Enhancing Capacity Building for Urban Transformation as a Means to Close the Planning–Implementation Gap in Europe and China †

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1. Introduction

China has experienced unprecedented rapid urbanisation process in the past three decades, while, at the same time, encountering and facing a series of big challenges such as fast urban population growth, acute industrial restructuring, limited environmental carrying capacity, wide environmental degradation and less well-coordinated governance due to the conflicts of interest from different stakeholders (Neumann et al. 2019). In terms of a city's routine operation and daily management, the emerging "urban diseases", such as air pollution, traffic congestion, inadequate public services and other problems, pose additional challenges to the government's adoptive capacities in urban management and governance (Xu and Zhu 2020). All these challenges call for new approaches for urban development and transformation of the static type of urban management into a more dynamic and real-time adaptive practice (Neumann et al. 2018). Therefore, the rise in Smart City development is logically becoming a paramount and urgent need in China's new round of urbanisation and city development, where the quality- and human-centred development approach is fully promoted and further emphasised to eventually develop socially integrative cities (Li 2012; Shen 2010; Sun 2013; Zhen and Xiao 2014).

However, due to the top-down governance structures in China, at least for now, it is still the central and local governments that play the dominant role in Smart City development and practice (Shen 2010; Sun 2013). While progress is being made in distinct cases, showcasing experimental and pioneering examples of sustainable urban development, systematic, collectively shared urban visions, followed by spatially embodied, well aligned and integrated implementation actions, are still scarce and occasional. Strategies that were partly, or not at all, implemented

do exist in cities in China (Xie et al. 2015), as well as in Europe. This mismatch between planning in a strategic sense (conducted by decision-making authorities; taking place both on the national and local levels) and the implementation of actions leads to inefficient use of resources and local potentials, failing processes, lack of alignment, missing knowledge transfer and missed synergies, as well as lock-ins and frustration among the involved stakeholders. Consequently, there is an urgent need to close this gap. We argue that a set of transformative capacities within cities can narrow the planning–implementation gap in cities by interlinking the strategic perspective with specific implementation efforts to address the (local) challenges in an effective way and induce long-term transformative change.

The main aim and contribution of this research is:

- operationalising and applying an analysis framework to the European and Chinese context to measure transformative capacities to address the planning–implementation gap of cities;
- exploring and illustrating innovative approaches based on case studies to bridge the gap between strategic development and integrated planning and implementation in Europe and China.

The article is structured as follows. A literature review in Section 2 explores the scientific discussion on the planning–implementation gap, and introduces the conceptual framework on the transformative capacities of cities as an approach used in the article to study innovative approaches to narrow the planning–implementation gap and the smart cities approach, as this approach is used for the empirical case studies. Section 3 describes the methods used. It describes the analytical framework to measure transformative capacities and the case study approach. Section 4 describes the results of the case studies in China and Europe and Section 5 includes a reflection on innovative approaches to address the planning and implementation gap and outlines further research.

2. Literature Review

In this section, a literature review is provided to: (1) the planning–implementation gap; (2) transformative capacities in cities as a means to address the planning implementation gap; (3) the smart cities' planning approach in China and Europe.

2.1. Planning–Implementation Gap

Researchers have been dealing with the problems of implementation processes for decades (Pressman and Wildavsky 1973; Gunn 1978). Earlier work saw a top-down policy as the ideal type for effective policy implementation. The approaches of the early 1980s (Lipsky 1980) see the so-called "street level bureaucrats" as

the key to successful or failed implementation and implementation must not be separated from policy-making. Recent approaches consider the political context much more comprehensively, since implementation will be influenced by complexity and unpredictability (Braithwaite et al. 2018), and the possible solutions vary according to the local context (Rittel and Webber 1973).

For decades, the normative top-down policy has been criticised as being based on three questionable elements: a chronological order in which expressed intentions precede action, a linear causal logic whereby goals determine instruments and instruments determine results, and a hierarchy within which policy formation is more important than policy implementation (Hill and Hupe 2015). Understanding has increased that the success of policies is not self-evident, and governments must do more to ensure that the results are implemented (Hudson et al. 2019).

In parallel, urban qualities are strongly influenced by social, environmental and technical changes, and urbanisation and traditional planning methods can no longer satisfy the growing demands for sustainable urban planning with regard to factors such as complexity, problem size, and level of detail, and these limitations make the development of new approaches necessary. More flexible and iterative planning approaches must focus more on participatory actions, implementation and see the city as a dynamic, complex system consisting of stocks of resources and flows of networks, e.g., through links to budgets, projects and a citywide or regional infrastructure (Kunze et al. 2011; Healey 2007; Innes and Booher 2018).

Many cities are currently confronted with fundamental challenges, such as rapid urban growth due to migration, environmental pollution, and social fragmentation. They look for unconventional solutions to manage and eventually overcome these challenges, by unlocking their innovative potential and encouraging niche innovations. Furthermore, they establish new institutional structures, practices and modes of action, which have a greater potential to successfully lead to more sustainable urbanisation (Frantzeskaki et al. 2019; Loorbach et al. 2016; Wolfram 2016; Wolfram and Frantzeskaki 2016; Neumann et al. 2018; Neumann et al. 2019).

A fundamental question arises in the context of this debate: whether new approaches to strategic planning, as well as to implementation, inherently contain a gap. Is the gap between the conventional paths of practice and novel urban strategic "push" potentially necessary to fuel and drive the process of innovation and advancement?

2.2. Transformative Capacity Building in Cities

Our hypothesis is that whether urban transition emerges or accelerates to close the planning–implementation gap depends, to some extent, on the urban transformative capacity as a prerequisite for long-term transformative change. According to Walker et al. (2004), transformability, as such, is the capacity to create a fundamentally new

system when ecological, economic, or social structures make the existing system untenable. Similarly, Loorbach et al. (2016) relate the term "transition" to "locked-in regimes that are challenged by changing contexts, ecological stress and societal pressure for change as well as experiments and innovations in niches driven by entrepreneurial networks, and creative communities and proactive administrators" (Loorbach et al. 2016, p. 2). Transformative change from unsustainable to sustainable development paths can be seen as multi-actor processes, which entail interactions between social groups (Geels 2010).

We look specifically into urban transformative capacities to respond to the planning implementation gaps in smart cities. Transformative capacities take many forms and there is no "one size fits all" approach. The term "transformative capacity" originates from sustainability science, more specifically from the transition management discourse. In this scientific context, "transition" refers to discussions and practical applications with the aim of promoting fundamental and lasting changes in urban societies regarding the path to sustainable development (Neumann et al. 2019; Wolfram 2016; Wilson et al. 2013; Ziervogel et al. 2016) have started to define transformative capacities and identify structuring elements. According to Wolfram (2016), transformative capacity can be defined as the "collective ability to conceive, prepare for, initiate and perform path-deviant urban change, thus enabling future development within planetary boundaries". Wolfram (2016) suggested an integrated framework to inform analytical as well as intervention approaches. The framework maps out 10 interdependent key components grouped into three clusters (agency and interaction forms, core development process and relational dimension) (Figure 1). Crucially, this framework refers transformative capacity to urban stakeholders, places, and processes—both as a capacity source and a subject of transformation. Wilson et al. (2013) identifies similar elements of transformation (identity, feedbacks, structures and functions). The identity of the system, as well as the feedback element, which includes the interaction between people, institutions, and the environment, maps towards the "agency and interaction forms" of Wolfram (2016), the function of which includes the outcomes of the process maps towards the "core development process" and the structure, which includes relationships between the elements or parts of a system mapped towards the "relational dimension". Ziervogel et al. (2016) outline that cultivation of transformative capacity includes: (1) an awareness of and a re-connection to life-support systems (collaborative co-creation); (2) a well-developed sense of agency (creativity); (3) social cohesion (relatedness, growing community). Awareness and collaborative co-creation include many elements of the core development process, social cohesion and relatedness includes many elements of the relational dimension and the agency element maps towards the agency and interaction forms of Wolfram. However, Ziervogel et al. (2016) and Wilson et al. (2013) look specifically at transformative capacities for sustainable system change,

whereas Wolfram operationalised his framework more specifically towards urban changes. For the investigation of urban transformative capacities, the framework of Wolfram seems most appropriate, as it includes elements highlighted by other researchers for transformative capacities, but, at the same time, was specifically developed for the urban context.

