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THE GOVERNANCE OF FLOOD RISK PLANNING IN GUANGZHOU, CHINA: USING THE PAST TO STUDY THE PRESENT

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Based on the framework of governance adapted from the work of Patsy Healey and drawing on the case of Guangzhou, which is regarded as the most vulnerable city in China to flooding and waterlogging, this paper adds to the literature on urban climate change adaptation. It does so by shedding light on the history of the city's struggle against the water and examining why the current spatial planning and flood risk management fails to address the growing flood risk linked with climate change. The paper distinguishes two major transformations of the approach to dealing with water in Guangzhou. Historically, the city was built under the influence of *Fengshui* Philosophy and co-existed with water. Then, the approach shifted towards engineering-based solutions to containing flood risk under the stress of rapid city expansion. After that, in the context of a changing climate, to minimise flood risk the local government is transferring its priorities from the planning of hard engineering solutions (back) towards soft nature-based solutions. However, the deeply rooted top-down planning culture and clear-cut functional separation between different departments of the local government critically affect the implementation of the policy and cooperation between the different agencies to address the present and increasingly urgent cross-cutting climate change adaptation agenda.

Keywords

coastal cities; flood risk planning; climate change adaptation; governance challenges; on-going process

How to Cite

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INTRODUCTION

Climate change usually brings about more negative impacts than positive impacts, heat waves, rising sea levels, frequent storms, severe water scarcity, etc.¹ Due to poor preparation, most coastal cities with low altitude cities are negatively influenced by the flood risk, with existing large accumulation of populations and assets threatened.² What is worse, in some rapid growing countries, for instance China, uncontrolled urban expansion is rapidly eroding floodplains which leaves the new urban areas at high risk of flooding. Consequently, these coastal cities face tremendous pressure from the tension between leaving the room for water or for urban development.³

To meet these challenges, a new notion of climate adaptation in flood risk planning is increasingly adopted by coastal cities.⁴ Corresponding, various measures, strategies and programmes in the realm of spatial planning tries to apply this notion. However, in practice, it remains extremely challenging to integrate adaptation measures with the existing governance behaviour.⁵ The potential reason might be there is a gap of a deep understanding of the underlying mechanism of governance of flood risk planning. This paper tries to respond to this gap by exploring the mechanism via a historical perspective, using the past to study the present. It helps to understand what the characteristics of governance in flood risk planning are, in what context they emerge, and, the most important, how they change and evolve over time.

The term governance refers to ‘an arrangement where one or more public agencies directly engage non-state stakeholders in a collective decision-making process that is formal, consensus-oriented, and deliberative and that aims to make or implement public policy or manage public programs or assets.’⁶ It has been increasingly used in analysis of spatial planning when climate adaptation and flood risk are concerned.^{7,8}

In this paper, a framework from Healey is adopted in the analysis of governance of flood risk planning. In her theory, the governance is a dynamic process.⁹ This standpoint helps to present how the characteristics of governance are linked together and how they evolve over time.

This article uses the case of Guangzhou to enhance our understanding of the governance of urban flood risk planning and its implications. It does so by looking back into the history of the relationship between urban development process, approaches to tackling flood risk and the stakeholders and network involved, which in turn allows for better understanding of the present challenges that the city faces in climate change and the magnified flood risk that it brings. Thus, the paper addresses the following research questions:

- Q1: How governance of flood risk planning has been organised and changing over time in Guangzhou ?
- Q2: How the negotiation between the different stakeholders in the governance of flood risk planning is organised across different governance episodes?
- Q3: How culture characteristics and values embedded in the Chinese governance determine the changes in governance behaviour?
- Q4: What are the implications of this evolution for the current challenges posed by climate change?

The article is organised in the following way. First, it explains why Healey’s governance theory is adopted as a theoretical framework for this study. Second, the paper takes stock of Guangzhou’s historical relationship with water and the evolution of the ways in which flood risk was addressed within the planning system. Policy tools such as the central government’s mission statements, policies and regulation, or local and regional strategic plans and detailed urban designs, are examined in a chronological order; to investigate the changes of scale, type, content and discourse concerning flood risk. Thirdly, the article rethinks the current changes and future trends in the planning system itself, reflecting upon the opportunities for better integration and implementation of flood risk reduction measures in climate adaptation measures. These opportunities are related to the on-going shift towards greater stakeholder engagement and more integrated approach to urban challenges.

