environmental and climate-related issues, which likely created a more solid support network for low-carbon mobility. However, that cannot be confirmed with the materials used for this study.

Gradually, sustainable mobility returned to the political agenda of Graz when the Green Party gained more votes. In 2008, Lisa Rucker from the Green Party was appointed as a city councilor, with traffic, the environment, and commerce as areas of responsibility. Graz implemented several mobility-related surveys among residents and issued documents to give new life to the "soft mobility" policy. The most important of the documents was the "2020 Master Plan for Mobility" (Graz, 2010) which was built upon the provincial master plan from 2008 (Graz, 2021). In addition, Graz issued long-term visions until the year 2050. On Rucker's initiative, Graz also launched a bike pool experiment that started operating in 2012.

The shorter-term plan boldly stated that Graz would emerge as one of Europe's top 10 middle-sized cities and establish itself as an international smart city and center for innovation, technology, and smart services. (Graz, 2020) Graz also issued specific master plans for mobility, energy, and climate protection. The slogan of this long-term plan was "I live in Graz", and it envisioned that by 2050, Graz would have developed into a dynamic, affluent city with the highest quality of life. However, these plans seemed rather centrally driven and at the core of the outward brand-making efforts. For example, the slogan "I live in Graz" was not widely known among Graz residents (Unofficial Discussions in Graz, 2016). In any case, Graz aimed to reach these goals by enabling green mobility and reducing the necessity of using vehicles.

The leading idea of the master plan was that behavior change requires a change in one's way of thinking. The slogan of the awareness-raising campaigns was "Mobility starts in the head." This kind of change in thinking would also make soft mobility socially acceptable and attractive (Graz, 2010).

The plan further emphasized that the traffic department should not be the only unit that promotes and supports bicycling but also other actors, such as companies, schools, and public institutions (Graz, 2010). Hence, the local government decided to make concerted efforts to create a broad and institutionalized network of local actors supporting these policies.

As the new documents were prepared and issued, a new tide turned the public attention towards immigration issues, and right-wing populist ideas started to occupy the political agenda, taking attention away from environmental issues.

Despite fluctuations in the attitudes towards sustainable mobility during this period, various EU-funded projects supported the gradual institutionalization of green mobility governance practices in Graz. Once the public support for green transport strengthened again, the City Council took a strong role and issued decisive long-term plans leaning on the local "soft mobility" brand. These plans were incorporated into the new internationally-oriented city branding strategies that gradually laid the ground for comprehensive smart city plans.

### *Smart Infrastructure for Cars (ca 2010-2020)*

A change in the relative strength of political parties in the City Council in 2012 led to compromises in the ambitious plans on "soft mobility." During the 2012 elections, the Green Party lost voters. Traffic became the responsibility area of Mario Eustacchio from the right-wing populist Freedom Party of Austria. He criticized his predecessor's costly green traffic project and turned down a new cyclist and pedestrian-friendly projects that would have required significant investments (Radlobby Argus, 2013). According to a local researcher and green activist, the cycle-friendly political atmosphere had faded by 2016. (Discussions in 2016).

These developments occurred despite the 2011 EU White Paper on Transport and the subsequent Austrian Transport Master Plan of 2013, which introduced measurable reduction targets for emission and energy consumption. Nevertheless, the EU remained a central source of inspiration and funding for various mobility-related initiatives in Graz (Graz, 2020).

The master plans for mobility were still in effect, and the vision for a Smart Graz was a central component of the long-term plans that stretched until 2050. The smart city plan became the main component of the city's development and branding in 2013 (Nussmueller, 2017). The smart projects provided a suitable framework for pro-car politicians, as the focus could be shifted from various restrictions to car use to smart infrastructure projects. The smart city pilots were also anticipated to generate commercial solutions that could be replicated elsewhere in Austria and abroad. Hence local researchers and companies became central actors in the local traffic governance framework.

The visions that were related to mobility focused on the saving of resources (Graz, 2016a). Typical for smart city projects, many of the projects in Graz were limited to certain areas in which smart infrastructure development was more feasible and would create more added value (Graz, 2016b).

The global, EU-level, and national concerns for the impact of motorized traffic on climate change and the livability of cities were reframed during this period within the globally trending smart city agenda. It enabled the expansion of motorized traffic, which found wide support among the voters. In addition, it provided a suitable platform for city branding and the marketing of local smart city innovations. In this way, companies and researchers became closely involved in the local mobility-related governance network. Various EU-funded initiatives enabled the continuation of low-carbon "soft mobility" projects.

