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Public Water Governance in Contemporary China

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Zusammenfassung

Die vorliegende Arbeit thematisiert Wasserpolitik im heutigen China. Unter Zuhilfenahme der Theorie Öffentlicher Güter und des *Institutional Analysis and Development frameworks* wird untersucht, warum die chinesische Regierung die Probleme der Wasserversorgung und -Verschmutzung noch nicht gelöst hat und welche Fortschritte in der Wasserpolitik erzielt wurden.

Wasser wird als Allmendegut identifiziert, dessen positive Externalitäten Akteuren Anreize verleihen die Ressource übermäßig zu nutzen und folglich zu erschöpfen. Gleichzeitig entstehen Anreize offen zugängliche Wasserressourcen zur Entsorgung von Abwasser zu nutzen. Abwasser kann auch als negative Externalität privater Handlungen interpretiert werden.

Die Arbeit zeigt, dass die chinesische Regierung enorme Fortschritte in der Wasserpolitik gemacht hat und die überwiegende Mehrheit der heutigen Politikmechanismen theoretisch die Internalisierung der Externalitäten zur Folge hätte, was zur Lösung von Wasser-Übernutzung und -Verschmutzung führen würde. Aufgrund konkurrierender Präferenzen und beschränkter Kapazitäten von staatlichen Akteuren, wurden bislang jedoch nicht alle Externalitäten internalisiert. Zudem behindern Probleme kollektiven Handelns die Wasserpolitik.

Content

1. Introduction

The People's Republic of China is currently confronted with problems of water scarcity and pollution. The following definition is used for water scarcity in this thesis:

> "Water scarcity is defined as the point at which the aggregate impact of all users impinges on the supply or quality of water under prevailing institutional arrangements to the extent that the demand by all sectors, including the environment, cannot be satisfied fully [sic!]. Water scarcity is a relative concept and can occur at any level of supply or demand."[1]

Water scarcity can thus be caused by a rise in demand for water or changes in water supply, for example through climate change. Even though water scarcity can occur at high levels of supply and demand by this definition, hydrologists detect water scarcity if the per capita available water resources are below 1000 m³/year.[2] However, this thesis employs a relative definition of water scarcity, and this data is merely used as a rough guide.

While China possesses large total annual renewable water resources compared to other countries, its total actual per capita renewable water resources of 2111 m³/ year in 2008 are well below the global average of 6466 m³/ year.[3] This situation of generally low per capita water resources is aggravated by the uneven geographical distribution of water within the country. The southern part of the country has about 80% of the country's natural water resources, leaving the North of the country with a very limited water supply of 778.9 m³ per year. As the North is densely populated and agricultural, industrial, and domestic demand for water is high, the North experiences serious water scarcity.[4] The consequences are drying rivers and lakes, groundwater depletion, desertification, and the disappearance of wetlands in the North of China.[5]

The other major problem, which this thesis elaborates upon, is water pollution. Pollution "consists of unwanted wastes or leftover materials that arise from the economic and social activities of mankind"[6] and is thus by definition a man-made problem. According to the Ministry of Water Resources (MWR) (2011), 19.3% of all water samples collected on 160,000km of river in 2009 were found to contain water that was unusable for irrigation, industrial uses, and human consumption even after treatment because the water was too polluted. The same was true for 14.0% of samples collected on 27,000km²

[1] UN Water (2010).
[2] Xie et al. (2009), xx, 10; UN Water (2010).
[3] AQUASTAT (2010a); The term "actual" in this context means that this amount of water is "observed in reality" (AQUASTAT, n.d., Glossary "water resources, actual") and is contrasted by the term "natural" (AQUASTAT, n.d., Glossary "water resources, natural"), which accounts for the theoretically available water resources under natural conditions without human influence.
[4] AQUASTAT (2010a); Xie et al. (2009), 9-11; The country is by definition divided into North and South by the Chang Jiang. The Chang Jiang basin belongs to the South and the region north of it is defined as the north of the country (Xie et al., 2009, 9; World Bank, 2001, 47).
[5] AQUASTAT (2010a); Gleick (2009), 86.
[6] Ross (1988), 131.

of lakes in the same year. [7] This poses health risks to the population if they eat crops that have been irrigated with polluted water or drink contaminated water, and entails severe consequences for the environment.[8]

This description shows the seriousness of the problem at hand. These problems affect a resource that is vital for the environment and humanity, as it is a living space for fresh water species, drinking water and an essential resource in agriculture and industry. A World Bank study refers to the situation in China as an "emerging water crisis"[9] and reports that the economic costs of water scarcity and water pollution were estimated at 2.3% of the GDP in 2003. These costs do not comprise the costs of ecological destruction and the reduction of quality of life, which are impossible to estimate.[10] It thus becomes clear that solving the problem of water pollution and scarcity is urgent, which is reflected in the aim of the Chinese leadership to combat China's water problems. President Hu Jintao's 2007 report to the 17th National Congress of the Communist Party of China (CPC) argues for limiting water consumption and water pollution.[11] The Twelfth Five-Year Plan (2011-2015) also sets targets for more efficient water use, increased wastewater treatment, and a more secure supply of water. [12] A key target of the plan is to decrease water consumption per unit of value-added output in the industrial sector.[13] The water problems of the country have thus found their way into the considerations of the highest leadership in China.

The aim of the thesis is to explain why the Chinese government has not solved the problems of water scarcity and pollution. It shows that there are obstacles within government and administration which impede the sufficient provision of water resources and the obviation of water pollution. The thesis also illustrates that the Chinese government has made progress in the field of water governance. The analysis employs Public Goods Theory to explain the behavior of the actors involved and the impact of governmental decisions on water consumption and pollution. The structure of the thesis is based on the Institutional Analysis and Development (IAD) framework by Ostrom et al. (1994), who have also employed it in conjunction with Public Goods Theory. The theoretical framework is described in chapter 2.

The two problems of water scarcity and pollution are interconnected. Water pollution exacerbates the problem of water scarcity in that polluted water is unsuitable for many or even all uses. Moreover, water scarcity aggravates water pollution, because the

[7] The data is taken from Ministry of Water Resources (MWR) (2011a, 19f) and the interpretation of the date is retrieved from Xie et al. (2009, 14).
[8] Gleick (2009), 79, 81, 83; Ma et al. (2000), 3; Economy (2004), 4.
[9] Xie et al. (2009), xx.
[10] Xie et al. (2009), xxi.
[11] Gleick (2009), 88.
[12] Twelfth Five-Year Plan (2011), section 22, article 2; section 24; section 26, article 1.
[13] Xinhua (2011).

pollutants are diluted in a smaller volume of water,[14] leading to a higher concentration of pollutants. In addition, the problems are also caused by the same actors. The literature on the topic refers to three groups of actors causing water pollution, namely agricultural, industrial and domestic actors.[15] The same classification can be observed when analyzing the causes of water scarcity. Water consumers are also classified as agricultural, industrial or domestic appropriators.[16] These groups of actors have in common that they are major water consumers and polluters. Because the two problems are interconnected and are caused by the same groups of actors, it seems appropriate to deal with both problems at the same time.

As implied in the aim phrased above, the thesis only elaborates on water governance exercised by the Chinese government and does not touch upon water governance by private actors. This would be suggested by the broader definition of water governance as "the range of political, social, economic, and administrative systems that are in place to develop and manage water resources and the delivery of water services at different levels of society"[17] by Xie et al. (2009). The thesis, however, is limited to water governance by the Chinese government to reduce the scope of this work. The limitation seems reasonable, as chapter 3 shows that government intervention is essential for effective water governance based on Public Goods Theory and on the properties of water resources. Nevertheless, the reduction of scope also entails that solutions to the water crisis beyond the public sphere are largely disregarded, which does not imply that there are no such solutions in the private realm or that these solutions are not worthwhile studying.

The aim of the thesis implies that the problem is in principle at least improvable, if not solvable by a government in theory. At first glance, this hypothesis is plausible for water pollution, as the problem is by definition a man-made issue and can be solved with wastewater treatment. In the case of water scarcity, a government only has very limited opportunities to increase the supply of water and thus often is unable to simply increase the annual available water resources to at least 1000 m^3 per inhabitant. A government can, however, decrease water consumption and thus soothe water scarcity, which is interpreted as the condition when the demand for water cannot be fully satisfied. This argument is substantiated in chapter 4, which offers a detailed description of the conditions of water resources in China and the human actions which directly affect these conditions. It gives a first impression of which actions the government should prohibit or impede in order to improve the water situation.

[14] Ma et al. (2000), 6; Xie et al. (2009), 1, 11; AQUASTAT (2010a).
[15] Xie et al. (2009), 11; Ma et al.(2000), 2f; Ross (1988), 133-135.
[16] Ross (1988), 93f; Xie et al. (2009), 23, 26; Wouters et al. (2004), 251; Yang et al. (2005), 3f.
[17] Xie et al. (2009), 42.

The fifth chapter briefly introduces the government and administrative structure in the People's Republic and the political economy. This introduction is important, as the government in China is not to be regarded as one single actor, but as a heterogeneous group of different state actors. This background information is important to understand the framing of the debate around water resource management. It is the basis for the analysis of the government's water governance in the main part of the thesis in chapter 6. Based on the IAD framework, the main part of the thesis is divided into two parts. A government can influence the behavior of law addressees towards water through the issuance of rules, and the thesis accounts for two levels of rules. The chapter first concentrates on the highest level rules, constitutional-choice rules, which concern water governance. The second part elaborates on laws and regulations, which have to abide by the constitutional-choice rules and govern all water consumers and potential polluters in China. To answer the question of why the Chinese government has not solved the water problems and where progress has been made, the sixth chapter concentrates on the rules and their enforcement. The rules and the preferences of the actors concerned with water governance and consumption are assessed and analyzed with Public Goods Theory. The capacities of the governing actors are also taken into account.