GOVERNANCE OF FLOOD RISK PLANNING AT MUNICIPAL LEVEL

Governance, as opposed to government, refers to the involvement of public and private actors in decision-making in the public sphere.¹⁰ Nowhere should this approach to public policy be more advocated than in flood risk planning in cities. First, the wide scale of impacts of flood in cities and vague definition of responsibilities to address them make this issue difficult to tackle drawing on expertise in just one specific area, such as water management.¹¹ Second, the long term perspective and uncertainty associated with flood risk management, exacerbated in the wake of climate change, call for a flexible mechanism to receive the feedbacks from the changing situation and create scope revising the original plans. Third, given the potential negative and uneven impacts of flood and measures to counter it on the different actor groups in the city, the involvement of the different stakeholders is a necessity to allow everyone to exercise the right to defend their interests.^{12,13} In the context of spatial planning responses to flood risk, governance is the mechanisms allowing to mitigate the conflicts stemming from planning strategies and maintaining coordination between flood-risk management actions and the different spatial interventions.¹⁴

FRAMEWORK USED IN THE ANALYSIS OF GOVERNANCE OF FLOOD RISK PLANNING

Following Healey’s framework governance has three dimensions: episode, governance process and governance culture (see Table 1).^{15,16} This framework was first used by Healey to assess the experiences with the introduction of ‘area committees’ to local planning system by Newcastle City Council in the UK.¹⁷ That paper examined the potential of ‘area committees’ as an institutional innovation and explored its capacity to set off changes in that context.

In Healey’s framework, a specific episode represents a period when agreements between practical problems and strategies are made in spatial development. It starts by an initiative caused by a big event in natural environment, for example a serious flood, or a transition in spatial planning system, such as a revocation of an department and lasts until a new configuration of actors and arenas arises and opens a window of opportunity that drives policy-making into a new episode.^{18,19} A specific episode, therefore, can be regarded as a reflection of a series of constant changes in a period of time, which turns to another new episode by some dramatic or remarkable event. Every episode is marked by the special characters of stakeholders, network, discourses and practices and influenced by modes of governance, embedded cultural values and formal and informal structures for policing discourse.

DIMENSIONS AND ELEMENTS OF GOVERNANCE OF CLIMATE ADAPTATION. SOURCE: HEALEY (2003)	
Specific episode	<ul style="list-style-type: none">• Actors - roles, strategies and interests;• Arenas - institutional sites;• Setting and interactive practices - communicative repertoires
Governance processes	<ul style="list-style-type: none">• Networks and coalitions• Stakeholder selection processes• Discourses - framing issues, problems, solutions, interests, etc
Governance cultures	<ul style="list-style-type: none">• Practices- routines and repertoires for acting• Range of accepted modes of governance• Range of embedded cultural values• Formal and informal structure for policing discourse

TABLE 1 Dimensions and elements of governance of climate adaptation. Source: Healey (2003)

Furthermore, governance process represents the way in which measures are actually worked out and governance culture represents the assumptions and meanings associated with the spatial planning system in relation to social values, governance traditions and beliefs. Compared with changing governance process, governance culture is usually continuous and stable, even if it can change gradually in some circumstances as a result of learning processes or major reforms redefining the structures of opportunities for the actors. This framework is used here to analyse the governance of flood risk planning of Guangzhou, albeit with an emphasis on the evolving character of governance in the planning practice.

CASE SELECTION

The paper examines the governance of flood risk planning using the case of Guangzhou, China. In the past, the livelihoods of generations of Guangzhou dwellers were nurtured by Pearl River. They lived in proximity to or even with water and adapted to the frequent flooding, which brought fertility to the arable land. Areas at higher altitude were used for residential area, while the lower places were used for farming. Today, however, the rapidly expanding Guangzhou – a megacity located at the heart of the economic powerhouse and magnet for millions of migrants namely the Pearl River Delta (PRD) - is emblematic of the flood risk management challenges encountered in many Chinese cities. The climate change scenarios for the PRD include, among others, such negative impacts as the growing risk of coastal flooding and more frequent extreme precipitation. These phenomena, together with the continuing urban expansion into flood-prone areas, strengthen both the scale and degree of Guangzhou's exposure to flood risk.²⁰ Actually, in the file *Ranking of the exposure of world coastal cities to coastal flooding caused by climate change, assessing current and future exposure (2070)*, Guangzhou ranks second in terms of assets exposed and fourth in terms of population at risk.²¹ Thus, it is a city that has a long and rich history of living and fighting with water, which currently is at highly vulnerable level to new flood risks stemming from the changing climate.