3 Categories	10 Key Components
Agency and interaction forms	– Inclusive and multiform urban governance – Transformative leadership – Empowered and autonomous communities of practice
Core development processes	– System(s) awareness and memory – Urban sustainability and foresight – Diverse community-based experimentation with disruptive solutions – Innovation embedding and coupling
Relational Dimensions	– Reflexivity and social learning – Working across agency levels – Working across political-administrative levels and geographical scales

Figure 1. Transformative capacity concept. Source: Wolfram (2016, pp. 127–28), used with permission.

Pathways towards transition for integrative planning on the level of strategy, neighbourhood planning and implementation can be derived based on the understanding of transformative capacities and the building of such a capacity by Wolfram (2016). Wolfram et al. (2019) indicated that further research is needed to obtain complementary insights into how such multi-agency and co-production processes emerge and unfold in different global contexts, urban domains, and places. This research addresses Wolfram's call for empirical research into transformative capacities in a global context.

2.3. Smart Cities Planning Approach

Smart Cities is an innovative planning approach in China and Europe to address the current challenges, as outlined in the introduction. The Smart City concept has been prominently promoted in China and Europe and has received attention from the city authorities. In both Europe and China, the Smart City concept is mainly driven by the policy level. Although there are differences in the understanding of Smart Cities in China and Europe, cities in both are considered smart if they use technological solutions to improve the management and efficiency of the urban environment.

How the term "smart city" should be defined, and how this definition can be operationalised to measure progress in smart city development, has been broadly discussed among academics (Neumann et al. 2015; Huovila et al. 2017). In this article, however, we do not refer to any specific academic definition, but focus on what funding agencies and other owners of relevant funding and financing programmes

call the "smart city". These include, on the European side, the Smart Cities and Communities initiative within Horizon 2020, the Joint Programme Initiative Urban Europe and the European Territorial Cooperation Programme URBACT. On the Chinese side, we refer to the initiatives "National Smart City Pilots" (NSCP) of the Ministry of Housing and Urban Development (MOHURD), "Smart City Cloud Platform for Spatio-Temporal Information" (NSCP) of the National Ministry of the National Administration of Surveying, Mapping and Geo-information (NASMG), the "National Information Consumption City (NIC) Pilot Program" of the Ministry of Industry and Information Technology of PRC (MIIT), the "Technology and Standard Pilot Program for Smart City (TSPPSC) Construction" of the Ministry of Science and Technology (MOST), and the People-Beneficial-Oriented National Information Cities (NIPC), an initiative that has been jointly funded by several national ministries and bureaus.

At the European level, Smart City programmes are one of the key initiatives through which European cities are bringing forward technological innovation and fighting climate change (European Commission, and UN Habitat 2016, p. 179). Smart Cities have been supported through various EU instruments, such as European Structural and Investment Funds, European Research and Innovation Programme and the European Innovation Partnership on Smart Cities and Communities (European Innovation Partnership on Smart Cities and Communities 2013) since 2013. These instruments support the aims of the energy union (European Commission 2015) and the Urban Agenda for the EU (European Commission 2016). For example, the European Research and Innovation Programme entails an annual call on Smart Cities and Communities. This call finances the large-scale demonstration of replicable solutions in the context of cities. The focus of all projects is on the innovative application, testing and validation of already existing technologies or technologies in neighbourhoods, rather than on the development of new technologies (Gaiddon et al. 2016). Additionally, many Member States in Europe have additional strategic policy documents and respective funding programmes.

Compared with Europe, smart city construction in China faces a more complicated situation and has attached greater strategic significance to urban development in an aim to cope with the challenges associated with the increasing speed of the urbanisation process and induced by irrational urban expansion: i) the increasing pressure on resources and ecological environment in the context of the rapid growth of the urban population; ii) insufficient inter-department coordination and inefficiency in urban management; iii) incompatibility between traditional production/management techniques and the increasingly emphasised demands for innovation, governance and sustainability (Wu 2013). The development and application of IoT, cloud computing, big data, and other emerging IT technologies is regarded by policy makers as a key instrument and solution for mitigating, or even

cleaning, the various incurred urban diseases, and thus having higher motivations and expectations for Smart City development. As a consequence, various levels (state, provincial, municipal, etc.) of government-initiated and -led pilot cities/projects have become the backbone and most powerful organisational form for China's Smart City construction. This government-led pattern has further catalysed and stimulated the enthusiasm of all sectors of society. At present, the focuses of Smart City construction projects in the state mainly include: (i) interconnected smart infrastructure systems, (ii) highly-coordinated urban governance and civil service, and (iii) technology embeddedness, based on multi-application scenes (Huang et al. 2020). There are many stakeholders actively participating in those programmes, such as enterprises, research institutions and universities (Shen 2010; Sun 2013). When it comes to the "soft" aspect, technologies are widely considered as tools of "technological empowerment" (Zheng 2007). Recently, public participation has been identified as an important starting point of pursuing "modernisation of state governance" (National Development, and Reform Commission 2013). Currently, the implementation of smart city projects (most of them with too-high technical entry barriers and too high a threshold for the public to engage in) is still focused on the short-term interest division between the government and enterprises. Nevertheless, some emerging possible patterns for public participation have been explored and practiced. For example, in the field of resource and energy supply (such as water, electricity, natural gas, etc.), by being embedded into the high-tech market, multiple actors, including the government, enterprises, and the public, can be involved in the participation process based on commercial networks (Chen 2020).

As the Smart City concept is being pushed in Europe and China at a strategic policy level, and additionally by funding instruments on the operational level, it is suitable to use Smart Cities to measure transformative capacity to narrow the planning implementation gap.

3. Methodology

A range of methodologies was selected and applied to gather empirical information on the transformative capacities of Smart Cities in eight European and Chinese city case studies to learn about innovative approaches to closing the planning–implementation gap (Figure 2).

First, an analytical framework to operationalise transformative capacities in Smart Cities has been developed (Section 3.1). This framework has been the basis for guiding questions in the city case studies. Second, a case study approach has been developed (Section 3.2).

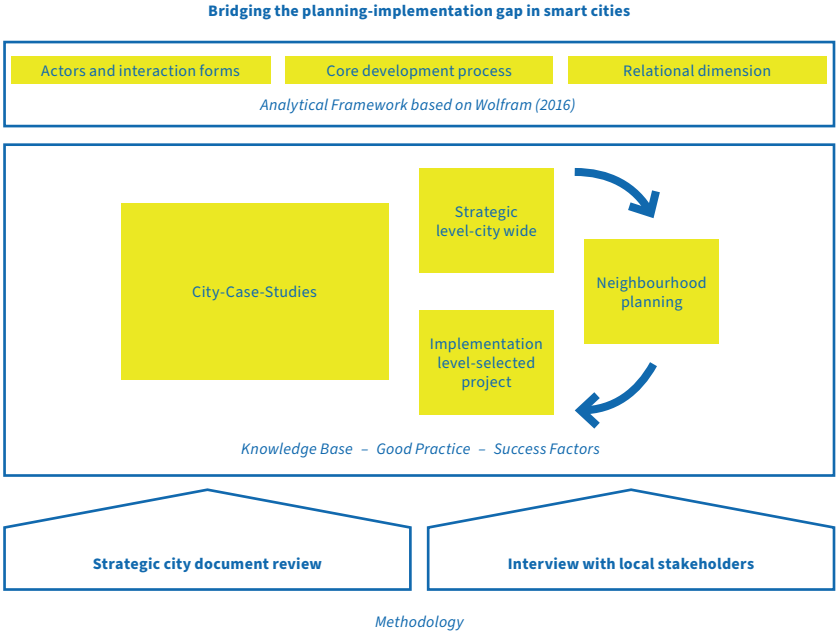

Figure 2. Case Study Approach. Source: Figure by authors.

3.1. Framework to Measure Transformative Capacities of Cities to Address the Planning–Implementation Gap

While the framework of Wolfram (2016) has been operationalised for application in specific public services sectors in cities previously (e.g., Brodnik and Brown 2018), it needed to be adapted to this research paper. To this end, the framework of Wolfram (2016) (see Section 2.2) has been applied and contextualised in the context of smart city development in China and Europe for planning and implementation purposes. We followed the methodological approach of Ziervogel et al. (2016) and applied the transformative capacity framework with the aim of identifying and mapping innovative activities and tools towards the dimensions and key components and aspects. The identification of activities should support the detection of transition pathways to close the planning–implementation gap in smart cities (Neumann et al. 2019). Based on the three dimensions and the key components, key aspects have been derived to identify activities that build transformative capacity, to narrow the planning implementation gap.