This brief introduction shows that China faces challenges of water scarcity and pollution, which require effective water governance, as water is an essential resource in the natural environment and human development. This thesis analyzes the water management of the Chinese government concerning these two problems to find out why the problems have not been solved and which improvements have been made. As can be seen in the list of references used in this thesis, China's water problems have found immense attention in scientific circles. Ross (1988) and Smil (1993) are among the oldest scientific sources used to learn about water governance up to the 1980s and early 1990s. A very detailed and topical source of information is the World Bank study on water scarcity by Xie et al. (2009). Other scientific contributions used in the work concentrate on one particular Chinese law, such as Winalski (2009), or only partially concern themselves with water governance, such as the book by Ma et al. (2000) on environmental governance in China. What seems to be new about this paper is the consistent application of Public Goods Theory on water governance in a whole country. Ross (1988) and Xie et al. (2009) use vocabulary that stems from Public Goods Theory on some occasions but do not consistently apply the theory to the problem.[18] In Ostrom's et al. (1994) publication, several authors apply the IAD framework and Public Goods Theory on case studies, such as the study on groundwater systems in California by Blomquist.[19] This thesis, by contrast,

[18] For example Ross (1988, 100); Finger et al. (2006), 21-23.
[19] Found in Ostrom et al. (1994): Blomquist, William: Changing Rules, Changing Games: Evidence from Groundwater Systems in California. 283-300.

employs Public Goods Theory and the IAD framework in an analysis of a problem of national scope, which necessitates some changes in the framework. The approach of the thesis to apply Public Goods Theory to water governance in China seems highly valuable because it makes a systematic assessment and analysis of water governance possible, which is needed to understand the problems remaining in water governance as well as the effective solutions. Public Goods Theory thus helps to answer the two questions of this thesis in a systematic manner and can even be used by policy makers to assess their governance decisions.

2. The theoretical framework

2.1. The Public Goods Theory

The Theory of Public Goods is the most fundamental theory of this thesis. It can help to understand the problems of water scarcity and water pollution in China and offers useful vocabulary to capture the problems in a systematic way.

Table 1: Four types of goods

		Excludability	
		Easy	Difficult
Rivalry in consumption	Rival	Private good • Food	Common-pool resource • Sea fish
	Non-rival	Club good • Concert	Public good • Lighthouse

Source: see Kölliker (2006), 203; Ostrom (1994), 7; Table created by the author.

The theory defines a good by its two attributes excludability and rivalry in consumption. The attribute excludability indicates, whether actors can be excluded from consuming a good by physically and economically feasible means. This attribute can be dichotomized as it is either easy or difficult to exclude outsiders.[20] For example, it is easy to exclude people from a piece of land by building a fence and it is difficult to exclude actors from using the atmosphere for breathing. The second attribute of goods is rivalry in consumption, which means that the consumption of the good by one user reduces the benefits another user can obtain from the good. One can distinguish between rival and non-rival consumption. For instance, food is a good that is rival in consumption, since it is used up through consumption. By contrast, a concert or a bridge is non-rival in consumption, because the benefits of these goods do not decrease by using them.[21] The combinations of these two attributes result in four types of goods, which are visualized in Table 1. Table 1 also shows one obvious example for each type of good.

These types of goods should be regarded as ideal types because in reality many goods cannot be clearly related to one type of good.[22] A concert, for example, can be regarded as a club good because it is easy to exclude a person from enjoying it and because it is not used up by someone listening to it. The consumption might be rival, however, if the number of seats is limited and visitors become rivals over the available

[20] Kölliker (2006), 202; Ostrom et al. (1994), 6.
[21] Kölliker (2006), 202f; Ostrom et al. (1994), 6.
[22] Kölliker (2006), 203.

seats. Moreover, the classification of a good as one ideal type of good is variable because the classification is not only given by nature but also influenced by political decision-making and technological progress. Government can decide whether to make a good a public or a private one. For example, the atmosphere is by nature a common-pool resource because it is difficult to exclude anybody from using it. However, the European Union now regulates the usage of the atmosphere for the emission of greenhouse gases and issues emission certificates.[23] It may be very difficult to exclude non-contributors from a good due to several reasons. First of all, the physical nature of the good might impede exclusion, which becomes obvious when comparing the atmosphere with a piece of land. Secondly, the benefits from exclusion might be lower than the costs of exclusion, which would be an economic reason not to exclude actors from a good. Thirdly, there might be ethical reasons, which might have expanded into a Constitution, that prohibit the exclusion of beneficiaries.[24] For instance, a Constitution might grant every citizen the right to clean drinking water, as it is unethical to exclude anybody from this good. Consequently, it might be possible to exclude others from a good and thereby convert it to a private good, but as this is often hindered or even prohibited by these three reasons, it is legitimate to distinguish between goods with high and low excludability.

This kept in mind, it can be useful to relate a real good to an ideal type good because the theory allows making assumptions about the production and availability of each type of good. To explain this, it is important to understand the concept of externalities or external effects. Externalities are the impact of a good on actors that have not participated in its production. These externalities can be positive or negative. Positive externalities arise if the excludability of a good is low, as in the case of collective-pool resources and public goods.[25] Positive externalities are benefits actors enjoy that have not participated in production and hence have not shared the cost of production. Consequently, the producer of a good with positive externalities is not the sole beneficiary of the good, but outsiders can also avail themselves of its positive external effects. [26] For instance, navigators benefit from the existence of a lighthouse but do not bear the costs of its construction and operation. The builder of the lighthouse bears the full cost because the positive externalities of the lighthouse can be used free of charge. Negative externalities, on the other hand, are costs that not the producer, but outsiders pay for. In other words, negative external effects occur if a producer of a good shares the costs with uninvolved actors who do not benefit from the good. One example of a negative

[23] Rittberger et al. (2010), 345.
[24] Ostrom et al. (1994), 7f.
[25] Kölliker (2006), 203f.
[26] Rittberger et al. (2010), 345f.

externality is the emission of pollutants into the atmosphere by industrial facilities.[27] The industrial enterprise produces a good and draws profit by selling the good on the market, but it passes on part of the production costs - polluted air - to people that live close to the factory and do not benefit from the goods the enterprise produces. While positive externalities can be linked to non-excludable public goods and collective-pool resources[28], negative externalities can be generated by each of the four types of goods but are often associated with "private activities"[29].[30]

These externalities influence the availability of goods on markets with rational market actors. Based on their individual equation of costs and benefits, a rational actor has strong incentives to use a good with positive externalities without paying for or producing them. This behavior is called free-riding. In a market, this individually rational behavior results in an undersupply of goods with positive externalities, hence public goods and common-pool resources. Negative externalities, by contrast, lead to an oversupply of the good that causes them because the producer of the good can pass the production costs on to uninvolved actors and thus increases his profits. Hence, the producer has strong incentives to produce more such goods and consequently more negative externalities. For this reason, both types of externalities result in an inefficient allocation of resources on a market with rational actors.[31]

Common-pool resources are the type of good with the most extensive provision problems, as they have positive externalities due to their low excludability and they are rival in consumption. Kölliker (2006) states that the vaster positive externalities and the more rival a good, the less rational non-contributors want to be included in the production of a good. Consequently, from the four types of goods, rational actors have least interest in participating in the production of collective-pool resources. It is in the producer's interest, however, to include free riders into the production of a good, even more so if the consumption is rival. Therefore, common-pool resources show the highest "divergence of interests between the ins and outs"[32] of all types of goods.[33] This is the reason why common-pool resource "dilemmas" [34] arise. Such a dilemma is characterized by suboptimal outcomes from the group's perspective, which is caused by individually rational behavior of the group members, and at least one alternative, realistic strategy, which would lead to more efficient outcomes than the strategy that has lead to the

[27] Rittberger et al. (2010), 346.
[28] Kölliker (2006), 203f.
[29] Rittberger et al. (2010), 346.
[30] Rittberger et al. (2010), 346.
[31] Rittberger et al. (2010), 346;
[32] Kölliker (2006), 227.
[33] Kölliker (2006), 225-227.
[34] Ostrom et al. (1994), 15.

suboptimal outcome.[35] The suboptimal outcome in the case of common-pool resources is logically the overuse of the resource because demand exceeds supply due to the positive external effects and the rivalry in consumption of the good.