DATA SOURCES AND METHODS

The research builds on an extensive review of academic literature of relevance in the fields of spatial planning, flood risk management and political science. The data is drawn from planning and policy documents (strategic), building regulations (guidelines, technical handbook), government publications and reports (mission statement and other policy documents). Most of the documents studied played critical roles in framing the decisions on tackling flood risk in the course of history of Guangzhou's development. In order to show how the governance of flood risk planning is evolving and how the water issue is incorporated as a part of spatial planning at the local level, the following variables are investigated : institutions and stakeholders involved, policy activities, tools and discourses in the field of flood control. This is complemented by an analysis of the governance culture and features deeply embedded in the Chinese planning system.



FIGURE 1 Map of Guangzhou in Qing Dynasty illustrating the relationship between the city and the water according to Fengshui philosophy,
 Source: Xie Shaoliang (2014)

THE EPISODES

EPISODE 1: CO-EXISTENCE AND ESCAPE (BEFORE THE 1910'S)

In Guangzhou's history of living with water, the first episode could be named co-existence and escape. Before the 1910's, China was still a feudal society. Urban construction was then based on empiricism. The traditional belief of Fengshui was regarded as the basic paradigm for construction. It concerned the relationship between humans and the living environment and focused on the harmony between natural and man-made forms. An important principle in Fengshui was that the ideal location for a city was a place adjacent to high mountains and water resources. Building a city in a place with too high altitude should be avoided, because it would increase the difficulty in the access to water. Building a city in a place too close to the water was not advised neither, because of the need to invest more heavily in managing the flood risk.

The location of ancient Guangzhou was selected according to these traditional principles. It benefited from a high terrain to the north and a lower one to the south. The Yuexiu Mountain sited in the North of the city formed a natural defence to protect the town, while the Pearly River located in the South of the city provided favourable conditions for shipping and farming. Based on this geographic condition, three types of water systems formed. The six canals flowing through the inner city were regarded as important shipping lines, which supported numerous commercial activities alongside waterways. The canals surrounding the ancient city were used as the moat to protect the whole city.²² The Pearly River was recognised as the economic lifeline for the external trade with many docks built along the side. During this period, the slow development of ancient Guangzhou followed the traditional principle of living with water, while avoiding the disadvantages of periodic flooding.

Stakeholders and network in the first episode

In this period, official water affair administrators, such as Water Official in Qing Dynasty(1916-1912), were merely set at national and regional level, while folk organisations played an important role in water management at municipal level. The responsibility of flood management in Guangzhou at Qing Dynasty was in the hands of the so-called River Dredging Association (*Qinghao Gongsuo*). Qinghao built and maintained water infrastructure in the city, while at the same time promoting the economic activities along the river and canals. In fact, Qinghao was composed of rich merchants who invested in water facilities construction, then bought land at a discount price along waterways and finally established commerce along the side of the water. One could thus argue that water management was then organised in a bottom-up manner and was in the hands of the private sector, even though the construction required a consent of the local authority.²³

EPISODE 2: STRUCTURAL FLOOD CONTROL AND URBAN EXPANSION (FROM 1910`S TO THE END OF 20ST CENTURY)

During the second episode, that could be named structural flood control and urban expansion, the city mainly relied on engineered construction to offset the negative impacts of flood and allow for an expansion of the city toward the floodplain area. It was attributed to the rapid growth in population and the increased demand for land. Specialised flood control infrastructure were then built in a wide scale which gradually channelled the natural river into an inland river. This episode could be divided into two stages. The first stage covered the period from 1910`s to 1980`s, during which the expansion of Guangzhou was a gradual process. The second stage covered the period from 1980`s to the end of 20st century, during which Guangzhou had experienced a rapid expansion in the wake of liberalisation and opening of China's economy prompting unprecedented economic growth and migration from the country side to the cities.