A framework has been developed to identify activities' transformative capacities for a change in strategic planning, neighbourhood planning and implementation, to close the planning implementation gap in Smart Cities. Based on the three dimensions and the key components, key aspects (Neumann et al. 2019) have been derived to measure transformative capacity in the context of narrowing the planning

implementation gap in China and Europe (Table 1). As an example, the development of the key aspects will be illustrated. *Transformative Leadership*, as a component of "Agency and interaction forms", has been put into the context of Chinese and European smart city development. The following aspects and activities have been identified and covered in the city case studies:

- Who were the key actors in the smart city planning and implementation process? Who has taken leadership and ownership for smart city strategy making, planning and implementation?;
- What has been the personal and functional competences of key actors?;
- How has decision making for strategy, planning and implementation taken place and how transparent was the process? How (if at all) are implementation projects implemented in overarching strategic efforts?

At this stage, it has been assumed that all identified key aspects are relevant along the entire policy cycle for integrative planning spanning from (1) urban strategic planning, (2) neighbourhood planning, and (3) implementation (Figure 3). In order to generate empirical evidence on innovative activities and tools to build transformative capacities, interview guidelines for city case studies have been developed based on the key aspects (Section 3.2).

3.2. Case Study Approach

The case study approach[1] includes the identification and sampling of cities for case studies in China and Europe and the implementation of the case studies.

The selection approach for city cases considers smart innovation and implementation projects in China and Europe, which have successfully passed a selection process of one of the above-mentioned Smart City programmes and been implemented. These projects can, therefore, be seen as exemplary for the current state of smart city practice. All these projects aim to address the implementation of city strategies in an innovative way. Thus, they provide insights and learning material for others looking to close the planning implementation gap.

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[1] A more detailed description of the case study approach can be found in the deliverable of the respective research project in (Neumann et al. 2019).

Table 1. Operationalisation of transformative capacity to close the planning–implementation gap in China and Europe.

Agency and interaction forms
Inclusive and multiform urban governance
• Diversity of actors involved, resources of actors to become active and benefits of actor • governance structure, involved bodies and strategic alignment • Continuity of active actors across multi-level governance/bodies • Commitment for action and decision
Transformative leadership
• Key actors, leadership and ownership • Personal and functional competences of key actors • Decision-making and transparency of decisions
Empowered and autonomous communities of practice
• Continuity of commitment towards implementation by actors/community involved
Core development processes
System(s) awareness and memory
• Cross sectoral integration in Strategy/Planning/Implementation
Urban sustainability and foresight
• Common vision of all actors at the beginning of the strategy process, or the strategy itself as a reaction to existing problems/symptoms • Alignment and orchestration of vision, strategies, planning and implementation • Alignment of strategy with national and international strategies
Diverse community-based experimentation with disruptive solutions
• Opportunities for experimentations and testing • New solutions generated in the implementation phase
Innovation embedding and coupling
• Innovative action and its embeddedness in strategy/planning/implementation
Relational dimensions
Reflexivity and social learning
• Evaluation and monitoring from strategy to implementation • Learnings (positive and negative) among the active actors, integration of learnings in future processes/activities • Information/documentation of processes from strategy to implementation (transparency and process-oriented)
Working across agency levels
• Experience/history of already existing cooperation • Solutions for emerging problems/conflicts through cross-sectoral activities
Working across political-administrative levels and geographical scales
• City/actors' experience and exchange of know-how at national and/or international levels • Working across various departments in the city administration

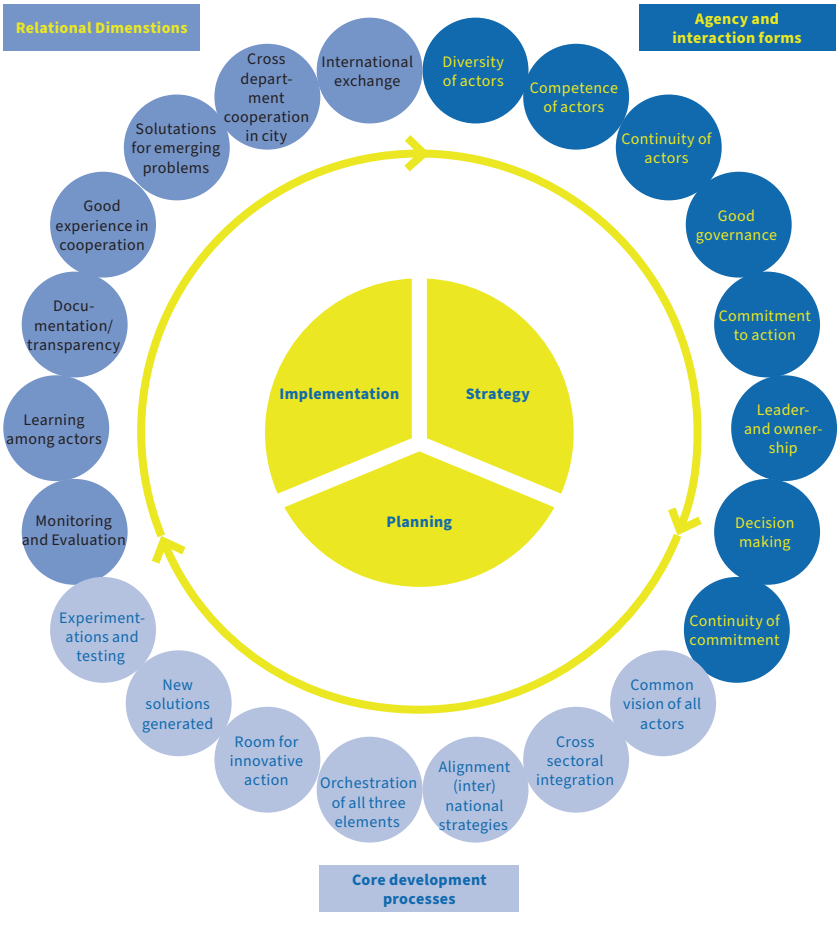

Figure 3. Analytical framework to assess transformative capacities in smart cities. Source: Figure by authors.

3.2.1. European Smart City Programmes and Selection of Cities for Case Studies

In Europe, the concept of smart cities has been widely used in city strategies, as it is rooted in European, national and regional policy strategies. Moreover, research and innovation programmes have been targeted towards smart city development to support technological, organisational and social innovations needed. The main aim is to support research and innovation needed for the implementation of smarter cities.

European R&I Programmes dedicated to urban development are the following:

- The first programme is the European research and innovation framework programme of the European Commission. In the 8th (Horizon 2020–2014–2020) R&I framework programme, cities have been actively mobilised to apply to projects dedicated towards the development of smart cities (but, also, other

types of city: digital city, eco-city, etc.). The projects considered for analysis started in the period 2013-04/2018.

- The second programme is the European URBACT III programme of the European Commission (2014–2020) that supports innovative activities in cities. Projects considered for analysis started in the period 2013-04/2018.
- The third R&I programme is the European Joint Programming Initiative Urban Europe that funds R&I projects dedicated to sustainable development on transnational basis. Projects considered for analysis started in the period 2013–2017.

For the selection of city cases an analysis of three large European/transnational R&I programmes has been conducted to identify cities actively involved[2] in such programs. (cf. Neumann et al. 2019). In total, 273 projects dedicated to sustainable urbanisation could be identified, with 161 participating cities, meaning city authorities/municipalities. A total of 213 out of 273 projects with city participation are funded by Horizon 2020, 33 projects by URBACT and 27 projects by JPI Urban Europe. Moreover, this reveals that the identified cities vary in size, from small (<50.000 inhabitants) to large (>1.000.000 inhabitants). Appendix A shows a map of Europe with the engaged cities in projects, according to the number of projects they are engaged with.

Based on the 161 cities, a sample was generated for case studies. The following sample criteria were applied: the active involvement of cities in the project generation, the number of projects cities are involved in, and the variety of programmes they are active in.

Table 2 summarises the sample criteria for cities (*column 1*), the selected cities according to the different sample criteria (*column 2*), and a first selection of 19 cities (*column 3*), where eliminated cities were sampled more than once. Based on this first selection, a second selection was made, reducing the sample by cities that had similar sample criteria (e.g., Vienna and Hamburg—both are active in three projects, and have similar size). In a further step, taking into account the availability of the contact persons and their availability for interviews, the number of cities was reduced to eight. Table 3 summarises the eight cities in Europe selected for case studies, their sample criteria and population size, and the number of projects they are involved.