A strategy to solve such a dilemma concerns the regulation of demand or supply of the resource.[36] As there is expected to be a shortage of common-pool resources, the dilemma could be solved by limiting the demand or by increasing the supply of the resource. According to Ostrom (1994), there are two types of strategies. The first type of the two strategies is developed by the appropriators of the resource themselves, by communicating with each other and agreeing on a strategy to reach a more optimal outcome. The strategy does not affect the structure of the action situation (see chapter 2.2) but is a way to solve the dilemma within a given structure. The second type of strategy is to change the structure of the situation itself by changing the rules. These rules of the strategy should modify the incentives of the actors involved in the dilemma to achieve a better outcome. This second type of coordinated strategy solves the problem on a higher level. The legislation of a national government with the goal of overcoming the dilemma also belongs to this second type of coordinated strategy. In reality, both strategies are often implemented at the same time.[37]

This thesis primarily addresses the second strategy. The reason why states have been regarded as the proper solution to the undersupply of public goods and common-pool resources[38] is explained in the following. To produce a good with positive external effects efficiently, its externalities have to be internalized. This means that free riders have to be excluded from the positive externalities and that the group that produces the good has to include all consumers of the good. When all externalities have been internalized, the actors within the group have incentives to produce the good because the possibility to free ride is eliminated and the producers of the good are compensated for the costs of production. The demand to internalize externalities can come from actors who produce goods with positive externalities and are not compensated properly.[39] One may also assume that this pressure builds up among actors that suffer from the insufficient supply of goods with positive externalities, which results from the missing incentives to produce the good. Kölliker (2006) differentiates between territorial and sectoral externalities, with territorial externalities affecting actors in other jurisdictions[40] and sectoral externalities

[35] Ostrom et al. (1994), 15f.
[36] Ostrom et al. (1994), 16.
[37] Ostrom et al. (1994), 16-18, 46f.
[38] Rittberger et al. (2010), 347.
[39] Kölliker (2006), 208.
[40] Kölliker (2006) uses the term territorial externalities to describe externalities that cross national borders. The internalization of such transnational externalities would require international cooperation (Kölliker, 2006, 210f). This thesis, however, concentrates on jurisdictions within nation

affecting actors in other sectors of society. If a good has sectoral externalities, the involvement of the state in the production of the good is more likely[41] because a large part of society is affected by the good and the issue thus becomes a public concern. If a good does not have sectoral externalities, only one decisive part of society is affected, which makes a private arrangement to internalize the externalities more likely.[42] Territorial externalities influence the geographical scope of an effective arrangement for the production of a good. If the externalities are limited to one jurisdiction, the dilemma can be solved on the local level. In the case of externalities that cross the border of the jurisdiction, however, the central government might be pressured to step in, or there has to be an arrangement across the affected jurisdictions to overcome the dilemma effectively.[43] These two types of externalities and the consideration, that internalization of all positive externalities lead to the effective production of the goods, add up to four feasible arrangements for effective good production, which are visualized in Table 2.

Table 2: Territorial and sectoral externalities

		Territorial externalities	
		Strong	Weak
Sectoral externalities	Strong	Central state; public arrangement among affected jurisdictions	Public arrangement within affected jurisdiction
	Weak	Private arrangement among affected jurisdictions	Private arrangement within affected jurisdiction

Source: see Kölliker (2006, 211); Table created by the author.

Besides the necessity to internalize all externalities for the efficient production of a good, it is important to overcome collective action problems within a group that aims at producing a good. Collective action problems arise when positive externalities create incentives for actors within the group to free-ride and not to contribute sufficiently to goods

states, as it is confined to the Chinese nation state and does not discuss the water crisis on the international level.

[41] Kölliker (2006), 209f.

[42] Kölliker (2006), 210f.

[43] Kölliker (2006), 210f; Kölliker (2006) differentiates between the national and the international level and does not touch upon jurisdictions within a nation state. This thesis, by contrast, deals only with borders within the nation state. Kölliker's (2006) ideas about territorial externalities are translated to the level of the nation state by equating national borders with jurisdictional borders. Consequently, Kölliker (2006) oversees territorial externalities if more than one state is affected, and this thesis observes territorial externalities if more than one jurisdiction within a state is affected. One major difference between the internalization of territorial externalities within and beyond a nation state is that within a nation state a central government can step in. Beyond the nation state there is no superior actor with coercive power over the nation state, with the exception of the EU. It should thus be noted that Kölliker's ideas on territorial externalities have been adapted to the requirements of this thesis in this regard.

production. The consequence is an undersupply of goods with positive externalities. Common-pool resources and public goods are especially prone to be affected by collective action problems because of their low excludability and positive externalities. This problem becomes even worse if the good is characterized by rivalry in consumption. Hence, collective action problems can especially be associated with common-pool resources, as their excludability is low and they are rival in consumption.[44]

Turning to the question of how to overcome such collective action problems, public arrangements seem to be more effective in this regard because of the coercive power of the state. Private arrangements lack the authority of the states and therefore face difficulties in solving collective action problems. Using its authority, a state can obligate free riders to share the costs of production. Consequently, the involvement of the public arrangement is likely when collective action problems arise, and since these plausibly come about with public goods and especially with collective-pool resources, these two types of goods are likely to be provided by the state or with public assistance.[45] These two conditions - internalization of externalities and the elimination of collective action problems - shed light on how the four types are most likely to be provided. It becomes obvious that the state plays a major role in providing common-pool resources, especially those with sectoral externalities. The central government's involvement, however, is not to be regarded as the magic bullet in the struggle against common-pool resource dilemmas because it is possible that a central government may not be interested in adjusting the rules or that it lacks the capacity of enforcing and monitoring the rules.[46]

One can differentiate between two fundamentally different ways of providing goods with positive externalities. The producer of these goods is likely to be the state, as explained above. The first way to provide a good is to directly produce a tangible good. This method is often used to produce public goods like lighthouses and public schools. As this production method implies the distribution of goods and there is the potential to benefit from economies of scale, this production method is likely to be centralized. The second way a good can be provided is regulation. The good is subsequently provided when the addressees abide by the rules. The producer can advance the private production of such goods, which includes that the state can create incentives for private actors to produce the good and sanction free-riders.[47] In the former case, the provider of the good reduces the costs of producing the good with positive externalities, which makes it profitable for private actors to produce the good. An example is public subsidies for the construction of low-energy houses, which help providing the good of climate protection.

[44] Kölliker (2006), 212f; Rittberger et al. (2010), 357f.
[45] Kölliker (2006), 212f, 216; Rittberger et al. (2010), 347.
[46] Ostrom et al. (1994), 18.
[47] Kölliker (2006), 219; Rittberger et al. (2010), 347.

Sanctioning free-riders on the other hand assigns costs to free-riding, which makes free-riding less attractive. Consequently, potential free-riders are forced to share the costs of production, which makes the adequate provision of a good with positive externalities more likely. For instance, states sue citizens that refrain from paying taxes, which means that they benefit from the state's provision of publicly used goods and do not share the costs. This second method by definition means that the production of the good is highly decentralized, as the addressees of the regulation produce the good. However, they have incentives not to abide by the rules in the case of goods with positive externalities. As a result, it is highly important, that the provision of goods by regulation is closely monitored because the rules are not self-enforcing.[48]

This chapter introduces Public Goods Theory, which sheds light on the difficulty of providing public goods and common-pool resources and how they can be provided most efficiently. It becomes obvious that the state plays a major role in providing these goods.

2.2. The IAD framework

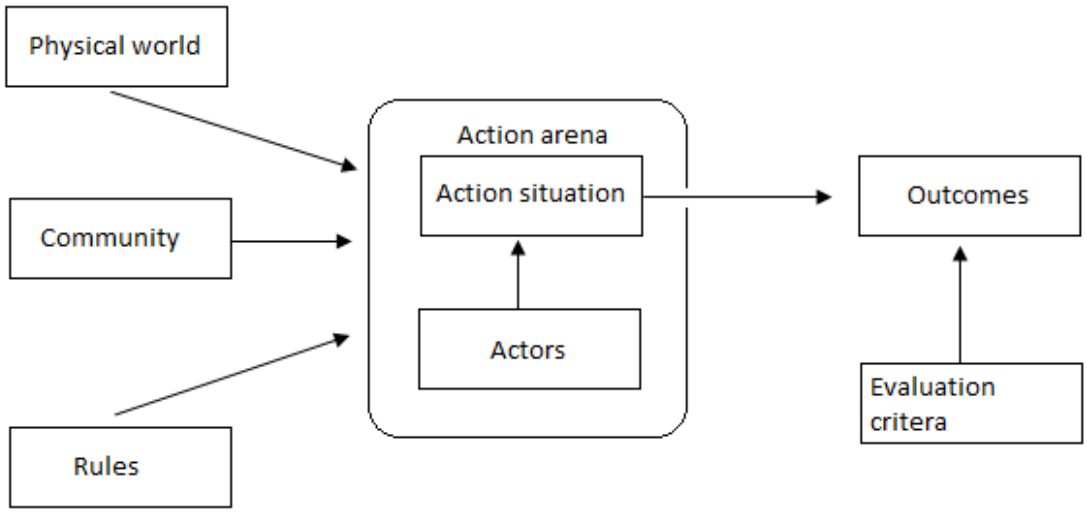
The Institutional Analysis and Development (IAD) framework was developed by Ostrom et al. (1994) and is a useful tool to organize this thesis and to properly reflect on the situation of Chinese water problems. In this thesis, a modified version of the IAD framework will be used, which is necessitated by the application of the framework to a nation-wide problem, which was originally designed for problems with smaller or local scope. Ostrom et al. (1994) mention the possibility of using the framework together with Public Goods Theory.[49]

The framework is visualized in Figure 1 and is described in the following paragraphs. At first, the IAD framework calls for identifying so called "action arenas"[50], which then serve the researcher as focus of the analysis. An action arena comprises "an *action situation* component and an *actor* component".[51] The actor component is observed first. In order to understand how the actors in an action arena behave, it is necessary to take a closer look at their preferences and their capacities.[52] The preferences of actors mark what actors *would like to* do. As this thesis employs Public Goods Theory, the assumptions on the actor's preferences rest on this theory as well. The thesis presumes that the actors behave rationally and try to maximize their utility. Their utility depends on

[48] Kölliker (2006), 219, 221-224.
[49] Ostrom et al. (1994), 25.
[50] Ostrom et al. (1994), 28.
[51] Ostrom et al. (1994), 28 (original emphasis).
[52] Ostrom et al. (1994), 33; Ostrom et al. (1994, 29) differentiate between the actors preferences, information, selection criteria and resources. It is assumed that an actor's preferences are based on the information available to them and on the criteria they use to make decisions. Thus, the first three aspects are combined. While Ostrom et al. (1994) call the forth aspect resources, this thesis uses the more encompassing term "capacity" instead, which is defined above.

the calculation of economic costs and benefits[53] and is influenced by environmental education. If actors develop a sense of environmental awareness due to environmental education, it decreases their utility from actions that are environmentally destructive. This is a broader understanding of Ahlheim's (2009) deliberation on the influence of environmental education on water consumption: An actor's utility from water consumption increases with every additional cubic meter of water without environmental education. Through environmental education the actor learns about the problem of water scarcity and the negative consequences of his own water consumption. This awareness decreases his utility of additional water consumption, diminishes his incentives to consume more water, and thus reduces the actor's water consumption.[54] An actor's capacity indicates what actors *are able to* do and it limits or enables the actors in following their preferences. Important resources are budgetary capacities, time[55] and know-how. In case the relevant actor is an administrative unit, the number of personnel is also an important variable.