After 1910`s, China stepped into the era of The Republic of China. Guangzhou was ushered in a short term of stable development from 1910`s to the end of 1930`s. In that period of time, the position of Guangzhou had been greatly raised by the central government.²⁴ According to *Plans for National Reconstruction*, proposed by President of Sun Yat-sen in 1921, Guangzhou was expected to be the most important harbour in Southern China. In this spirit, the attention was transferred from the development of inner city to the coastal areas. It brought up two effects. First, the plans *Guangzhou development and implementation plan* launched in 1930 and *Guangzhou Urban Design Guideline (Draft)* launched in 1932, paid more attention to the development of private industry and commerce along the two sides of the Pearl River. Hence, massive construction of water defence infrastructure, such as docks, levees and harbours was prioritised. Second, the commerce along the six open canals in the city gradually faded and the economic function of these inner canals degraded.²⁵ As a result, these canals were abandoned and finally covered up.²⁶ It seemed that Guangzhou were well prepared with fast development. However, due to the disturbance of wars and revolution from the end of 1930`s to 1970`s, Guangzhou's development slowed down due to economic stagnation or even recession at certain times. Nevertheless, some big projects were still carried out at the end of 1950`s. Four artificial lakes were constructed in Guangzhou to improve its capability to face flood risk and waterlogging. After that, the large-scale construction of flood control infrastructures in Guangzhou stalled.²⁷

From the 1980`s, when the reform and opening-up policy was proposed, a new chapter in the history of the city was opened. Guangzhou was then redefined as an important port city and a centre for finance and foreign trade in the 14th *Guangzhou Land Use Masterplan* in 1984. Based on that, Guangzhou stepped into a period of rapid expansion. One thing to note here was that in 1988, the Ministry of Water Resources was founded, which was officially granted the power to take measures to control flood risk. From then on, engineering-based resistance measures were widely advocated in flood management regulations issued by water affair administrators. While the recognition of flood risk was limited in land use masterplans, which paid much more attention to economic development. For instance, in the 15th *Guangzhou Land Use Masterplan* (1992) and 16th *Guangzhou Land Use Masterplan* (2002), the commercial development in coastal areas was emphasised, while very little attention was paid to flood risk issues.

Stakeholders and network in the second episode

The stakeholders in the first stage of the second episode were limited to mainly governmental sectors. Guangzhou municipal government was the main actor who owned a high degree of autonomy and responded to flood risk. The municipal department in charge was the Works Bureau, whose duty covered the urban planning and building construction. That said, in that period the President of the Republic of China, Sun Yat-sen, personally played an important role in shaping the water policy in Guangzhou, by outlining the main principles for water management and flood risk infrastructure construction in the *Plans for National Reconstruction*, which sketched the blueprint for China's economic development and reserved a key role for Guangzhou's harbour and waterways for Southern China.

THE EPISODE OF STRUCTURAL FLOOD CONTROL AND URBAN EXPANSION (FROM 1910'S TO THE END OF 20ST CENTURY)

First stage: gradual expansion (1910's -1980's)			
Department / Level	Policy activities / Year	Content of tools / Category	Activities of water defence and structural flood control measures
President Sun Yat-sen	Plans for National Reconstruction (influential book outlining, among others, the strategic role of water and harbour of Guangzhou for the economic development of China) / 1921	resistance measures / flood (risk) management	emphasis on infrastructure construction in coastal areas, such as channels docks, harbours;
Works Bureau of Guangzhou municipal government / Municipal level	Guangzhou development and implementation plan/ 1930	resistance measures / flood (risk) management	mainly focus on water infrastructure construction, for example: dredging the clogged channel, straightening the natural channel and building dikes and levees
Guangzhou municipal government, Municipal level	Guangzhou Urban Design Guideline (Draft)/ 1932	resistance measures / flood (risk) management	emphasis on infrastructure construction docks and harbours
Second stage: rapid expansion (1980's - the end of 20st century)			
Department / Level	Policy activities / Year	Content of tools / Category	activities of water defence and structural flood control measures
Guangzhou Urban Planning Committee / Municipal level	Guangzhou land use masterplan (the 14th version)/ 1984	resistance measures / flood (risk) management	mainly focus on water infrastructure construction, for example: dredging the clogged channel, straightening the natural channel and building dikes and levees
	Guangzhou land use masterplan (The 15th version)/ 1992	No description	emphasis on the importance of construction of harbours and commerce in coastal areas
	Guangzhou land use masterplan (the 16th version)/ 2002	No description	emphasis on the importance of commerce in coastal areas
Ministry of Water Resources / National level	River management regulations of the People's Republic of China /1988.06	resistance measures / flood (risk) management	emphasis on water infrastructure construction and management
	Guideline Framework for Safety and Construction of Flood Storage Area/ 1988.10	resistance measures and avoidance measures flood (risk) management	and non-engineering flood control measures (e.g. flood storage area to mitigate flood)
	Regulations of Reservoir Dam Safety Management/ 1991.03	resistance measures / construction of technique basis	emphasis on infrastructure construction in levee and dike
	Flood Control Regulation of the People's Republic of China / 1991.07	resistance measures / flood (risk) management	emphasis on flood dispatching and temporary remedial measures,