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[2] In our understanding, a city is actively involved in a programme if it is a partner receiving funding in one or several projects financed by the respective programme.

Table 2. Sample criteria and selection of European cities for case studies.

Sample Criteria	Cities	1st Selection #19 (Assumption: Different Type of Cities)	2nd Selection #8
Cities that are most active in projects across all funding schemes	Torino (7 projects), Santander (7 projects) Madrid (8 projects)	Amsterdam Antwerp Barcelona Bratislava Bristol Budapest Dublin Genova Hamburg Ioannia Lisboa London Maastricht Madrid Rijeka Santander Stockholm Torino Vienna	Amsterdam Budapest London Madrid Rijeka Santander Stockholm Vienna
Cities that are most active in H2020 projects	Torino (7 projects), Santander (7 projects) Madrid (8 projects)		
Cities that are most active in URBACT projects	Ioannina (2 projects)		
Cities that are most active in Joint Programming Initiative Urban Europe	Maastricht (2 projects), Amsterdam (2 projects)		
Cities that are active in all three funding schemes	Antwerp, Stockholm		
Cities that are active in 3 or 4 of the city concepts	Santander, Torino, Genova, Dublin, Lisboa, Madrid, Barcelona, London, Bristol		
Cities with many projects, but from different planning background	Napoleonic: Torino (7 projects), Santander (7 projects) Madrid (8 projects) Eastern: Budapest (2 projects), Bratislava (2 projects), Rijeka (2 projects) Germanic: Vienna (3 projects), Hamburg (3 projects)		

Table 3. Overview of city sample for European case studies.

City	City Population	Projects
1-3 Amsterdam	500.001–1 Mio.	3
Budapest	>1 Mio.	2
London	>1 Mio.	9
Madrid	>1 Mio.	8
Rijeka	100.001–250.000	2
Santander	100.001–250.000	3
Stockholm	500.001–1 Mio.	3
Vienna	>1 Mio.	4

3.2.2. Chinese Smart City Programmes and Selection of Cities for Case Studies

The rapid and fast urbanisation in China in the past decades caused many serious challenges to Chinese urban development in a quantitative way, including less manageable urban sprawl, heavier pollution, and increasingly enlarged social disparity. Therefore, Smart City development is optionally becoming a paramount and urgent need in China's new round of urbanisation and city development. To scientifically explore the different approaches to the construction, operation, management, services and development of Smart Cities in the Chinese context, different ministries of the state council have launched a series of pilot programmes to encourage incorporating Smart City practices into urban development strategies, to enhance the management and service capability at city level, and thus to improve the process of urbanisation and of industrial restructuring, and to improve governance and public services towards sustainability. There are many stakeholders actively participating in those programmes, such as enterprises, research institutions and universities. However, due to the top-down governance structures in China, at least for now, it is still central and local governments that play the dominant role in city development and practice. Because of their nature, and considering the various level of government in China, it is preferred to start with pilot and demonstration cases to test any kind of new preferential policies and gain experience in developing the new type of city. It can be fairly and reasonably assumed that pilot cities in China (which usually receive more policy support from central government) are more likely to become the showcases for excellent performance in Smart City construction, while its real effectiveness needs to be further assessed and evaluated. But nevertheless, these pilot cases are still valuable references for understanding the Chinese approach in this regard and are a good entry point for international comparative studies.

The following Pilot Programmes dedicated to Smart City construction in China were launched by Chinese government ministries or agencies. More information for each programme is provided in Appendix B. They are used for identifying the cities that are more active in Smart City development:

- In May 2012, the Ministry of Housing and Urban-Rural Development of the PRC (MOHURD) issued a Notice on Carrying Out the National Smart City Pilot Programme (NSCP).
- In Dec 2012, the National Administration of Surveying, Mapping and Geo-information (NASMG) announced the launch of a pilot programme of constructing Smart City's Cloud Platform for Spatio-Temporal Information (CPSI).
- In Dec 2013, the National Information Consumption City (NIC) Pilot Programme was launched by the Ministry of Industry and Information Technology of PRC (MIIT).

- The Technology and Standard Pilot Programme for Smart City (TSPPSC) Construction was jointly issued by the Ministry of Science and Technology of the PRC (MOST) and the Standardization Administration of China (SAC) in 2012.
- In 2014, 12 national ministries or bureaus (D12) jointly approved a list of 80 cities for pilots of People-Beneficial-Oriented National Information Cities (NIPC).

In total, 1028 pilot projects on smart city construction in China exist to date, distributed to 193 cities (including 189 prefecture-level cities and four provincial-level municipalities) of 31 provinces. Appendix C presents a map of all identified cities. Among them, 527 pilot programs are related to Smart City development, discussed above. The other 501 pilot programmes launched by the central government on city development will not be used for further comparative study, given that there are no such data from the European side. Corresponding to the sample criteria of European cases, Table 4 shows the criteria and process of selection for case studies in China based on the 193 pilot cities identified above, including the sample criteria for cities (Column 1), the primary selection according to different sample criteria (Column 2), the first selection of 17 cities after removing those cities that have been sampled repeatedly (Column 3), and the final identification of eight cities in consideration of both heterogeneity of the sampling criteria (cities are both active in carrying out Smart City and Eco-City pilot programs) and comparability with European cases (Column 4) in terms of Smart City development.

Table 5 shows the basic information and characteristics for the eight identified cities for further international comparative studies, including the sampling criteria, city clusters to which they respectively belong, resident population of 2016 and programmes they are involved in. In China's domestic urban system: i) Beijing, Shanghai, Tianjin, Chongqing, Shenzhen, and Wuhan are Megacities (cities with an urban resident population more than 10 million), representing an intensive, innovative, international and integrated form of settlement in the 21st century; ii) Suzhou and Dalian are Big Cities (the urban resident population is between 1 million and 5 million). Their scale and influence could reach a relatively high level, but emerge with the bottleneck of upgrading the quality of urban development. According to the World City Ranking (2020) report, published by GaWC, Shanghai, Beijing, Guangzhou, and Shenzhen are categorised as first-tier world cities (Alpha), Tianjin, Wuhan, and Dalian as the second-tier (Beta), while Suzhou is categorised as the third-tier (Gamma).

Table 4. Sampling criteria and selection of exemplary Chinese cities for case studies.

Sampling Criteria	Cities	1st Selection #17 (Assumption: Different Type of Cities)	2nd Selection #8
Cities that are most active in Smart City and Eco-city pilot programmes	Suzhou (19 projects), Chongqing (16 projects), Weifang (16 projects), Beijing (16 projects), Qingdao (14 projects), and Hangzhou (13 projects)	Beijing Chongqing Dalian Fanyang Hangzhou Ningbo Qingdao Shanghai Shenzen Suzhou Tianjin Weifang Wuhan Xianyang Xi'Ning Yichang Zhengzhou	Shanghai Chongqing Beijing Wuhan Dalian Suzhou Shenzhen Tianjin
Cities that are most active in Smart City pilot programmes	Beijing (13 projects), Qingdao (9 projects), Suzhou (8 projects), Chongqing (8 projects), Weifang (8 projects), Tianjin (8 projects)		
Cities that are most active in NSCP	Beijing (11 projects), Tianjin (6 projects), Qingdao (6 projects), Suzhou (6 projects),		
Cities that are most active in NIC	Shanghai (3 projects)		
Cities that are active in all 5 Smart City pilot programmes	Dalian, Xiangyang,		
Cities that are active in 4 Smart City pilot programmes	Wuhan, Shenzhen, Zhengzhou		
Cities that are active in different pilot concepts	Garden City: Weifang, Suzhou, Shanghai		
	Ecological Garden City: Suzhou		
	Climate-smart City: Chongqing		
	Sponge City: Xining		
	Low-carbon City: Wuhan		
Cities with many pilot projects by city clusters	Yangtze River Delta: Suzhou (19 projects), Hangzhou (13 projects), Ningbo (12 projects), Shanghai (11 projects)		
	Middle-Yangtze River: Wuhan (9 projects), Xiangyang (7 projects), Yichang (7 projects)		
	Shandong Peninsula: Weifang (16 projects), Qingdao (14 projects)		
	Zhongyuan: Zhengzhou (8 projects)		

Table 5. Characteristics of the eight exemplary Chinese cities for further comparative studies.