Figure 1: Framework for institutional analysis



Source: created by the author based on figure by Ostrom et al. (1994, 37).

These two aspects of actors – preferences and capacities – allow for an adequate understanding of the actor's behavior. Regarding the actor component, there is an important modification of Ostrom's et al. (1994) framework. Ostrom et al. (1994) look at "individual"[56] preferences and capacities of actors, and this thesis mostly elaborates on groups of similar individuals or units. For instance, not one particular provincial government is described, but the assumptions are mainly related to all provincial

[53] Rittberger et al. (2010), 345.
[54] Ahlheim (2009), 9f.
[55] Ostrom et al. (1994), 35.
[56] Ostrom et al. (1994), 33-35.

governments. The reason is that the thesis does not focus on a particular local water dilemma but aims at explaining the water dilemma on the national level. The thesis does employ several case studies with individual actors, but the main focus is the national level.

The second component of an action arena is the action situation, which is defined as "the social space where [actors] interact, exchange goods and services, engage in appropriation and provision activities, solve problems, or fight"[57]. It is important to understand which actions actors can undertake in an action situation and what costs and benefits are tied to these possible actions.[58] The interactions that take place in an action situation can be understood by making assumptions about the preferences and capacities of the participants.[59]

These interactions in the action situation finally lead to an outcome, in the case of this thesis an effect on the water dilemma in China. These outcomes are evaluated with the criteria of fairness[60], environmental friendliness and sustainability of water consumption, as defined below. In the context of Public Goods Theory, fairness is interpreted as a goal, which is achieved when all externalities on other actors are internalized. In other words, an actor is treated unfairly if he is affected by negative externalities, which implies that the actor shares the costs, but not the benefits of a good. An actor is also treated unfairly if a rival and non-excluded good is used up by other actors and is thus deprived of this good. For environmental friendliness there seems to be two conditions in Public Goods Theory: The first condition is that the environment is not affected by negative externalities from an actor's good production. One negative externality on the environment is, for example, the untreated discharge of wastewater from a factory into a river. The second condition is that the natural resources are not subject to overuse, which can be guaranteed if the positive externalities are internalized and by a limit to the overall consumption of the resource to a harmless amount. The third evaluation criterion is sustainability, which is narrowly defined as the physical possibility of maintaining the consumption of a certain volume of water over a long period of time. Water consumption is not sustainable if the withdrawal rate exceeds the recharge rate of the water body. From this description it is obvious that this last criterion of sustainability is only applied to the quantity and not the quality of water and has no bearing on

[57] Ostrom et al. (1994), 28; Ostrom et al. (1994, 28f) actually differentiate between actors and participants, with participants being actors that participate in a particular action situation. Thus, Ostrom would use the term participants instead of the term actors in this quote. The differentiation is, however, not used in this thesis in order to simplify the framework and to adapt it to the national level.
[58] Ostrom et al. (1994), 29-32.
[59] Ostrom et al. (1994), 35f; Ostrom et al. (1994, 37, figure 2.2) split the action situation from the interaction of the participants. This thesis, by contrast, subsumes these components under the term action situation, as it seems more practicable not to split these tightly connected aspects and does not impede the observation.
[60] Ostrom et al. (1994), 36.

environmental considerations, although the term sustainability is often used in an environmental context. These are the three criteria outcomes of water appropriation are evaluated with.

Moreover, three factors influence the action arena, namely the physical world, the community and rules. The factor physical world implies what actions are physically possible and what properties the good in question has.[61] In this thesis, the discussion of this factor is divided into two separate chapters. The first one interprets water as a common-pool resource and thus elaborates on the physical attributes of water and the consequences these attributes entail. The second one describes the condition of water resources in China and the outcomes that directly lead to this condition. Ostrom et al. (1994) mention that the physical attributes might be more or less important in different cases. In the case of water governance, physical attributes are essential, as the degraded state of water resources necessitate governance in the first place, and governance aims on alternating the physical attributes of water resources. The second factor besides the physical attributes and rules is called community and is introduced in the following way:

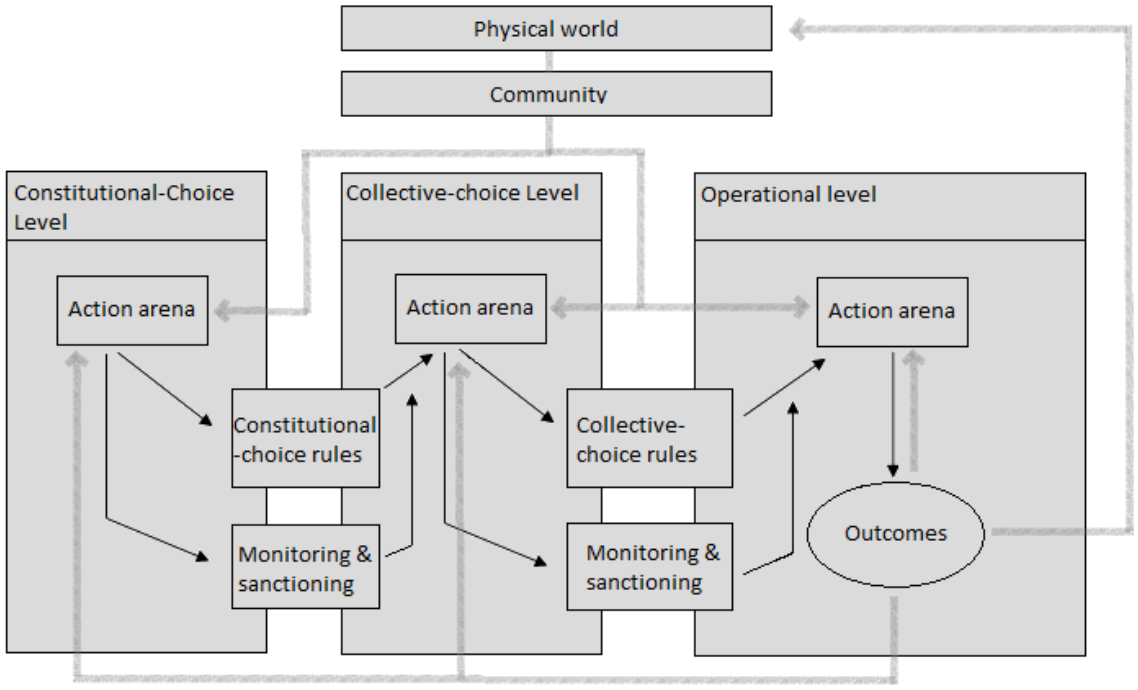
> "The attributes of a community that are important in affecting the structure of an action arena include generally accepted norms of behavior, the level of common understanding about action arenas, the extent to which preferences are homogeneous, and distribution of resources among members. The term culture is frequently applied to this bundle of attributes."[62]

As the thesis elaborates on the nationwide water dilemma in China and focuses on decision-making within the national government, the chapter on the community concentrates on the government and administrational structure, the one-party-rule of the CPC, and the shift from a planned economy to a market economy. The third and the most important factor for this thesis are the rules that affect an action arena. Ostrom et al. (1994) define rules as "prescriptions that define what actions (or outcomes) are *required*, *prohibited*, or *permitted*, and the sanctions authorized if the rules are not followed"[63]. In this context, chapter 2.1 introduces the possibility of solving common-pool resource dilemmas with two strategies. While the first strategy describes the resolution of the dilemma by the appropriators without changing the rules, the second strategy means that the rules of the action situation are changed.[64] This implies that rules in this framework can be regarded as an instrument to solve common-pool resource problems, rather than only a factor affecting the action arena. The rule factor is the focus of this thesis and is the part of the framework that describes the influence of the government on water resources.

[61] Ostrom et al. (1994), 44f.
[62] Ostrom et al. (1994), 45.
[63] Ostrom et al. (1994), 38 (original emphasis).
[64] Ostrom et al. (1994), 47.