Looking at the outcomes of the policies, the modal split of mobility has not significantly changed since 1982. The share of car trips was 42.6% in 1982; some 40 years later, in 2018, it was only one percent lower, at 41.6%. Despite numerous efforts to improve the public transport network and its availability, the use of public transport had only increased by 1.7 %, to 19.8%. However, here, it needs to be noted that the population of Graz had grown by 50,000 residents during that period, and thus the number of public transport users was much higher in 2018 when compared with 1982. A significant development was the clear increase in cycling. The share of trips made by bicycle increased from 8.2% to 19.3% (Presse, 2021).

Table 1 Important Documents and Initiatives within the Multi-level Governance Framework: Graz

	Phase 1 (1986-ca 2000)	Phase 2 (ca 2000-2010)	Phase 3 (ca 2010-2020)
<b>global</b>	- Agenda 21 (1992) - Kyoto Protocol (1997)	- Copenhagen Climate Change Conference (2009)	- Paris Summit (2015)
<b>regional</b>	- EU projects	- European Climate Change Program 2000 - White Paper on European Transport Policy - EU projects	- EU White Paper on Transport (2011) - EU projects
<b>national</b>	- Austrian Integrated Traffic Concept (1991) - Austrian Federal Transport Route Plan (1998)	- Austrian Transport Master Plan (2002)	- Austrian Transport Master Plan (2013)



	Phase 1 (1986-ca 2000)	Phase 2 (ca 2000-2010)	Phase 3 (ca 2010-2020)
<b>provincial</b>	<ul style="list-style-type: none"> <li>- Smog prevention (1989)</li> <li>- Styrian Integrated Traffic Concept (1991)</li> <li>- Styrian Integrated Traffic Concept (1991, 1996, 2000)</li> </ul>	<ul style="list-style-type: none"> <li>- Styrian Master Plan for Mobility 2008+ (2008)</li> </ul>	
<b>municipal</b>	<ul style="list-style-type: none"> <li>- Soft mobility initiatives (1986)</li> <li>- Integrated Traffic Concept for Graz (1987)</li> <li>- Transport Policy Guidelines 2000 (1992)</li> <li>- Eco-city 2000 (1995)</li> </ul>	<ul style="list-style-type: none"> <li>- 2020 Master Plan for Mobility (2010)</li> <li>- 2050 Smart city vision (2010)</li> </ul>	<ul style="list-style-type: none"> <li>- Smart City Graz (2013)</li> </ul>

Note: The table is not meant to be exhaustive. It contains a selection of the most important policy documents.

## 4.2. Hangzhou: “Quality of Life without Travel Problems

### 4.2.1 Tackling the “Travel Problem” with National Pilot Projects (ca 1990-2005)

At the national level, from the 1980s until the early 2000s, China’s traffic policies focused on expanding the road system. Private car ownership was new in China, and boosting China’s car industry became gradually a national priority. Families were encouraged to buy cars (Wang & Chang, 2014). Only in 2004 did the Ministry of Construction issue guidelines on developing public traffic, initiating a series of national-level guiding documents on improving the urban public transport systems. It was not until 2007 that the State Council issued a document prioritizing public transport. The document “Comprehensive Energy Reduction Program” required cities to construct rapid public transport and metro lines to reduce energy consumption (Pan, 2012).

Despite a strong domestic agenda on traffic, global agendas were also visible in China’s national policy documents. China localized Agenda 21 in 1994 in a white paper, “China’s Population, Environment and Development in the 21st Century.” Government units at different levels of administration were urged to pay attention to the White paper in drafting the ninth five-year plan (FYP) for the years 1996-2000.

As the capital of Zhejiang, one of the richest provinces in China, Hangzhou’s leaders have excellent resources to show their capabilities and pave the way for their promotion. Thanks to its ambitious leaders, Hangzhou has been regarded as one of the best-managed cities in China. It has set emissions control indicators and evaluation targets that are the strictest in the country (Ahlers & Shen, 2018). However, during the 1990s, local city governments, Hangzhou included, were occupied with economic development while environmental issues were sidelined. Although the government of Hangzhou mentioned Agenda 21 in its ninth FYP (1996-2000), the available documents do not disclose to what extent the agenda was observed in local policy implementation.