City	City Cluster	Urban District Population	Projects
Shanghai	Yangtze River Delta	20 Mio.–30 Mio.	*11*
Chongqing	Chengdu-Chongqing	20 Mio.–30 Mio.	16
Beijing	Beijing-Tianjin-Hebei	20 Mio.–30 Mio.	16
Wuhan	Middle-Yangtze River	5 Mio.–10 Mio.	9
Dalian	Harbin-Changchun city cluster	2.5 Mio.–5 Mio.	11
Suzhou	Yangtze River Delta	2.5 Mio.–5 Mio.	19
Shenzhen	Pearl River Delta	10 Mio.–20 Mio.	6
Tianjin	Beijing-Tianjin-Hebei	10 Mio.–20 Mio.	12

3.2.3. Implementation of City Case Studies

City case studies have been conducted to gather empirical information from a variety of stakeholders involved in the planning and implementation of smart city projects. The city case studies included:

- development of a guiding questions related to each key aspect of the analytical framework to be followed during the empirical data collection for each city case study;
- desktop research on strategic and planning documents and potential implementation areas;
- interviews with selected stakeholders from the strategy, planning and implementation phase;
- analysis of empirical data and development of a city case study according to a template oriented towards the analysis framework.

The city case studies shall exemplify the argument of this book chapter and support the story-telling. Eight case studies in Europe and China were aimed for. Two case studies could not be realised in Europe (Amsterdam, Rijeka). The main reasons for not realising the case studies are no access to or response from adequate interview partners, interview partner rejected interview due to limited English language capabilities, and limited information on city strategy/implementation available in English language.

4. Results—Case Analysis: Building Transformative Capacities in European and Chinese Cities to Close the Planning and Implementation Gap

This section highlights different exemplary measures to increase the transformative capacities of cities that have contributed to a better alignment of city planning and implementation. Detailing the specificities of all empirical cases is beyond the limitations and scope of this book chapter. Instead, we present a selection of the most innovative approaches for building the transformative capacities found in the Chinese and European cases. The illustrations from the European cases are described individually because the cases were highly specific, demonstrating the idiosyncrasies of European city planning and implementation frameworks. Each city in Europe has its own exploration and implementation of the smart city approach based on its institutional context und planning culture. In China, the implementation approach is mainly a top-down process, usually based on a pilot experiment. This pilot experiment is usually taken by a megacity, given its strong financial capacity and comprehensive situation, so the pilot projects are successful in most cases. Once a successful case is gained, a quick upscaling can be promoted and implemented to other cities with a large scale of replication. The replication can then form a cluster of cities, which use similar tools and instruments in their implementation in China.

Illustrations from the Chinese cases are subsumed when multiple cases exemplified a set of related transformative capacity-building measures.

4.1. Building Transformative Capacity in European Cities

Stockholm (Sweden) demonstrates several measures that support and sustain the different transformative capacity domains across the entire policy cycle. In particular, Stockholm highlights measures that increase the diversity of actors (domain: "Agency and Interaction Forms"), as well as a common vision and orchestration of vision, strategies, planning and implementation (domain: "Core Development Processes") and measures that aim to work across various departments in the city administration, Evaluation and Monitoring and collective learnings among the active actors (domain: "Relational Dimensions").

For example, Stockholm has co-developed a common long-term vision for Stockholm with a range of stakeholders. Stockholm sees this vision as a commitment to sustainable development at the highest strategic level. The vision was developed together with various city departments, companies and external partners and was led by the City Executive Office. The development of this vision also entailed a comprehensive citizen engagement process, which consisted of information events, communication initiatives and public exhibition phases, where people were informed about the status of the strategic document and given the opportunity to provide feedback and voice their ideas. Importantly, the overarching vision for Stockholm frames the various other strategies and anchors different urban development projects in a widely shared and democratically legitimised strategic direction. The merit of this measure is that it helped to create an overarching and shared agenda and collective energy for realisation in practice. Furthermore, the benefit was that, by defining the long-term goal, the vision became a powerful tool to create alignment between other strategic documents of the city. For example, the Green IT Strategy of Stockholm 2009 is aligned with the Environment Programme 2008–2011 and the strategy for a fossil-fuel-free Stockholm by 2040 is aligned with the current Environmental Programme 2016–2019. Alignment was not only achieved between strategies, however, but also between documents at different strategic levels. As such, Stockholm managed to successfully translate strategic objectives into different city planning documents. For example, the Stockholm City Plan shows many connections to the various strategies and takes their diverse objectives into account. Additionally, civil contracts have been used in an innovative urban development project: The Royal Seaport Stockholm. At this development site, the city owns the land and sets the requirements for developers through civil contracts. The requirements for these land allocation contracts are strict and specify a range of environmental, social and economic targets that become elaborated and translated into development requirements in thematic working groups, which consist of experts from different

city administration units and private sector companies. The use of such forums creates a space and process for working across city departments and sectors in an interactive way. As such, breaking down targets into binding requirements is used as an opportunity and designed as a process that brings otherwise separate groups together. Through a carefully facilitated series of workshops, a lively dialogue between private and public stakeholders creates critical learning and reflection opportunities and establishes shared accountability. In turn, the commonly agreed targets and requirements create the basis for regular monitoring and evaluation, which is also structured through these interactive working groups. The frequent reporting of monitoring results with property developers creates a direct feedback on how the sustainability requirements work in practice. The continuous feedback mechanism that this creates provides significant input into how the sustainability specifications could be adapted and improved moving forward. Used this way, monitoring and evaluation, in the form of a structured dialogue, becomes a central part of the development process, which enables learning, as well as the transfer and documentation of experience gained from the project as the implementation proceeds. For each year, the Stockholm Development Administration reports the results of the property developers and how the project contributes to the city´s overall planning and implementation framework. The sustainability report and the monitoring reports are aimed at widely disseminating these lessons learned within the city and to all external stakeholders that are not directly involved with the Royal Seaport Project. The benefits of these measures lie in their ability to create accountability while engaging stakeholders in a feedback process that strengthens learning and collaboration.

In terms of transformative capacities, London (United Kingdom) exemplifies strong measures around the diversity of actors, appropriate key actors, leadership and ownership, as well as the continuity of active actors across multi-level governance/bodies, decision making and transparency of decisions (domain: "Agency and Interaction form"). London also exemplifies other capacity-building measures, such as orchestration of vision, strategies, planning and implementation (domain: "Core development process"), as well as evaluation and monitoring (domain: "Relational Dimension").

In terms of inhabitants, London is one of the biggest cities in Europe and one of its economic hotspots. It is also one of the frontrunners in the European Smart City arena. London has a governance system which strengthens the role of local governments at the district (so-called "boroughs") level. London's governance system is characterised by the coexistence of the Greater London Authority (GLA), which is led by the Mayor of London, and 33 boroughs, each of which has its own council and administrative system.

The boroughs are responsible for most of the daily operations of the city, while the role of the GLA is, to a large extent, coordination. As the GLA itself has very limited resources and competences for implementation, the GLA acts as a facilitator, while the boroughs play a key role in the implementation on the ground. Leadership and ownership in the smart city development are well-defined. The Smart City team of the GLA sees itself as the advocate of the citizen in the digital transition process. This includes ensuring that citizens have effective means of recourses to safeguard their rights against technology providers in case a technology fails or is used in an irregular way. London's smart city activities are clearly focused on the rollout of digital technology to improve the quality of life of the inhabitants and to stimulate the local economy. This was outlined in the "Smart London Plan" presented in 2013, which was followed in 2018 by the "Smarter London Together" roadmap. This roadmap defines priorities (so-called "missions") for the Smart City Development of London. Each of the missions is broken down into several actions. The roadmap and the actions are very well orchestrated. The Smart City Team of the GLA promotes the implementation of these actions. When building project-based partnerships with a diversity of actors, such as the boroughs, the top five local universities, the private sector and organisations of the so-called "mayoral family" (e.g., Transport for London, Police, Fire Brigade and the Cyber Security Agency), are an important vehicle for the implementation of the roadmap. As such, the measure is critical for coordination amongst a diverse set of stakeholders responsible for urban development issues at a strategic level. Furthermore, 13 boroughs have agreed to set up and co-fund the "London Office for Technology and Innovation" as a permanent institution to guide and steer the city-wide digital transition. Various projects of all sizes are currently being carried out and contribute to the implementation of the Smarter London Together Roadmap, with two of the most remarkable ones being the London Cybersecurity Strategy and the European Smart City Lighthouse Project Sharing Cities. For the sake of transparency and progress monitoring, the status of all implementation projects is permanently shown on a publicly accessible Trello board. This gives an indication of the character of the Smarter London Together Roadmap: it is not static, but was set up as a living document that undergoes regular monitoring and updating to ensure that emerging issues can be addressed effectively. As such, the measure supports transparency, increases the legitimacy and improves public perception of the implementation projects.