In the following, the rule factor is analyzed in more detail. The resolution of a dilemma by changing the rules that apply to an action arena indicates a shift to a higher level. Ostrom et al. (1994) introduce three levels of analysis, namely the constitutional-choice level, the collective-choice level and the operational level. The three levels are shown in Figure 2. On every level there can be one or more action arenas with action situations and actors. The outcomes of the action arena on the highest level, the constitutional-choice level, are constitutional-choice rules. These rules define the scope of decision-making on the collective choice level and who is entitled to make these decisions. Constitutional-choice rules thus affect the collective-choice level and the operational level. The collective-choice rules are drafted on the collective-choice level. They define what is legal or illegal on the operational level and must respect the constitutional-choice rules. The operational level is where commonplace decisions are made.[65]

Figure 2: Three levels of analysis



Source: see figure by Ostrom et al. (1994, 47); Figure created by the author.

Ostrom et al. (1994) mention that the action arenas are not necessarily formal institutions.[66] However, as this thesis intends to analyze the impact of state institutions on water pollution and scarcity in China and to show that the dilemma also has institutional reasons, the action arenas on the constitutional-choice and collective-choice level are interpreted as formal government institutions. The three levels of action arenas in the IAD framework in a way correspond to Kölliker's (2006) idea that goods can be either provided

[65] Ostrom et al. (1994), 46f.
[66] Ostrom et al. (1994), 46.

by producing a "tangible"[67] good directly or by creating rules which ensure that a good is produced indirectly though the compliance of citizens with the rules,[68] as mentioned in chapter 2.1. The first way of producing goods belongs to the operational level. In the second approach, the government creates rules on the constitutional-choice and collective-choice level in order for a good to be produced on the operational level.

Figure 2 shows that the actors on the two highest levels do not only make rules, but also have to ensure that the actors on the lower levels follow the rules because rules are not self-enforcing.[69] And as described in the last chapter, breaking the rules is highly tempting if the rules aim on solving a common-pool resource dilemma. Enforcing rules involves monitoring the compliance of the rules addressees with the rules and sanctioning those actors that fail to adhere by the rules. These activities entail costs that are not to be neglected. Costs arise, for example, when officials have to carry out inspections and follow up on cases where actors have not followed the rules.[70]

The action situations on the operational level produce outcomes that directly affect water scarcity or pollution in China. Examples for such outcomes are that an industrial company discharges waste water into a river or a farmer uses water saving irrigation methods. These outcomes change the physical world, for instance, as the industrial company exacerbates the water pollution and the farmer contributes to solving the problem of water scarcity. The action arenas on all three levels are also affected by the outcomes on the operational level, as the actors can react to the outcomes and alter their behavior. For example, the above mentioned industrial company can decide to treat its wastewater before discharging it after seeing the polluted river.[71] On the collective-choice or even the constitutional-choice level the government can react to the water pollution by amending the rules to better prohibit negative outcomes like this. Finally, the physical world and the community affect the actions arenas of all three levels. Ostrom et al. (1994) only establish a connection between the physical world and the community on the one hand and the action arena on the operational level on the other hand.[72] It seems to be logical, however, that these factors have an impact on the collective-choice level and the constitutional-choice level as well. For example, if the water quality deteriorates, the government can react to this condition in the physical world by drafting rules to improve the situation. And as the thesis interprets the nature of the state as the factor community, it is obvious that the community factor affects the constitutional-choice and collective-

[67] Kölliker (2006), 219.
[68] Kölliker (2006), 219.
[69] Ostrom et al. (1994), 40, 48.
[70] Ostrom et al. (1994), 40, 48; Ahlheim (2009), 8.
[71] Ostrom et al. (1994), 48; Ostrom et al. (1994) also show in their figure that the outcomes also influence the community factor, but this connection is not observed in the context of Chinese water governance.
[72] Ostrom et al. (1994), 47 (figure 2.3).

choice level, as government institutions act on these two levels of the framework. For example, the People's Republic and the CPC have a history of planned economy. Therefore the government prefers to employ command and control methods instead of market mechanism to govern the country.[73] This is an example of how the community factor impacts on the two higher levels of the framework.

To avoid confusion, it should be noted that state actors do not necessarily act on the constitutional-choice and collective-choice level. In principle, an actor is not tied to one level, but his behavior is tied to one level. If a government actor engages in rule making to govern water resources, this action takes place either on the constitutional-choice or the collective choice level. However, a government actor can also decide to use water saving facilities or to carry out large infrastructure projects. These actions take place on the operational level. Chapter 6.3 examines and analyzes such government involvement on the operational level in the example of the South-North Water Transfer Project.

2.3. Outline of the thesis

This chapter explains the outline of the main part of the thesis based on the theoretical framework introduced in the two previous chapters. Fundamental for the structure of the thesis is the IAD framework.

The next chapter identifies water resources as a common-pool resource. Based on public goods theory, theoretical assumptions are made on the behavior of actors who appropriate water resources. Moreover, the chapter derives from public goods theory why the Chinese central government is an appropriate force for solving Chinese water problems.

The next two chapters – chapter 4 and 5 – elaborate on the two factors community and physical world, which influence the action arenas around water on all of the three levels. In the context of this thesis, the factor of the physical world focuses on the recent development and current situation of the Chinese water resources. It offers a detailed description of the problems in this field and the direct natural and anthropogenic causes. Since the water situation in China influences the action arenas on all levels and urges policy-makers and the rule addressees to respond to the problems, it is important to fully understand the problems at hand from the beginning. The chapter about the community factor briefly introduces the characteristics of the Chinese government and political economy and the tremendous changes these aspects of the Chinese state have experienced since 1978. These aspects define the scope of policy-making in China and are thus important to understand the rules concerning water.

[73] Ross (1988), 20.

The sixth chapter is the main part of this thesis and addresses the factor rules. It analyzes the impact of the Chinese government on water scarcity and pollution to answer the question of why the Chinese government has not solved these problems. It also identifies aspects where the government has made progress. To do so, the constitutional-choice level with its governmental actors and rules is analyzed. This chapter mainly discusses whether the actors involved are committed to improve the water dilemma, or in other words, if water governance is of inferior importance to other preferences. Secondly, the collective-choice level and the impact of the collective-choice rules on the operational level are described. To show how the rules can affect water usage in theory, the rules are explained with the vocabulary of Public Goods Theory. It explains and assesses the laws and regulations on water and sheds light on the enforcement of the laws.

3. Water as a common-pool resource

This chapter argues that water can be regarded as a common-pool resource and that the properties of water suggest that the government should provide this good. This chapter draws upon the explanations on public goods theory in chapter 2.1.

As described in chapter 2.1, water can be defined as a common-pool resource if it is difficult to exclude non-contributors and if the consumption of the good is rival. Water is indeed characterized by low excludability because at first it is physically complicated to hinder people from using water in rivers, lakes and groundwater aquifers[74]. The costs of prohibiting people to use water are high and the value of water is relatively low, which inhibits such measures. Secondly and most importantly, the access to clean drinking water is a human right,[75] and it is unethical to prohibit anyone from consuming water. Besides for drinking and sanitation, water is an essential resource for irrigation and livestock breeding and for industrial production, and depriving these actors from using water would restrain them from pursuing their profession.

The term non-contributor, however, needs further clarification in the context of water because water is a good provided by nature. This makes everybody a non-contributor under natural conditions. However, the provision of fresh water also includes the treatment of wastewater, the obviation of discharging wastewater into fresh water sources and the limitation of water consumption to a level where steady water supply can be ensured. Through desalinization, actors can actually produce fresh water themselves and thus add to the supply of fresh water. Another possibility to locally increase the water supply, which is very prominent in China, is the transfer of water from one region to another. In China, the government plans to transfer water from the water abundant South to the water scarce North.[76] Hence, there are provision activities to be conducted besides the natural provision of fresh water and consequently there are contributors and non-contributors.

Water is by nature a good, which is characterized by rivalry in consumption, as the water usage by one actor decreases the utility other actors can gain from this source of water. This applies to the consumption of water, as it reduces the volume of water, and to the use of water to dilute wastes. If an actor uses a water source to dilute wastes, the polluted water cannot be used by other water appropriators, unless they bear the costs for treating the water beforehand. This shows that water is a rival good. In combination with

[74] It might seem easy to prohibit people from using groundwater because it is underground and one needs to drill a well. However, in China people drilled wells illegally and it was difficult for the government to deter them from doing so (Ross, 1988, 105).
[75] UN News Centre (2010).
[76] Yang et al. (2005).

the low excludability of water, water can be interpreted as a common-pool resource. As mentioned in chapter 2.1, the classification of a good is not only given by nature, but also defined by politics. A government can theoretically decide to exclude actors from a good, although it is difficult or costly to exclude them. Those government decisions are accounted for in chapter 6.