The situation changed at the turn of the millennium. In 2000, the city government decided to tackle the most difficult problems the residents met daily. To this end, a city-wide survey was conducted. In 2002, based on additional surveys, solving the “seven urgent difficulties” became a slogan that Hangzhou leaders used to show their commitment to improving the city's livability. One of these problems was related to traffic, specifically, “traveling and parking.” the city government identified solving the “travel problem” as its top priority. This was an urgent issue

in the city, as the number of cars had increased exponentially after China joined the WTO in 2001 (Ling, 2014).

Hangzhou applied to the “intelligent transport system” pilot cities project to support these mobility strategies and won the nomination in 2002. In 2004, Hangzhou published a localized version of the national public transport document emphasizing the role of public transport in solving the “travel problem”. At the same time, Hangzhou was also profiled as a National Model City of Civilization and Culture, and public traffic policy was incorporated into that model city program. In this context, city authorities aimed to promote civilized and law-abiding traffic behavior among car drivers and cyclists. The campaigns also included awareness-building to guide residents to use public transport instead of private cars (Hangzhou, 2004).

The governance slogan of that time, “Government leads, policies support, society participates, markets operate” (Shi, 2002), illuminates the local governance network and the roles of different actors in developing the transport system. The local government had a central role in the planning and implementing the policies. However, in Hangzhou, leaders were willing to listen to the residents' opinions.

By the early 2000s, Hangzhou's mobility-related multi-level governance system showed strong dynamism between the city and the national government and its residents. Using the traditional local methods of socialist China of “collecting opinions from the masses”, it identified traffic as one of the most urgent problems among residents. To solve these problems, Hangzhou actively utilized various pilot projects launched by the ministries. However, the residents were mainly concerned about traffic jams that complicated their daily lives rather than the environmental consequences of motorized vehicles to the environment. At the same time, Hangzhou could boost its profile as an exemplary city within China and show off the capabilities of its leaders, who were eager to get promoted to higher positions. Nonetheless, the international dimension of the mobility-related governance system remained rather weak.

#### *4.2.2 Five-year Plan for a Low-carbon City with a High Quality of Life (ca 2005-2010)*

After the turn of the millennium, Hangzhou and many other Chinese cities became a hot spot for various internationally oriented eco and low-carbon urban development projects. The frameworks of these projects were defined by international planning and architecture bureaus using the latest trendy concepts, and the cities became test sites for technological innovations. Hence, the low-carbon mobility features embedded in the globally circulating concepts of urban development also reached Hangzhou.

At the national level, the government responded to the UN framework convention on climate change by issuing the National Climate Change Program in 2007.

The 11th FYP (2006-2010) began a new cycle in Hangzhou's traffic policies. On the one hand, well-functioning traffic was linked to Hangzhou's new brand-building strategy. On the other hand, low-carbon economy, energy-saving actions, and carbon emission reduction were included in the national level plans and, hence, also localized in Hangzhou.

In Hangzhou, the framework for local actions was created by Hangzhou's new branding as a “city of quality life” which was declared in 2006 in Hangzhou's 11th FYP and later formulated into clear policy goals in 2007. The ultimate objective was to contribute to Hangzhou's branding as a livable city providing an excellent environment for residents and companies. The city leadership aimed to make Hangzhou one of China's most attractive cities and reach international recognition for its good living and business environment (Hangzhou, 2010; Delman, 2014). In 2010,

Hangzhou was designated as a national low-carbon pilot city, and low-carbon traffic was one important aspect of the pilot program.

Solving the major difficulties in people's daily lives was one of the core objectives of the "City with a high quality of Life" program. In 2007, the city issued a new document on how to solve the "seven urgent difficulties" experienced by the residents of Hangzhou. The policy document emphasized the improvement of the public traffic network but also included measures for improving traffic behavior. The document emphasized good manners, respect for traffic rules, and awareness about green mobility. The document promoted a "public traffic week" and "car-free day" with the slogan, "Green mobility starts with me" (Zhejiang News, 2009), which resembles Graz's slogan, "Mobility starts from the head."