TABLE 2 the Episode of structural flood control and urban expansion (from 1910` s to the end of 20st century). Source: Author

In the second stage, there was a trend for clear functional division. Before the second stage, the description of flood risk management was an important issue in urban planning, and was considered in documents such as *Guangzhou development and implementation plan* and *Guangzhou Urban Design Guideline*. However, in this second stage, the main responsibility of dealing with flood risk became the sole responsibility of the water resources administration, and urban planning documents paid less attention to water issues. The history of this functional fragmentation helps to understand the current difficulties in collaboration across the municipal departments dealing with water and urban development to tackle the growing flood risk, as will be argued later in the article.

EPISODE 3. TOWARDS THE NEXT EPISODE OF ADAPTATION AND SYMBIOSIS? (AFTER THE END OF 20TH CENTURY)

As the negative impacts of climate change have been increasingly recognised from the end of 20th century, the need to respond to them was gradually brought to the forefront. In seeking to deal with these threats, the National Climate Change Coordinating Leading Small Group (NCCCLSG) was founded by the Chinese government in 1990. It was the first step towards the emergence of the Chinese climate policy. Nonetheless, due to limited authority in the early stage of its activity, this pioneer agency failed to spur the development of climate change governance in China.²⁹ In Guangzhou as well, climate adaptation considerations were not at all reflected in the plans and strategies related to flood risk. Although there were some early attempts to explore the potentiality of low impact development or green-blue infrastructure, for example in the *Nansha District Develop Plan*, launched in 2001, which tried to apply the notion of “Green-blue network” to protect the hydrological and ecological values of the coastal landscape, while trying to address the conflicts between land use and water management. However structural flood control was still regarded as the main method to deal with flood risk.

The substantive progress of adaptation initiatives dated back to 2007 when China`s *National Climate Change Programme* was launched at national level. Even though the emphasis was put on climate mitigation with limited description about adaptation, it set the basis for preparation of climate actions in China. The year 2011 could be regarded as a big turning point for the promotion of climate adaptation (see Table 3). In the document *12th 5 Year Plan (National Social and Economic Development Plan 2011-2015)*, a chapter was introduced to describe the impact of climate change. This was significant, as the 5 Year Plans in China actually define the direction that the whole country should strive to follow deploying all possible efforts. Normally, previous 5 Year Plans merely focused on social and economic issues instead of climate issues, which require actions that do not tangible benefits in the short-term. It was thus the first time that climate adaptation was proposed and emphasised in this series of national documents. Before 2011, in the documents such as *10th 5 Year Plan* and the *Plan for the Reform and Development of the Pearl River Delta*, flood risk was always considered as a paroxysmal hazard with little connection to the long-lasting trend of climate change. Therefore, responses during that period from national to municipal level mainly focused on resistance measures to avoid flooding. Lots of money was thus poured into the construction of water engineering defences.

The next step in this evolving approach was the policy promoting the notion of a sponge city. Following the *12th 5 Year Plan*, *Technical Guideline for Sponge City Construction* was launched in 2014, emphasising the combination of “engineering facilities” (drainage system) and “biological facilities” (green space system, river system and road system) to improve the permeability of the city’s underlying surface in the face of flood and waterlogging. More importantly, the document clearly pointed out the necessity of horizontal cooperation among different departments at the municipal level to reach that goal. It provided the institutional support for urban planners to handle waterlogging. However, this problem was not explicitly recognised as being exacerbated by climate change. Before the sponge city policy, most plans concerned with water management in the urban space remained on paper with little support from other departments such as the municipal *Water Affairs Bureau*, however, this policy is set to change that pattern.