Santander (Spain), exemplifies how a diversity of actors can continuously be involved, from smart-city-planning to implementation (domain: "Agency and interaction"). It also shows that close collaboration across the different departments (domain: "Relational Dimension"), to develop a smart city, was a success factor.

The Santander case study highlights that smart city development was strongly led by the university. The municipality and the private stakeholders were critical

enablers for collaboration across the different departments, which was possible because of the "small-scale" project (a rather small city with 170,000 inhabitants in the north coast of Spain). Furthermore, the involvement of various actors in a continuous manner had been a crucial factor, as the city has been in touch with many internal stakeholders (for example, individuals, service providers, operators, or entrepreneurships) as well as external stakeholders (such as the World Bank, etc.). In terms of building individual and organisational capacities, training was necessary for the municipality, and appreciated by the city actors, to build transformative leadership. Overall, the measure helped to create continued commitment and a collaborative approach between different stakeholders from the early planning phase until project implementation.

Madrid (Spain) provides examples for measures of transformative leadership and inclusive urban governance (domain: "Agency and interaction forms"). It is also an example of how cities can take up opportunities for experimenting and testing (domain: "Core development processes") not only of new technologies, but also new forms of urban governance and the importance of facilitating learning among the active actors (domain: "Relational dimensions").

The Madrid case study shows innovative ways of dealing with crisis and approaching multiple funding options (e.g., exchange of properties between city, private property owners and a football club to allow the realisation of a large implementation project), as well as developing local, tailor-made solutions (due to a lack of regional and national (direct) support). A crucial factor for bridging the gap between the strategy by the city and its implementation was intensive efforts to build trust between city actors and citizens from the scratch (no "culture of participation" so far), as well as trying to create "ownerships" of multiple small-scale implementation measures by various stakeholders. As such, the measures created the necessary relationship between key stakeholders over time, and other resources required for smart city project implementation.

4.2. Building Transformative Capacity in Chinese Cities

Across all six Chinese case studies (i.e., Beijing, Shanghai, Shenzhen, Wuhan, Chongqing and Tianjin), a prominent aspect of transformative capacity building is leadership and ownership (domain: "Agency and interaction forms") as the process of smart city development follows a top-down government approach.

The most successful factor in the promotion of smart city construction in China is the top-down government-dominated development approach. Leadership and ownership of the process is strongly hierarchically organised. This approach is further magnified by the deep hierarchy in government organisation in the country. The vertical hierarchy of governmental structure in China is a "top-down dominated structure", in which upper-level governments have

the dominate/decisive power in policy/regulation supervision and implantation monitoring/evaluation through controlling the allocation of personnel, investment, and the administration of lower-level governments, although, in reality, the decision-making and implementation process is a rather complicated course of power gaming case-by-case, and region-by-region in terms of "opinion expression - opinion collection—decision making - implementation", as well as "monitoring - information feedback". Particularly, along with the modernisation reform of the governance system and the transformation of government functions, coordination approaches for a vertical intergovernmental relationship are becoming increasingly popular in China. As illustrated in the above-mentioned smart city programmes, all the initiatives started from national governments or their affiliated agencies or bureaus, which allows the pilot city, from the very beginning, to be integrated into the national urban system and gain policy support and morale incentives, to carefully play the role of a experimental and demonstration case. The centralised leadership that the national government exerts also provides the pilot city with more flexibility and the ability to launch more customised policies based on their local settings. As such, leadership and ownership is a top-down advantage in all Chinese cases, which trickles down to lower levels of government and can, for example, effectively empower the municipal leadership in their implementation of new plans with high efficiency, and meanwhile allow the municipal government to reflect local characteristics.

The merit of this measure in narrowing the planning–implementation gap in China lies in the fact that the strong government leadership secures the legal status of planning and its authority, while, as owner of the plan, the government's constant monitoring process enhances the implementation effectiveness.

Aligned with the top-down approach, another successful factor in China in closing the planning implementation gap is to have a government-led and dominated strategic visionary designing with a series coordinated consistent plans for orchestration across various case studies (domain: "Core development process") to make sure that different sorts of plans can be integrated and reinforced as much as possible.

To realise various objectives based on the changing socio-economic needs, there are various plans in urban China. The most notable plans include the five-year socio-economic plan, which focuses on sectorial development and long-term vision in overall structure changes; the urban territory land-use plan, which focuses on the land quota distribution of functional areas over the planned time period; the city masterplan, which deals with the functional division of land use and design of construction land within the urban proper; the environmental protection and ecological construction plan, which focuses on the improvement in the urban eco-environment and various thematic plans, such as smart-city planning, urban

agriculture planning, which focuses on dealing with specific issues, usually incurred by special national programmes. Because of the diversified objectives of different plans, the key to successful implementation is to keep the various plans with consistent principles and guidelines for better orchestration from strategy to implementation. Shenzhen and Wuhan cases show that, to facilitate coordination between different plans, cities in China usually establish a special commission to maximise the representativeness of different stakeholders, such as government agencies, research institutions, enterprises and civil society, and set up a working office to facilitate the implementation process.

The effectiveness of this measure is that, based on city-wide discussion, the government sets the visionary strategy to the whole municipality while allowing involved institutions and stakeholders to have their own actions, maintaining the consistent coordination among high-level government, while maintaining flexibility for lower-level actors to play their initiatives.

The case studies of Shanghai, Shenzhen and Wuhan show that a diversity of urban actors are involved in the different planning and implementation stages (domain: "Agency and interaction forms"), to ensure commitment to implementation.

A government-led multi-stakeholder partnership is increasingly becoming a new fashion in the planning and implementation process in China, and is attributed to the successful actions. Under the lead of the special commission and working office, a larger partnership or stakeholder network will be formed to promote the whole process of planning and implementation. The typical partnership usually consists of relevant government agencies/department, research institutions and consultant companies, leading enterprises in the industry, and associated medium- and small-sized firms, to take full advantage of the top-down process for protecting the equality and bottom-up process when maintaining efficiency. Meanwhile, different stakeholders will play a key role in different planning and implementation stages. Government agencies, research institutions and consultant companies usually paying more attention in the planning stage and awareness-raising period in the implementation stage, while leading enterprise sin the industry will focus more on setting up the framework and standards for implementation, as well as mobilising other investors and players whenever needed. Shanghai, Wuhan and Shenzhen could separately represent different pathways towards multi-agent participations and interactions in this process. Shanghai, supported by its open business environment, sound financial mechanism and strong competitiveness as a World City, has indisputable advantages in terms of introduction and mobilisation ability and capacity to attract the involvement of leaders, experts and entrepreneurs with global visions, jointly committing to outstanding social and economic benefits. Shenzhen, as a representative of China's most innovative city, has been exploring various innovative ways of organisation and institution to form multiple replicable

experience boosting governance flexibility and niche innovation. Wuhan's good practice in the development of the Smart City largely depends on policy makers' attitude, and their aspiration to obtain and even lead the development trends at home and abroad in smart technology applications, which has enabled Wuhan to achieve a first-mover advantage over other cities. The organic combination of "active policy resources, strong ICT industry foundation and high academic capabilities" can also be seen in its government-led multi-agent participation pattern in Wuhan.

The purpose of this measure is to mobilise many actors in a new kind of learning process through participating in the planning process and implementation commitment.

Across six Chinese case studies, one of the identified measures of successful smart city development is that pilot cities have the opportunity for experimentation and testing (domain "Core development processes") and other cities or governmental officers have the chance to exchange know-how and learn from pilots at national level (domain "Relational Dimensions").

This is a common and effective approach in the core development process of smart city promotion in China, in which national government is usually responsible for identifying long-term key issues, while the municipal government in pilot cities will address such issues through trying errors at community level, and then the successful experiences will be upscaled in regional and national approaches through exchanging government officials or study trips among cities. In this approach, the key factor is the high initiative and proactive attitude of the local government, i.e., the high initiatives from district government or even lower- to community-government level. Starting from a smaller scale is always more realistic and feasible in smart city implementation.

The merit of this measure is that, through pilot experiment and testing, the overall social cost of trial and error can be minimised, and upscaling can be run more smoothly via the analogous comparison and exchange field trip studies.