In connection with Hangzhou's ambitions to become a low-carbon city, its leadership decided to improve the policy implementation system to ensure the goals would be met. While it is usual for city leaders to declare such goals, environmental issues during that period were typically still neglected in favor of economic growth. A central method in China to ensure the implementation of policies is the civil servant appraisal system, wherein civil servants in leading positions sign annual contracts that define a set of goals that they need to reach to receive bonuses and ensure promotions. In Hangzhou, properly considering residents' opinions became a central criterion of civil servant assessment.

To respond to the wishes of the city dwellers, the municipal authorities used various channels to collect people's opinions. These channels and methods included the regular arrangement of surveys, the opening of telephone hotlines, the organization of residents panels, the use of traditional "letters and visits" methods of individual complaints, the use of communist mass organizations to collect people's opinions, and the establishment a website through which residents could post complaints and wishes.

The most important of these methods was the aspect of social assessment, which counted for 65% of leaders' performance assessments at the sub-municipal level. Responses were collected from ordinary citizens through traditional surveys. The influential social organization "Green Hangzhou" was an expert evaluator, and opinions were collected from companies and business organizations. The first of these comprehensive surveys was conducted in 2011. The dual problem of road transport and car parking topped the surveys, together with air pollution from vehicles (Delman, 2019).

The "Comprehensive Energy Reduction Program" that the State Council issued in 2007 required cities to construct rapid public transport and metro lines. Hangzhou started the building of metro lines the same year. However, another public transport initiative that became a signature for Hangzhou was its bike pool. Hangzhou was the first city in China to build a public bike system, and by 2015, it had grown into the world's largest, with 84,000 bikes and close to 3,500 bike docking stations. (Hangzhou Daily, 2015). The building of the bike pool began in 2008 as a part of the attempts to develop a city with a high quality of life. The bike system complemented the development of the public transport system by solving the "problem of the last kilometer" from bus to work and home. Hangzhou received additional funding for the development of the bike pool from various Chinese pilot programs such as the Improvement of the Transit System pilot, National Bicycle Transit System pilot, Public Transport Metropolis pilot, and City of Green Transport pilot. The commercial Hangzhou Bicycle Service managed the system. The local government provided the initial infrastructure cost, and the company collected revenues from advertising. It started turning a profit in 2010. In 2017, the Hangzhou Bicycle Service won the British Ashden Award for Sustainable Transport, which brought international fame to the city.

2010 the city issued specific traffic-related guidelines that reconfirmed a public traffic system comprising five transport modes. A bicycle pool, taxi services, and ferry lines would complement

the public bus and subway system. Thanks to its efforts, Hangzhou was nominated as the Public Transport Capital of China in 2013, and the sustainability trend gained further momentum when Hangzhou was appointed as the National Green Traffic Pilot City in 2016. The 2010 guidelines also laid the ground for the wider informatization of the traffic system (Hangzhou, 2010). It paved the way for the comprehensive digitalization of the mobility management system in Hangzhou, which will be discussed in the next section.

While residents' concerns and wishes were considered, they were subdued when the interests of the city's growth coalition were at stake. For example, the new metro lines and stations were not located in the old suburban areas where they were most needed. The increase in the price of land in newly developing residential areas was of higher priority in the city government, which received hefty revenues from land leasing, and within construction companies, who profited from higher estate prices (Xue et al., 2011).

During this period, the global low-carbon agenda was localized in China in consequent steps from the national level to municipalities. Various national pilot projects strengthened Hangzhou's reputation as a low-carbon public transport capital of China. While the low-carbon framing was important for city branding, actions in favor of public and non-motorized traffic were increasingly taken in Hangzhou due to pressure from residents (Ahlers & Shen, 2018). City dwellers who, in the early 2000s, had complained about commuting problems gradually became more concerned about the environmental impacts of motorized traffic.

The influence of international climate programs became stronger in the multi-level traffic governance system, which also expanded horizontally in Hangzhou. On the one hand, residents and selected social organizations were listened to more carefully. Still, on the other hand, the corporate sector gained a strong position in developing new traffic lines.

#### *4.2.3 Low-carbon City Brain with a Dense Multi-level Governance System (ca 2010-2020)*

Hangzhou's first smart city plans were launched in the early 2010s when it declared itself "Smart Hangzhou". Hangzhou's 12th FYP (2011-2016) was built upon this new concept in tandem with the city's low-carbon strategy and "quality life" branding. Consequently, local traffic plans were framed within a low-carbon framework with a strong "smart" techno-agenda. The plans benefited strongly from the Chinese tech giant Alibaba, which had its headquarters in Hangzhou. One of the popular features of Hangzhou's smart traffic policies was its traffic app. The app, which at that time had 15 different functions, provided information about timetables and disturbances in traffic and allowed passengers to buy tickets, book a taxi and send traffic-related comments, complaints, and suggestions.