Although in the national level there were limited new policies beyond the sponge city policy, at the municipal level, the trend went further. *Construction planning for ecological city of Guangzhou (2014.08)* and *Guangzhou Centre City Draining System Comprehensive Planning (2015.06)* were issued successively by the Water Affairs Bureau of Guangzhou, underlining the improvement of drainage and storm-sewage diversion system as a priority. These documents helped turn the focus of Guangzhou's municipal government from resistant measures to resilient measures. Both of them could be regarded as supplementary materials for the notion of sponge city, which provided the basis for practical project cooperation with *Guangzhou Land Resources & Urban Planning Committee*.

Stakeholders and network in the third episode

The stakeholders in the adaptation and symbiosis episode are numerous with different levels and various fields (see Table 3).³⁰ However, governmental institutions are still the main actors. National Development & Reform Commission (NDRC), Ministry of Housing & Urban-rural Development, Guangzhou Land Resources & Urban Planning Committee and Guangzhou Water Affairs Bureau are the key stakeholders, with little involvement of NGOs and civic organisations. This weak involvement of non-state actors reflects the features of the Chinese political system, in which participation act is regarded as a mere consultative process by the local government, with limited inclusion of its outcomes into the research, and with limited knowledge co-creation.³¹ However, the main reason might also be that civic organisations and NGOs do not have sufficient knowledge about climate adaptation. The recognition of adaptation needs is slow even among the departments of the municipal government, let alone the among the public.

There is also a deficiency in the operation of the network of stakeholders. Due to the strict functional division, the cooperation between the different departments at the municipal level is weak. In Guangzhou, Water Affairs Bureau usually has little connection and cooperation with Urban Planning Bureau.³² They work separately, relying on strict functional division. Such fragmented system can cause conflicts and obstacles in communication. A collaborative environment between the different sectoral municipal departments is needed to coordinate policies and build include a broad range of stakeholders in agenda-setting and learning opportunities.^{33,34} Although the policy of sponge city is a good start, as it advocates horizontal cooperation between the different institutions, its impact has to be evaluated over time and once the policy is actually implemented.

THE EPISODE OF ADAPTATION AND SYMBIOSIS (AFTER THE END OF 20TH CENTURY)

Department / Level	Policy activities / Time	Content of tools / Category	activities of flood risk planning with partly adaptation consideration
Guangzhou Urban Planning Committee / Municipal level	Nansha District development plan / 2001	No description	Emphasis on construction of “Green-blue network” to protect the hydrological and ecological values of the coastal landscape while trying to address the conflicts between land use and water management
	Guangzhou land use masterplan (the 16th version)/ 2005	No description	Emphasis on the construction of green belt along the Pearl River
National Development & Reform Commission (NDRC) / National level	10th 5 Year Plan (National Social and Economic Development Plan 2001-2005) / 2001	resistance measures / flood (risk) management	enhancing the construction of flood control infrastructure
	The Outline of the Plan for the Reform and Development of the Pearl River Delta (2008-2020) / 2008.1	resistance measures / flood (risk) management	focus on water infrastructure construction, without any description of climate change or climate adaptation
	12th 5 Year Plan (National Social and Economic Development Plan 2011-2015) / the beginning of 2011	resistance measures / climate change	The plan including a chapter on climate change and specific section on adaptation for the first time; mandating the development of a National Adaptation Strategy (NAS).
Ministry of Housing & Urban-rural Development (MoHURD) / National level	Key Work of Urban Construction Division in the Ministry of Housing and Urban - rural Development in 2014 / 2014.2	resilience measures / sponge city	emphasis on infrastructure construction in drainage improvement and Storm-Sewage Diversion System, firstly come up with the notion of sponge city in a national material, without any description of climate change or climate adaptation
	Technical Guideline for Sponge City Construction / 2014.11	resilience measures and construction of technique basis / sponge city	emphasis on the combination of “engineering facilities” (anti-waterlogging drainage system) and “biological facilities” (green space system, river system and road system) to improve the permeability of the underlying surface in face of flood and waterlogging,
	City adapt to climate change action plan / 2016.03	resilience measures and resistance measures / Climate change	emphasis on difference of climate features in different cities to compile action plan of climate adaptation ; Select 30 cities as pilot projects to implement climate adaptation action.
Ministry of Water Resources / National level	Guidelines for Developing Flood Risk Mapping / 2008.12	construction of technique basis / flood (risk) management	emphasis on the basic principles of flood risk map, still very vague, without any description of climate change or climate adaptation
	Technical Details for Developing Flood Risk Mapping / 2009.10	construction of technique basis / flood (risk) management	emphasis on difference of flood risk maps according to the geographic characteristics, still very vague, without any description of climate change or climate adaptation