The positive external effects of the common-pool resource water lead to an overexploitation of water resources in a group of rational actors. This potential outcome of overused water resources is deduced from a model action situation. Assuming that rational actors try to maximize their utility and their utility increases with every additional liter of water consumed[77] and the costs of consuming more water is zero,[78] water consumers have an incentive to use more water. At the same time, they lack incentives to use water efficiently. The actors in this model thus have the preference of high water consumption. As water is a limited resource and water consumption is rival, water resources can be depleted by excessive water withdrawals. In this action situation, water resources would thus be overexploited. If water appropriators consume so much water that it impinges on the water demand of other actors, this can be interpreted as a negative external effect of excessive water consumption and the private activity causing this. Ross (1988) also describes this phenomenon when analyzing water governance in China:

> "[…] [T]he common property phenomenon […] gives upstream users an incentive to use as much water as they can to preclude downstream users from increasing their own consumption, thus creating a de facto right of first use […]. […] Each property owner has the right to pump water through wells drilled on his own property regardless of the consequences for his neighbor. Thus a common property resource regime perversely leads to overconsumption […]."[79]

Moreover, an actor can use a water source to dispose of its wastewater. This can be interpreted in two ways: First, one can interpret it as the use of fresh water to dilute wastewater, or secondly, one can interpret it as a negative external effect of an actor's activities. In the latter case, an actor produces private goods, sells these goods on a market, claims the benefits, and shares the costs of production with the environment and other water appropriators downstream, who suffer from polluted water. A rational actor would drain the incidental wastewater into a water body if the costs of this behavior were lower than the costs of wastewater treatment. Wastewater treatment always entails some costs, as it requires the installation and operation of treatment facilities.[80] If the disposal of

[77] Ahlheim (2009), 9; This assumption of the causality of utility and water consumption applies to rational actors with weak environmental awareness (Ahlheim, 2009, 10).
[78] In this model, water is accessible for every actor and is free of charge. Other costs associated with water consumption could be costs to transport water to the site of consumption, as an irrigated field or an industrial company. These costs are neglected in this model for the reason of simplicity.
[79] Ross (1988), 100.
[80] The costs related to wastewater treatment are mentioned by Xie et al. (2009, 38f) and Ross (1988, 162), for example.

wastewater is free of charge, then rational actors will decide not to treat their wastewater.[81] Wastewater treatment can be interpreted as the provision of a good with positive externalities or as the internalization of negative externalities.

These explanations show that water would be overexploited and polluted, if water was supplied to everybody at zero costs as a common-pool resource. The probability of overexploitation or depletion of water resources logically rises with the number of actors per available cubic meter of fresh water. This outcome is not favorable when evaluated with the three evaluation criteria described in chapter 2.2. At first, the outcome of this model is unfair to the actors involved because water consumers are affected by the negative externalities of water pollution. It is also unfair if some actor's demand for water cannot be satisfied due to the high water consumption of other actors. The implicit "first come, first serve" rule[82] in this model thus can result in unfairness. This can also be interpreted as a negative external effect of private water consumption. Secondly, it is not environmentally friendly because water resources are affected by the negative externality of water pollution and the positive externalities of the resource are overused. The massive withdrawal of water might cause rivers, lakes and aquifers to dry up, which impedes their "ecological functions"[83]. Water pollution jeopardizes the living space of fresh water species and soil quality.[84] Thirdly, the excessive water consumption is not sustainable because it would logically also extend to non-renewable water sources like aquifers and lakes. Hence, the high water consumption, as predicted by the model with rational actors described above, cannot be maintained for long. The outcome of the model action situation is consequently unfavorable concerning all three evaluation criteria, which shows the necessity to coordinate and limit water consumption to a fair, sustainable and environmentally friendly amount and to obviate water pollution. The question which arises from this need for improvement is which actors are able to solve the problem. The following paragraphs show that the national government is an appropriate actor to solve the problems.

To provide water resources efficiently, all positive and negative externalities have to be internalized, [85] as discussed in chapter 2.1 on Public Goods Theory. If this

[81] This assumption does not take into account that water can be recycled after treatment, which means that it is reused by the actor who treated the wastewater (Xie et al., 2009, 40). If the costs of fresh water supply are higher than the treatment costs, it might be rational to treat and recycle wastewater. However, since water consumption does not cost anything if water is a common-pool resource, wastewater treatment is more expensive regardless of the possibility to recycle the wastewater.
[82] Ross (1988), 100.
[83] Xie et al. (2009), 17; Yang et al. (2005, 4) use the term "ecosystem water demand" instead. The idea is that water is also demanded by the ecosystem, not only by humans. The functions include the provision of living space for animals in lakes and rivers and the transport of silt by rivers. Another function is land conservation, for example (Yang, 2005, 4; Ross, 1988, 94).
[84] Xie et al. (2009), 14; Ma et al. (2000), 3.
[85] Kölliker (2006), 208f.

internalization is achieved, actors are incentivized to contribute to the good's production and to refrain from producing negative externalities. As the polluters would bear the costs of discharging wastewater, the actors have an incentive to clean the wastewater before discharge. If the positive externalities of fresh water are internalized, the appropriators account for the value of water and thus have an incentive to use water more sparingly. Which actor or group of actors is appropriate for this internalization depends on the scope of sectoral and territorial externalities,[86] as illustrated in chapter 2.1. Water has territorial and sectoral externalities: At first, fresh water is to be found in rivers, lakes, reservoirs and aquifers, none of which are necessarily within one jurisdiction. The Huang He (黄河, Yellow River), China's second longest river, for example, runs across nine Chinese provinces.[87] Even though many lakes in China lie within one province entirely, like the Dian Chi (滇池, Dian Lake) in Yunnan Province, the Tai Hu (太湖, Lake Tai) is an example for a lake which is shared by two provinces.[88] The Guanting reservoir (官厅水库) mostly lies in Hebei Province but was a major source of Beijing's surface water supply until 1997. Its catchment basin reaches across three provinces and Beijing.[89] These examples show that many water bodies do not lie within a single province, let alone within a single municipality or city. This means that water has territorial externalities across provinces because water withdrawal and water pollution does not only affect the province where these actions are undertaken, but all provinces that border the respective water body. Of course, some rivers cross the Chinese national border and thus have external effects of international scope. Two examples are Lancang Jiang (澜沧江, Mekong) and Yalun Zangbu (雅鲁藏布江, Brahmaputra), which rise on the Tibetan Plateau and then flow into Laos and India respectively.[90] The transnational externalities these stream courses entail should be managed through international cooperation according to Kölliker (2006).[91]

Water also has tremendous sectoral externalities because water is used by every member of society and is an important resource in agriculture and many industries. Water is essential in the domestic sector as drinking water and for sanitation. In agriculture, water is used for irrigation and for livestock breeding. And in industry, water is used for thermal power generation and manufacturing. Steel, paper, chemical and silk belong to the processing industries which use large volumes of water.[92] These sectors of society are thus swayed by the positive externalities of water resources and are compromised by

[86] Kölliker (2006), 209-211.
[87] Yellow River Conservancy Commission (YRCC) (n.d. c).
[88] World Bank (2001), 50.
[89] Nickum et al. (2007), 86.
[90] AQUASTAT (2010a).
[91] Kölliker (2006), 211.
[92] Finger et al. (2006), 23 - 26; Ross (1988), 93f; Yang et al. (2005), 2, 4.

negative external effects on water, like water pollution. Moreover, these sectors also produce negative external effects on water resources in form of water pollution. Because of these strong sectoral externalities, a public arrangement instead of a private one should govern water resources in order to internalize these externalities,[93] as can be deduced from chapter 2.1. This description shows that fresh water has sectoral and territorial externalities. According to Table 2, such a good should be governed by the central government or public governance arrangement composed of affected jurisdictions in order to internalize these externalities and provide the good effectively. An example for such an arrangement, which can be observed not only in China but also in several other countries, is river basin management systems. These management systems govern water according to their "natural boundaries"[94] instead of "administrative boundaries"[95] and thus internalize external effects of water. The central government and river basin level governance thus seem appropriate to internalize territorial externalities and both internalize sectoral externalities due to their publicness.

To govern water resources effectively, it is not only important to internalize the externalities, but also to solve group internal collective action problems. As described in chapter 2.1, collective action problems are most likely to arise if the good concerned is a common-pool resource like water. Its positive externalities allow for free-riding, which means that free-riders want to continue to use the good free of charge, and providers of the good want to share the provision costs. In solving this collective action problem, public actors have a decisive advantage over private actors: The state has the authority and the monopoly on the use of force to obligate the internalization of externalities (see p. 9). While private actors themselves do not have instruments of reliably enforcing an agreement on water appropriation on their own, a state actor can impose sanctions or even obtain the closure businesses. In solving collective action problems arising when governing water resources, public actors thus have an important advantage.

For this thesis the chapter is important in two ways: First, it shows what theoretically happens to water resources if they are not governed or if no rules affect the operational level action situation. Ostrom et al. (1994) mention that policies often fail because they lack a theoretical foundation[96] and this chapter offers the theoretical foundation to assess Chinese water policy. Secondly, the chapter shows why the government is responsible for solving the water crisis and thus underlines the legitimacy of analyzing the states policy-making, as it is done in the main part of the thesis.

[93] Kölliker (2006), 210f.
[94] Finger et al. (2006), 21.
[95] Finger et al. (2006), 21.
[96] Ostrom et al. (1994), 18.

That a public actor, who also internalizes territorial effects, manages water resources in a way that is environmental friendly, fair to all water appropriators, and sustainable, is not guaranteed. It is possible that public actors have no interest in managing the common-pool resource water or that the government is unable to implement its water management plan.[97] In fact, this thesis targets the imperfections and improvements of water resource management by public actors in China and their commitment to solving the problem.

[97] Ostrom et al. (1994), 18.

4. Water scarcity and pollution in China

This chapter describes the problems of water scarcity and pollution in the People's Republic and the ultimate causes of these problems. Regarding the IAD framework, this chapter serves as a description of the factor about the physical world, which influences the action arenas on all three levels, and the outcomes of action situations, which directly affect the physical world. The first subchapter deals with water scarcity and the second one with water pollution. When dealing with information concerning the water situation in China, it should be kept in mind that publishing data on water supply, consumption, and pollution is regulated by the government. Monitoring water resources requires the government's permission. Data ist only allowed to be published by the government itself or an authorized organization.[98] This means that the data, which is also used in this thesis to describe the water resource condition in China, can be taken as a reference point, but should not be taken at face value, because the government has an incentive to color the situation.[99]

4.1. Water scarcity

Water scarcity in the People's Republic is a problem brought on by natural conditions and aggravated by human behavior. China's annual internal renewable water resources measure approximately 2812 km³, which makes China the country with the fifth largest internal renewable water resources in the world. However, due to China's large population (1.34 billion in 2008), the total annual amount of actual renewable water resources per capita is only about 2111 m³, far below the global average of 6466 m³ as of 2008.[100] China thus faces a condition of generally low per capita water resources.