China's informatization strategy and, consequently, Hangzhou's smart city plans reached a new level in 2016 with the 13th FYP for 2016-2020. One of the plan's goals was to develop "Digital China." This plan was localized in Hangzhou with the upgraded slogan, "New-Style Smart Hangzhou", which replaced the "quality life" branding. Again, Hangzhou acted as a national pilot city for the "City Brain" platform. "City Brain," developed by Alibaba, aimed to improve urban management with the help of big data, cloud computing, and artificial intelligence. Initially, the goal was to find solutions to Hangzhou's ever-worsening traffic problems by using data from sensors on traffic lights and in traffic cameras (Caprotti & Liu, 2022). According to Hangzhou's webpage, thanks to the system, Hangzhou's position in the national "traffic jam ranking" dropped from 2nd to 35th place (Hangzhou, 2020). Nonetheless, this likely meant that the city still experienced heavy congestion.

The City Brain solution is intended to be replicable and, at this writing, has already been sold to several cities outside of China. Hangzhou also continued developing its five modes of transport,

putting emphasis on public transport and “slow mobility” (walking and cycling) to uphold its designation as the Public Traffic Capital of China (Hangzhou, 2016).

While the traffic monitoring system covered the entire urban center of the city, some districts were designated as specific areas of digital development, particularly when the City Brain 2.0 was launched in 2018. For example, Hangzhou’s Xiaoshan district, which was selected to host some Asian Games competitions in 2022 (postponed to 2023), was refurbished with the latest digital technologies to showcase China’s tech capabilities.

Alongside high-tech solutions to traffic-related problems, also purely regulatory measures were taken. In an air quality study conducted by Greenpeace, Hangzhou ranked 43rd out of 74 Chinese cities in 2014, which was not very flattering for a city that wanted to be known for its high-quality living environment. To tackle the issue, the provincial government issued strict restrictions on the use of cars and sales of car licenses in 2014. According to city officials, the amount of PM2.5 air pollution from traffic dropped from 40% in 2011 to 28% in 2014. Typical for China, these and other regulatory efforts towards better air quality were also taken in preparation for the 2016 G20 summit meeting in Hangzhou, by order of the Ministry of Environment, to convey a positive image of the city for the top-ranking visitors (Shen & Ahlers, 2019).

Caprotti & Liu (2022) have shown in their research that Hangzhou’s digital urban platforms were planned by actors on multiple levels, from ministries to the provincial government to local authorities in different sectoral departments. The national-level plans for China’s digitalization and Alibaba’s presence provided exceptional conditions for the localization of smart city plans in Hangzhou. Digitalization and smart solutions penetrated all aspects of traffic management in Hangzhou, from steering traffic flows to soliciting feedback from residents.

From the early 2010s to 2020, the public transport system expanded significantly in Hangzhou, especially thanks to the metro system. In 2011, only 20% of daily commutes in the central districts were taken by bus. At that time, the first subway lines were just about to open, and a quick increase in the use of public transport was to be expected. The share of public traffic was expected to pass 50% by 2021 (Zhongxinwang, 2013). In 2020, the share of motorized public traffic was reported to be 52.4% (Hangzhou, 2021).

Table 2 Important Documents and Initiatives within the Multi-level Governance Framework  
Hangzhou

	Phase 1 (ca 1990s- 2005)	Phase 2 (ca 2005-2010)	Phase 3 (ca 2010-2020)
<b>global</b>	- Agenda 21 (1992) - Kyoto Protocol (1997)	- Copenhagen Climate Change Conference (2009)	- Paris Summit (2015)
<b>regional</b>	-	-	-
<b>national</b>	- White paper on “China’s Population, Environment and Development in the 21st Century” (1994) - Opinions on Prioritizing the Development of Urban Public Transport (2004)	- National Climate Change Program (2007) - Comprehensive Energy Reduction Program (2007) - National pilot and model city programs	- Guiding Opinions on Prioritizing the Development of Public Transport in Cities (2012) - Atmospheric Pollution Prevention Action Plan (2013) - Ministry of Environmental Protection: G20Blue (2016)