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THE EPISODE OF ADAPTATION AND SYMBIOSIS (AFTER THE END OF 20TH CENTURY)

Department / Level	Policy activities / Time	Content of tools / Category	activities of flood risk planning with partly adaptation consideration
Pearl River Water Resources Commission / Regional level	Pearl River Basin Flood Control Planning / 2006	resistance measures and avoidance measures / flood (risk) management	emphasis on infrastructure construction, management and monitor with a regional framework ,without any description of climate change or climate adaptation
Guangzhou Land Resources / Urban Planning Committee / Municipal level	Guangzhou land use masterplan (2006-2020)/ 2006	resilience measures / land use planning and economic development	emphasis on infrastructure construction in levee and dike, without any description of climate change or climate adaptation
	Guangzhou Comprehensive Plan (2011-2020) / the middle of 2010	resilience measures / land use planning and economic development	emphasis on infrastructure construction in drainage and water reservoir, without any description of climate change or climate adaptation
	Guangzhou Haizhu ecological city comprehensive plan / 2013	resilience measures / land use planning and economic development	emphasis on ecological technology and water infrastructure construction to lower flood risk and improve aquatic ecosystem.
Guangzhou Water Affairs Bureau / Municipal level	Guangzhou Water White Paper 2013 / 2014.5	resistance measures / flood (risk) management	start to transfer attention to water management, climate change is regarded as one of reasons that resulting in the vulnerability of city in the face of flood risk and waterlogging
	Construction planning for ecological city of Guangzhou / 2014. 08	resilience measures / flood (risk) management	emphasis on water infrastructure construction in drainage and storm-sewage diversion system and the sustainable development of water economy
	Guangzhou Centre City Draining System Comprehensive Planning / 2015.06	resilience measures / flood (risk) management	emphasis on infrastructure construction in drainage improvement and Storm-Sewage Diversion System

TABLE 3 the Episode of Adaptation and Symbiosis (after the end of 20th century)

UNDERSTANDING THE CURRENT CHALLENGES THROUGH THE PRISM OF GOVERNANCE CULTURE

In spite of these new initiatives, it should be admitted that specific strategies and deep understanding of climate adaptation in Guangzhou at municipal level were still developing. In practical project, limited plans set adaptation as their initial targets, it is usually framed as a sub-topic of other policies and plans that could generate other socio-economic or environmental benefits in the categories of land use planning and economic development or flood risk management,³⁵ although some attempts in the notion of sponge city were promising. As the project progresses step by step, original intentions might change gradually with the topic adaptation finally neglected. After all, it was first defined as a sub-topic with less attention on it. At the same time, the diversity of adaptation has not been realised. It could be reflected in policies that although adaptation could be translated into different items in various projects, such as sponge city, low impact plan, sewage diversion system construction and drainage improvement, limited plans or projects set a notion that they related and could be organised overall. There is also a lack of description of the connection between these strategies and climate change, which leads to the fragmented understanding of adaptation measure, not conducive to the formation of a continuous response. It also explains that in the 12th 5 Year Plan, even climate adaptation proposed, there are limited descriptions about how to use this item in spatial planning.

The difficulties in getting adaptation agenda off the ground in Guangzhou can be attributed to some features of the Chinese governance culture. First, one is the top-down planning system. Chinese planning system is centralistic with limited autonomy of local government.³⁶ The strategies at the municipal level mainly rely on the direction of central government.³⁷ Although in the 12th 5 Year Plan (2011), the notion of adaptation is proposed, there is no clear description of measures and principles about how to handle this issue on the ground. This situation has been changing, however, since 2014 when the *Technical Guideline for Sponge City Construction* was issued. It offered a concrete and practical guidance on how to handle waterlogging and flood by the combination of engineering facilities and biological facilities. In that way, sponge city as a variation of adaptation is spread among the local governments and known by their departments gradually. That is the reason why there is a delay in the promotion of climate adaptation at municipal level and why many adaptation planning initiatives are mainly at national level, while fewer at the municipal level.