This condition is exacerbated by the highly uneven geographical distribution of water resources within the country, as water is plentiful in the South and scarce in the North. In 2008 the North only obtained 16.8% of the total annual water resources of the country.[101] While the annual per capita water resources were 3629 m³ in the South, the

[98] Gleick (2009), 97.
[99] Heilmann (2004, 177) also mentions the suspicion that data on environmental issues are colored by the government.
[100] AQUASTAT (2010a); AQUASTAT (2010b),1; According to AQUASTAT (n.d., Glossary "Water resources: total external renewable (actual)", "Water resources: total internal renewable"), the term "internal" labels water resources, which are generated within the country. On the contrary, external water resources are inflows of surface water or groundwater from other countries and a part of water resources in border rivers and lakes. Chinas dependency on external water resources is fairly low, as external water resources only account for 1% of the total. Internal and external renewable water resources add up to total renewable water resources of about 2 840 km³/ year.
[101] MWR (2010), part 1; This communiqué also divides China into north and south just north of the Chang Jiang basin (ibid.).

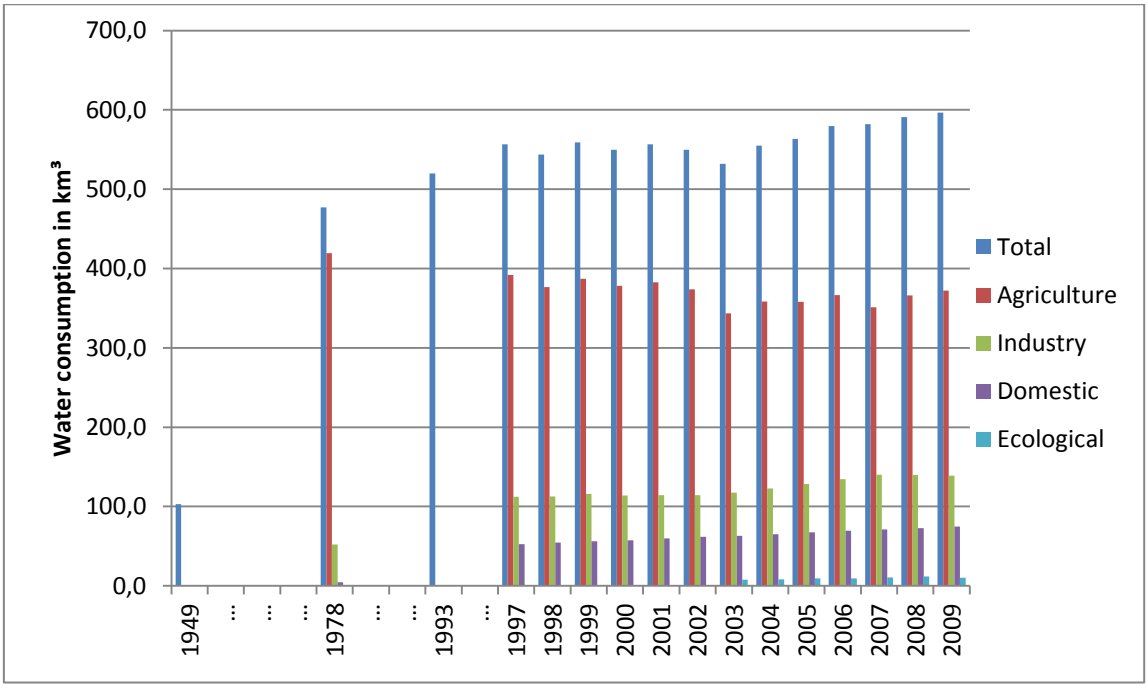
North only had access to 779 m³ of water per resident in 2008.[102] This unevenness has several natural causes. Precipitation is much higher in the South than in the North, especially compared to the extremely arid North-West. The average precipitation in the North is 330mm/ year as compared to 1190 mm/ year in the South.[103] Because 98% of river runoff in China is supploied by precipitation,[104] it seems logical that the flow of rivers in the North is also much lower than in the South. Comparing China's longest rivers makes this obvious: The Huang He in the North has an average annual runoff of 66.1 km³, which is low compared to the Chang Jiang, which has an annual runoff of 951.3 km³. [105] The distribution of groundwater resources between North and South is uneven as well, with the South again claiming the larger share. 70% of the Chinese groundwater resources are in the South.[106] These figures show that surface water and groundwater are abundant in the South and scarce in the North of China.

Moreover, precipitation in China strongly varies with the season. Large parts of South and East China are affected by the East Asia monsoon, which brings heavy rainfall in the summer months. The mountains and high plateaus block the monsoon rain from North-west China. In the region North of Beijing and the North China Plain[107], 70% and 60%, respectively, of the annual precipitation comes from the monsoonal summer rains, whereas the monsoon rain in Guangzhou only accounts for 25% of the province's annual precipitation. This climatic particularity leads to frequent droughts and floods and aggravates the condition of limited water resources during the dry season in the North.[108] In China's history, precipitation has varied strongly from year to year, with longer periods of low precipitation compared to the annual average. In the North, for instance, annual precipitation in the 1980s was recurrently 10% to 20% less than the annual average in the region, which endangered the water supply.[109] In addition to the geographic distribution of water, seasonal and periodic changes in precipitation bring forward the possibility of water scarcity in the North.

[102] Xie et al. (2009), 11.
[103] Smil (1993), 38f.; AQUASTAT (2010b), 3.
[104] AQUASTAT (2010a); The remaining 2% stem from glaciers in western high plateau (AQUASTAT, 2010a).
[105] Gleick (2009), 84; Ross (1988), 88; The data in these two sources slightly vary, but so insignificantly that one can draw the same conclusion from both sources, namely that the flow of northern rivers is lower than the flow of southern rivers. The annual runoff of the Huang He and Chang Jiang is based on Gleick (2009, 84), and the annual runoff of the Zhujiang is taken from Ross (1988, 88).
[106] Smil (1993), 42f; AQUASTAT (2010a).
[107] The North China Plain is the area around the lower reaches of the Huang He and the Huai He and Hai He basin (Smil, 1993, 45f).
[108] Smil (1993), 40f; AQUASTAT (2010a); Ross (1988), 92.
[109] Smil (1993), 40; Ross (1988), 91f.

This description shows that water scarcity is more likely in the North of China. Water scarcity only occurs, however, if the demand of human society and environment cannot be satisfied due to the impact of all water appropriators on the natural water resources.[110] To identify water scarcity in China it is therefore required to analyze water demand and to prove that the demand of humans and nature is not satisfied.

Figure 3: Water consumption in China (in km³)



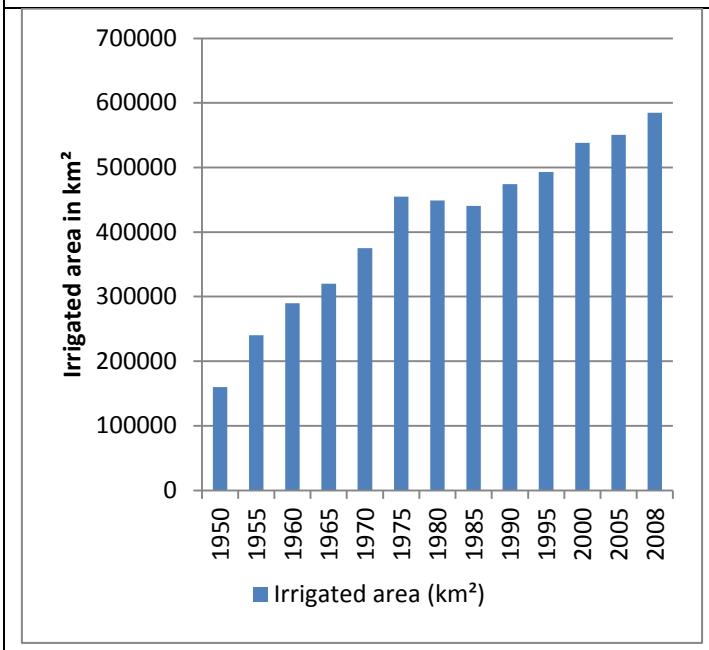
Source: created by the author; data 1949 by Jowett (1986, 9); data 1978 by Ross (1988, 93) and Jowett (1986, 9); data 1993 and 1997 by Ministry of Water Resources (MWR) (1997, part 3); data 1998 by MWR (1998, part 3); data 1999 by MWR (1999, part 3); data 2000-2008 by National Bureau of Statistics (2009, part 11-18); data 2009 by MWR (2011, 15).