	Phase 1 (ca 1990s- 2005)	Phase 2 (ca 2005-2010)	Phase 3 (ca 2010-2020)
			- National Informatisation Strategy 2016 –2020 - National pilot and model city programs
<b>provincial</b>	- Provincial equivalents of the national-level documents	- Provincial equivalents of the national-level documents	- Provincial equivalents of the national-level documents - Car license plate restrictions (2014)
<b>municipal</b>	- Measures to solve the seven urgent problems (2002-) - Constructing the “Urban Public Transport Priority” System and Solving the Problem of Citizens’ Traveling Difficulty (Trial) (2004)	- City of Quality Life (2007) - Priority Development Strategy of Public Transport to Create “Quality Public Transport” (Hangzhou, 2010)	- Smart Hangzhou (2010) - New Style Smart Hangzhou (2016) - Hangzhou Climate Change Plan (2013-2020) - Hangzhou Air Pollution Prevention and Control Action Plan 2014—2017

Note: The table is not meant to be exhaustive. It contains a selection of the most important policy documents.

## 5. CONCLUSION

The following preliminary results can be obtained when looking at the dynamics of multi-level governance as they relate to sustainable mobility policies in Graz and Hangzhou.

On the surface, the emergence and strengthening of low-carbon and smart agendas can be explained by local growth coalitions that followed the globally spread neoliberal rationality of rebranding the city to compete for a higher position in the global hierarchy of cities. Similar agendas were used in both cities to brand them as globally competitive and attractive places for investments with high-quality living standards. Both cities also utilized smart city agendas for advertising and creating markets for their local technological innovations. However, these entrepreneurial urban sustainability strategies are planted in different soils and thus develop other characteristics. They follow their dynamics and create variegated outputs depending on the local coalitions that promote them and their socio-political context. Building on Parnell and Robinson, Lawhon & Truelove (2020) maintain that “even where neoliberalism is prevalent, its explanatory power is not ubiquitous, and at times the concept insufficiently explains the causality of urban outcomes”. It is imperative to take a bottom-up view to expose other important causes for change.

In Graz and Hangzhou, the city level of governance was, as expected, the primary actor and the two cities were actively applying for important financial and strategic support from above. National policies created an important framework in both cities, and the provincial government occasionally intervened in their mobility-related issues. In the case of Graz, various EU funding schemes provided critical support and guidance, whereas Hangzhou benefited from various pilot city programs linked to China’s development strategies. Both cities developed their own mobility concepts that steered the localization of global and national-level agendas.

Both cities communicated with residents to improve their traffic systems and raise awareness about the benefits of public and non-motorized traffic. Campaigns such as “car-free day” were arranged in both places. However, the differences in political systems created divergences in how citizens could affect local traffic planning. In Graz, residents could influence traffic strategies through elections and survey participation and by being active in NGOs and political parties. In Hangzhou, residents could air their opinions and wishes through different consultative channels, and the city government relied on the expertise and resources of local environmental and social organizations. As the assessment system of the leaders in Hangzhou was tied to public opinion, these channels directly impacted local traffic policies on some issues. Another difference between the two cities lies in the level of environmental awareness among the residents. In Graz, the Green Party supporters and environmental experts were pivotal in promoting the green traffic agenda from the 1980s onwards. In Hangzhou, residents who demanded improvements in the traffic system were initially not interested in environmental issues but in a less troublesome daily life. However, as air pollution became severe, it ranked as the top concern among residents in municipal surveys.

Once the smart agenda became prevalent, high-tech companies became more prominent in localizing sustainable mobility policies in the two cities.

The results of this study also remind us that the direction of traffic policies can change again. Stakeholders should prepare for the possibility that national or supranational leaders could begin to focus on priorities other than low-carbon traffic, that public opinion could shift, or that the city leadership could fall into disfavor with national leaders and channels of support could be cut. Moreover, an intensive focus on smart solutions could lead to the concentration of high-tech low-carbon life in privileged posh districts while leaving the rest of the city with declining public traffic and worsening traffic jams. Thus, determining how to ensure the sustainability of sustainable traffic policies should be a key objective for future comparative research. This study has provided empirical evidence of similarities and divergences in localizing sustainability concepts. However, more comprehensive studies are needed for theoretical development.

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