Another governance culture feature that hinders the development of urban climate adaptation is the narrow focus on the technical role of spatial planning in most cities of China. Climate adaptation planning, if recognised as an objective at all, is regarded as a technical process to face the negative physical impact of climate change and to formulate the final blueprints,³⁸ not a course of mutual learning involving interaction between multiple-actors, which helps to improve the understanding of the present and future problems, and finally make better decisions.³⁹ Such learning-centred decision-making process is suitable for planning climate adaptation, as it facilitates handling multifarious negotiations among the multiple stakeholders concerned by climate change impacts dealing with uncertainties,⁴⁰ which require flexibility and adjustment to the plans in response to the changing situation.⁴¹ The incompatibility of such a 'soft' and performance-focused planning approach with the predominant rigid and formalistic Chinese planning approach, leads to weak cooperation in practical projects, misperceptions of the outcomes of a specific plan and, ultimately, implementation deficit.

CONCLUSION

By looking back at the history of the links between urbanisation and water in Guangzhou and exploring the current challenges posed by climate change in terms of growing flood risk, the paper highlights the transformations of the ways in which Guangzhou dealt with water over time. Historically, the city was built based on the notion of Fengshui philosophy. In that period people tried to learn living with water while avoid the negative impact of it. However, in the process of rapid city expansion, these traditional approaches were abandoned and the city shifted its attention to engineering-based infrastructural solutions to control the water. Ironically, this engineering-based solutions were not effective enough in the face of climate change impacts, such as intensifying rainfall. So the city now tries to make efforts to minimise flood risk by transferring its priorities from the planning of hard engineering solutions towards soft nature-based solutions (green-blue infrastructure, low impact development, sponge city etc.) under the influence of climate adaptation. Nevertheless, the development of adaptation policies and plans in Guangzhou just starts and is likely to face many challenges in the future. Currently, adaptation is barely mentioned and framed as a sub-topic of other policies and plans which can directly generate socio-economic or environmental benefits.⁴² As plans progress step by step, adaptation can be easily neglected and ultimately waived, in favour of other priorities, such as profit from real estate development. At the same time, there is a lack of recognition of the close connection between spatial strategies and vulnerability to climate change. Adaptation initiatives such as sponge city, low impact plan, and drainage improvement are regarded as separate issues. This fragmented understanding of adaptation strategies is not conducive to the formation of an integrated response in flood risk planning.

Apart from the early age before 1910`s when folk organisations were deeply involved and played an important part in water administration, normally the stakeholders in governance of flood risk planning are mainly governmental sectors, with limited participation from NGOs and civic organisations. This weak involvement of non-state actors makes it difficult for planners to safeguard the interests of the public and to take advantage of the local or expert knowledge that such actors could offer.⁴³ Moreover, the weak cooperation between different municipal departments can cause conflicts and obstacles in communication and implementation of adaptation strategies.⁴⁴ Spatial planning cannot only be regarded as a technical tool to draw a blueprint for the city's development, but instead should provide a platform for negotiation and mutual-learning,⁴⁵ which is particularly necessary when the multi-faceted challenges of climate adaptation are concerned.

Such governance arrangements in Guangzhou are subtly affected by the top-down planning culture, clear-cut functional divisions and the uncoordinated and sometimes conflicting agendas of the sectoral departments at different levels, from central to local. These planning culture characteristics critically affect the autonomy of the local government in proposing policies or plans. In addition, they also prevent horizontal cooperation between the different municipal agencies- which is needed to address the cross-cutting adaptation agenda - and undermine the motivation of the local leaders and planners to promote the notion of climate adaptation in the longer time perspective.

To sum up, the flood risk planning in Guangzhou is an on-going and self-evolving process, which presently is marked with the new notion "adaptation", though it is still at an initial stage. The adaptation epoch challenges the municipal government in at least two ways: there is little recognition of the climate change impacts in the policies and no guidelines on how to tackle them; and there are many stakeholders concerned while they are not collaborating and operate in separation. Addressing these challenges would require a shift in the understanding of the climate change impacts and the way that would combine the different sectoral agendas.

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