Tianjin, Wuhan and Chongqing case studies also show that higher public awareness and social learning systems are a key measure to increase transformative capacity. These measure increase the commitment towards implementation by actors/community involved (domain "Agency and interaction forms").

Mobilising and utilising all the existing media for raising public awareness is another key factor in reducing the planning and implementation gap in China thanks to its traditional culture legacy and strong government leadership. Once the planning is carried out and the pilot programme is implemented, the municipal government will usually launch a parallel process to raise awareness of the issue, and update the progress by branding and marketing the planning and implementation commitment through all means and media, including local TV programmes, newspaper, internet, and other social media such as WeChat, and short mobile messages. By doing so, the

overall transaction cost in the implementation process can be largely reduced by, for example, smoother relocation in the redevelopment process under the support of local residents. Through the application of new media, a more effective feedback and social learning system is gradually enhanced. It can be observed that all pilot cities in the national smart city programme in China generally have higher public awareness in terms of understanding the development of their own city and the knowledge scope of the smart city itself.

The case study of Tianjin shows that more international cooperation and collaboration in terms of exchange of know-how (domain: "Core development process") increases the quality of city planning (domain: "Relational dimension") and leads to more successful pilot city development in China.

Given that the smart city development is still in its pioneer stage worldwide, cities implementing this pilot programme have higher motivation to search for international cooperation and assistance whenever possible. More international projects then can be attracted to the city, which, in turn, becomes the catalyst for stimulating smart city development and improving the implementation process in the city. The Sino-Singapore eco-city in Tianjin provides such evidence in helping the city to enhance its overall quality in city planning and implementation.

The essence of this instrument is that raising public awareness and reaching a consensus for urban development vision is vital for closing the gap between planning and implementation.

Shenzhen demonstrates that room for experiments, innovation and entrepreneurship (domain: "Core development process") is another important successful factor in closing the gap between planning and implementation in China.

Recognising that the constant change in technologies requires timely adjustment and adaptation for planning and implementation in smart city development, Shenzhen dares to experiment with any new mechanisms in the process. Through fully realizing its advantages in terms of high entrepreneurship and high exposure to international society, which gives the city a good opportunity to integrate international best practice with its local settings, Shenzhen carried out some innovative mechanisms in the smart city development process. For example, Shenzhen took a different approach to digital city development, based on its own exploration, instead of outsourcing an overall player to carry out the project, as in the traditional popular way, Shenzhen divided the project into two subsystems, the user and supplier sides; each side then can concentrate its focus to jointly improve the whole system. This division of labour not only improved the efficiency of the implementation, but also greatly enhanced the quality of the whole system through maximising the expert role on two sides.

Actively exploring new technologies and innovative approaches based on the local setting is always an effective way to implement plans.

5. Reflection and Further Research

Reflections are made in correspondence with the two aims of this book chapter: (1) the application of a framework in the European and Chinese context to better understand transformative capacities, and (2) the illustration of innovative approaches based on case studies for bridging the planning implementation gap. Additionally, further research has been identified, to move from the identification of innovation approaches to actively shaping capacity-building.

The application of framework on transformative capacities of Wolfram (2016) (research aim number 1) to empirically identify activities that build transformative capacities has worked well in China and Europe, despite their differences in the planning processes. The application of the framework delivered innovative approaches and activities that were used in Chinese and European cities to overcome gaps, and which could be considered as measures to build transformative capacities. However, it was not always easy to conduct the case studies due to language problems, the availability of information and the different planning structures and actors responsible. The case studies illustrate innovative approaches and activities to address the planning implementation gaps, but they are less comparable than expected.

Because smart cities are relatively new concepts, European as well as Chinese urban practitioners are experimenting and developing new approaches to improve the alignment between urban planning and implementation. According to aim 2 of this book chapter, the innovative approaches to build transformative capacities that European and Chinese cities have taken should be illustrated. As conceptualised by the framework, transformative capacities have a positive effect on city planning as well as implementation. The case studies reveal that certain transformative capacity building measures and activities are critical across Chinese and European cities, which were addressed by all of them. These are: "Diversity of actors and appropriate resources", "Leadership and ownership by appropriate key actors" or "Continuity of actors cross multi-level governance/bodies". This suggests these measures are particularly important when it comes to the building capacity, to effectively close the planning and implementation gap.

Importantly, however, the case studies show that while there are commonalities in the importance of certain transformative-capacity-building measures between Europe and China, the way these capacity measures and activities are expressed differs between Chinese and European cities and always embodies the local context. For example, while the transformative-capacity-building measure of "diversity of actors and appropriate resources" is key in all cases studies, there is a difference in how this diversity plays out and what resources are made available. While European cities show a stronger tendency to organise and substantiate this diversity of actors in more horizontal way, Chinese cities express this diversity from a more

vertically organised governance perspective. A similar observation can be made with the transformative-capacity-building measure of "Leadership and ownership by appropriate key actors", which was also found to be critical across all cases. In European cities, this capacity measure manifests itself in a more decentralised way, in which leadership and ownership become a more distributed phenomenon in smart city planning and implementation. In Chinese cities, however, leadership and ownership are expressed in a more centralised and consolidated way, while also empowering actors at a lower administrative level.

These two examples also highlight that capacity measures are closely interlinked and shape smart city development in combination. Clearly, a more horizontal expression of the "diversity of actors" in European Cities goes hand in hand with more distributed and decentralised interpretation of "Leadership and ownership" measures in smart city development. Likewise, more vertically organised "diversity of actors" in urban governance will also have direct implications for the centralisation and consolidation of "leadership and ownership" in smart city development processes. Taken together, the Chinese cases highlight that top-down-focused approaches towards smart city planning and the provision of smart city programs is one of the success factors in China. On the contrary, top-down-focused approaches seem to be less likely to be the key factor for success in European cases and, instead, smart city planning and implementation success use more bottom-up-intensive approaches.

The case study analysis also revealed that more transformative-capacity-building measures related to the "Relational Dimensions" were used in European cities than in Chinese cities. One example of this is that European cities have used innovative approaches and processes to facilitate cross-departmental as well as cross-jurisdictional collaboration, even though this comes with higher transaction costs due to the additional coordination efforts. This finding was less pronounced across Chinese cases, which calls for attention to investigating measures that build this transformative capacity dimension in a more vertically and hierarchically organised city planning and implementation context in future analysis. Another example is European cities' approach to monitoring and evaluation (also part of the "Relational Dimension"). European case studies demonstrate that transparency in monitoring and evaluation is seen as an opportunity to facilitate learning between stakeholders and to allow for flexibility and adaptation in planning and implementation processes. In European cases, monitoring and evaluation were also used to develop best-practice examples and lessons-learned, which were shared with a wider group of stakeholders. Chinese cities, on the other hand, have developed a stronger focus on structured peer-to-peer learning among urban development officials, and on bi-lateral learning and experience-sharing partnerships with dedicated cities outside of China.

However, although the framework has worked well and we learned about innovative approaches and activities for capacity building, the research results only

outline the status quo in the case study cities. Further research is needed to distil more general measures and tools from the innovative activities and approaches, to build the necessary capacities to eventually generate a toolbox for the choice of city. Moreover, in the next step, the active shaping of transformative capacity would be to the benefit of cities. Loeber (2007) and (Cramer and Loeber 2004) outlined the transformative learning approach. This approach focuses on the development of dedicated and specific participatory and collaborative dialogues in cities, including a reflection process that leads to the production of transformative knowledge, commitment to implementation and, finally, transformative learning. This approach could be used to better address and refine the innovative approaches in a participatory way.

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Appendix A. Map of European Cities Active in Smart City Programmes

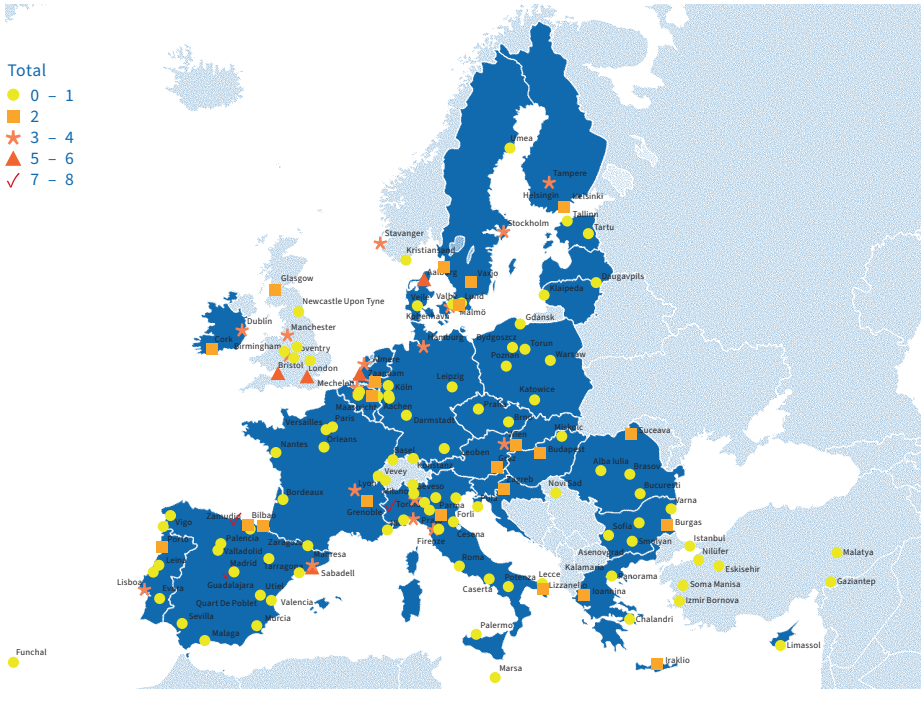

Figure A1. European cities that are involved in Smart City projects (legend shows the number of projects cities are engaged). Source: Figure by authors.

Appendix B. Detailed Overview of Smart City Programmes in China

The following approaches and practices of pilot programmes that have been launched by Chinese government ministries or agencies are used for identifying cities that are more active in Smart City development:

- In May 2012, the Ministry of Housing and Urban-Rural Development of the PRC (MOHURD), one of the leading stakeholders in city construction and management in China, officially issued a "Notice on Carrying Out the National Smart City Pilot Programme": each city with application intentions is required to formulate a specialised plan, coupling with national objectives and local conditions, which shall be submitted to the MOHURD after the approval of the corresponding provincial government. From 2012 to 2015, MOHURD announced three batches of National Smart City Pilots (NSCP) with a total of 277 programmes covering 179 prefecture-level or county-level cities distributed in 23 provinces, five national autonomous regions and four provincial-level municipalities;

- In Dec 2012, the National Administration of Surveying, Mapping and Geo-information (NASMG), the most important public technology supporter in China for Smart City development, announced the launch of a pilot programme constructing Smart City's Cloud Platform for Spatio-Temporal Information (CPSI), which mainly focuses on the construction of spatial information infrastructures. By collecting and analysing real-time spatio-temporal information, this is supposed to make great contributions to achieving more intelligent decision-making for urban development, more flexible public services for citizens, and more transparent and reliable pathways towards sustainability. Since 2013, about 10 cities were selected by NASMG for piloting each year, and the construction period for each pilot city is about 2 to 3 years. By 2018, up to 46 cities were listed as pilot cities;
- In Dec 2013, the National Information Consumption City (NIC) Pilot Programme was launched by the Ministry of Industry and Information Technology of PRC (MIIT), the most important administration agency in supervision and managing smart technology development and application in China. The essential criteria for pilot selection include that the city should have solid foundations in the economic performance and information infrastructure, i.e., the city should not only be advantageous for providing information services and products for citizens, but should also have excellent practices in the operation pattern, the innovation encouragement, public service function and governance capacity. By 2018, a total of 104 pilot cities (also including counties and districts) were promulgated, including more than five pilot cities in each of these provinces, including Jiangsu, Shandong, Anhui, Guangdong, Hebei, Jilin, Sichuan and Zhejiang. By the end of 2015, 25 demonstration cities with best practices were selected through the process of application by municipalities, pre-evaluation by provincial governments and final evaluation by national expert commission;
- The Technology and Standard Pilot Programme for Smart City (TSPPSC) Construction was jointly issued by the Ministry of Science and Technology of the PRC (MOST) and the Standardization Administration of China (SAC) in 2012 to carry out pilot demonstration work in 20 cities across the country. This programme aims to provide a network platform for local governments and national science and technology programmes involving Cloud Computing, Big Data, and the Internet of Things to form a general scheme for smart city development by promoting technological and economic cooperation. Each pilot city is asked to, respectively, formulate a concrete implementation plan for three years. By the end of the implementation, their performances and achievements will be critically and thoroughly evaluated to draw the replicable experiences. The replicable experiences from each city will then be further summarised and

standardised to contribute to China's technology and standard system of smart city construction;

- In 2014, 12 national ministries or bureaus (D12) jointly approved a list of 80 cities for pilots of People-Beneficial-Oriented National Information Cities (NIPC). The main objectives of this pilot programme are to improve the capabilities of/access to public services, optimise public resource allocation, and promote the sharing of knowledge, innovation, infrastructure and business networks among actors such as municipal government agencies, communities, enterprises and grassroots institutions. A spectrum of experts recommended by different ministries was jointly established to provide advice on construction and governance innovation in these pilot cities. Additionally, this programme takes communities or neighbourhoods as the basic spatial units to collect and integrate real-time data or information to avoid both extremes: unreasonably oversized information systems or the possibly emerging of "information isolated islands". The services involved in the information system cover many aspects and topics, including urban construction, social security, health care, pension, education, industry, employment and community services.

Appendix C. Map of Chinese Cities Participating in Smart City Programmes

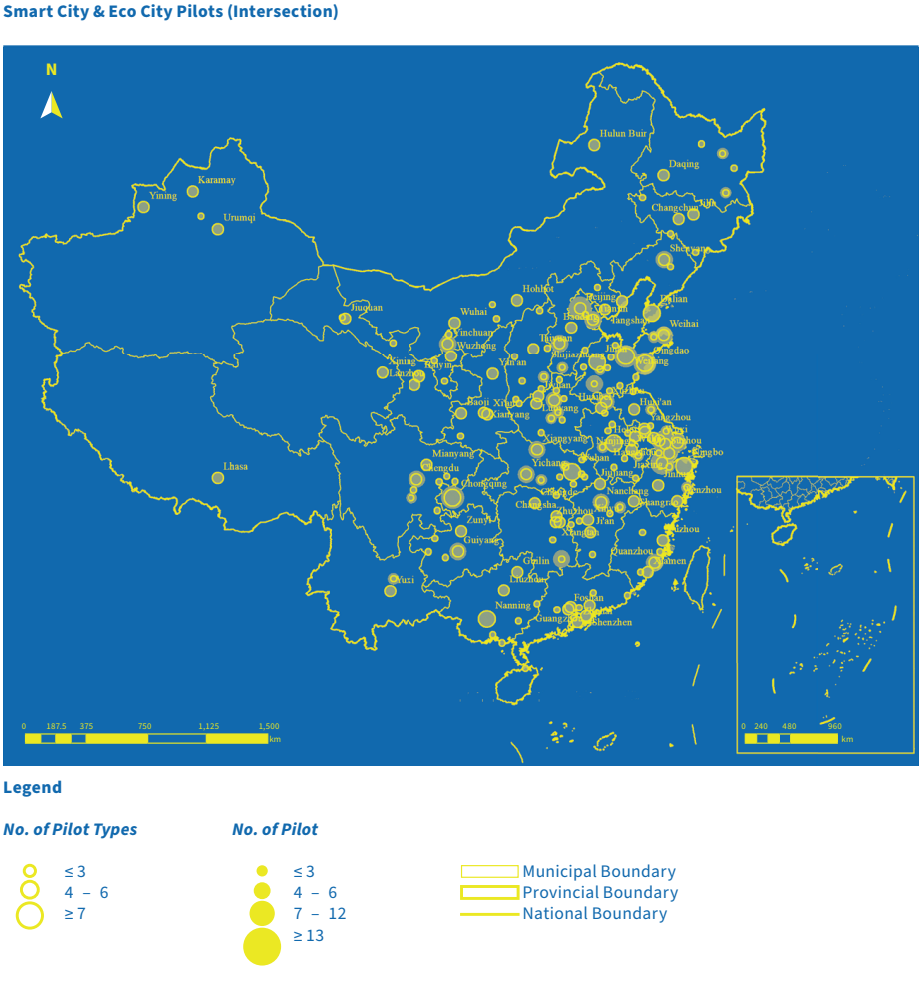

Figure A2. Chinese pilot cities by number of pilot projects and number of types of pilot programmes. Source: Figure by authors.

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