Total water consumption in China has risen considerably, as shown in Figure 3.[111] In 1949 China only consumed 103 km³ of fresh water. This volume more than quadrupled by 1978, when annual water consumption reached 477 km³.[112] While there is no other data available on the water consumption for the years before 1978, Ross (1988) reports that agriculture consumed 419.5 km³ of water (88% of the total water consumption) in 1978.[113] The extraordinary rise in total water consumption between 1949 and 1978 was mainly due to the agricultural sector, because China widely extended the irrigated area,

[110] UN Water (2010).
[111] Ecological water consumption is water withdrawal to artificially supply rivers, lakes and wetlands in urban areas (National Bureau of Statistics, 2009, chart 11-18). The other sectors of water consumption are explained in more detail in this chapter. Ecological water consumption is not further explained as it's proportion of total water consumption remains small. The ecological water consumption in this chart is not the same as the environmental water demand, which is the water to maintain ecological functions of rivers and the ecosystem.
[112] Jowett (1986), 9; Ross (1988), 93.
[113] Ross (1988), 93.

which is pictured in Figure 4. In 1950 only about 16% of all farmland or about 160,000 km² were irrigated, compared to about 456,000 km² or 45% in 1976. In the 1950s irrigation was mainly expanded in the rice fields in South China using surface water. In the 1960s and 1970s tube wells were drilled in the North China Plain to irrigate grain fields with groundwater. In international comparison, China became highly dependent on irrigation.[114]

Figure 4: Irrigated area in China 1950-2008



Source: created by the author with data from Smil (1993, 44f), National Bureau of Statistics (2009, 12-6).

Water in the agricultural sector is largely used for irrigation, but also for livestock farming, forestry, and fisheries.[115] This early rise of agricultural water demand, especially for irrigation, already lead to water related problems in the North China Plain in the 1980s. In the late 1980s 110,000 km² of farmland were irrigated in the North China Plain alone. Up to 75% of irrigation in the region was done with groundwater pumped to the surface using 2 million tube wells. In years with lower precipitation, too much groundwater was used, which lead to sinking water tables and land subsidence. In the Yuncheng basin in Shanxi Province, water tables sank by 70m. Despite this massive water consumption, the demand seems not to have been satisfied, because the used irrigation water per hectare farmland appears to have been low in the region. In Shanxi, farmers could not guarantee the sufficient irrigation of their fields and partly even lacked drinking water. The Huang River carries large amounts of silt, which are deposited in the river bed if the water flow is reduced. Since up to a quarter of the total flow of the Huang He was withdrawn during dry years, tons of silt precipitated on the river bed and increased the risk of floods.[116] This description shows that the North China Plain was already suffering from water scarcity in the 1980s.

For the 1990s and 2000s, Figure 3 and Figure 4 show that agricultural water consumption decreased slightly, while the irrigated area increased, after it had shortly

[114] Ross (1988), 93f; Smil (1993), 44.
[115] Yang et al. (2005), 4.
[116] Smil (1993), 45-47.

declined in the 1980s due to less public investment and work input by local farmers.[117] This is a sign of more efficient irrigation, as less water is used to irrigate a larger area.[118] Although this could be interpreted as a development to a more efficient water use in agriculture, Xie et al. (2009) rate agriculture to be the most inefficient sector in China today. The authors estimate that only 50% of water withdrawn reaches the crops, because of deficient irrigation canals and another 20-30% is lost due to poor water management by farmers. Some of the better water management techniques Xie et al. (2009) discuss are irrigating the crops at night, in order to reduce evaporation losses, to reduce weeding, and to plant crops which need less water in arid regions.[119] Flood irrigation and furrow irrigation are still widely used in China, although they are very inefficient since large amounts of water seep into the ground or evaporate before reaching the crops. Water saving irrigation can be achieved with drip irrigation, which entails high initial costs, however.[120] Using impermeable channel lining for irrigation furrows is an easier way of saving water.[121] Hence, agriculture is China's largest water consumer and there is potential of using water more sparingly.

The water demand of Chinese industry has also increased markedly, but is much below the agricultural demand. In 1978 Chinese industrial companies consumed 52.3 km³.[122] Until 2009 this volume rose to 139 km³, as can be seen in Figure 3. The proportion of industrial water consumption as part of total water consumption has also increased from 11.0% in 1978 to 24.0% in 2009.[123] This data shows that the industrial sector has become a major water consumer and is thus an important subject to water governance. The reason for this increase in industrial water consumption is rapid industrialization and economic growth in China.[124] Between 1978 and 2008 the industrial GDP has increased eighty-fold from 161.7 billion RMB to 12.9 trillion RMB.[125] The fact that water consumption has risen at a much slower pace than industrial GDP can be attributed to the use of water saving technologies and the faster growth of light industry compared to heavy industry. To

[117] Smil (1993), 45; Ross (1988), 170f.
[118] Ross (1998), 114f.
[119] Xie et al. (2009), 26, 35.
[120] Smil (1993), 159f; Yang et al. (2005), 6.
[121] Smil (1993), 160; Xie et al. (2009), 36.
[122] Before 1978 no data is available for industrial consumption, but Jowett (1986) indicates that industrial demand had risen rapidly in the 30 years before the article was published. Jowett (1986), 9; Jowett (2009, 9) reports that water demand of thermal power generation had risen sixty-fold and water demand of general industry had multiplied eleven-fold "over the past 30 years". This increase, of course, occurred on a much lower level of water consumption than in the agricultural sector.
[123] Ross (1988), 93; MWR (2011a), 16.
[124] Xie et al. (2009), 22, 137; Ross (1988), 94.
[125] National Bureau of Statistics (2009), chart 2-1; The industrial GDP comprises, production and supply of electricity, water and gas, manufacturing and mining as becomes obvious from the National Bureau of Statistics (2009, chapter 1, explanatory notes).

date, however, water use efficiency is low in China, which is also due to low water recycling rates.[126]

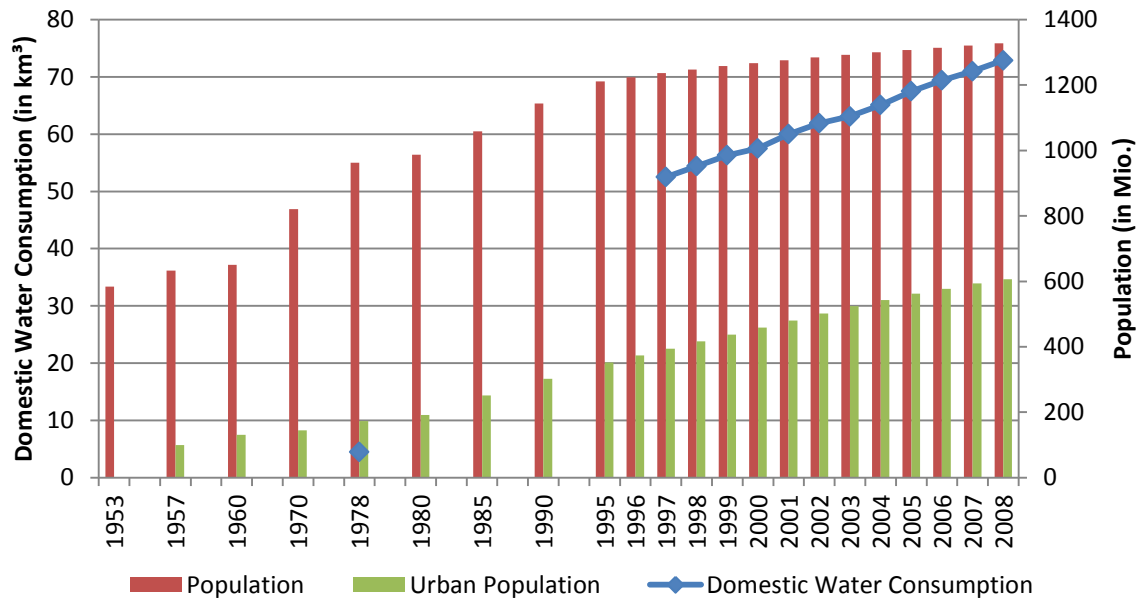
One of the largest water consuming industries has been thermal power generation, where steam turns turbines for power generation and water is used for cooling. Water is also used for the desulfurization of emissions and for capturing fly ash in coal fired thermal power plants.[127] Between 1978 and 2005, water consumption for thermal power generation rose from 26.0 km³ to 63.5 km³ as the amount of electricity produced by thermal power plants has increased greatly.[128] Among the manufacturing industries, steel, paper, and chemical industries use large volumes of water.[129] These manufacturing industries have been inefficient regarding water consumption, but the situation has been improving. Ross (1988) reports that the Chinese steel industry used 10 times more water per unit of industrial output than steel industries in industrialized nations in the early 1980s.[130] More than 20 years later, Xie et al. (2009) write, that "the largest steel mills [in China] use about 60 percent more water to produce a ton of steel than the combined average of the United States, Japan, and Germany, while water consumption by smaller firms is as much as five times higher than in those developed countries"[131]. This indicates that although the Chinese steel industry is still using water inefficiently, the gap between the steel industry in industrialized states and China has narrowed in the past 25 years. The water efficiency of the whole industrial sector can be measured as the volume of water used to produce each unit of industrial added value, and this ratio indicates that the Chinese industry has improved water use efficiency. For 10,000 RMB of industrial added value, Chinese industries on average used 363 m³ of water in 1997 and only 135 m³ in 2009.[132] However, compared to developed countries, the water use in Chinese industries is still inefficient today, also in manufacturing industries.[133]

The third group consists of domestic water consumers. This group comprises rural and urban households and the service, commercial, and construction sectors.[134] Domestic water consumption has risen considerably in the past 30 years, as can be seen in Figure 3. Figure 3Figure 3: Water consumption in China (in km³)In 1978 only 4.5 km³ of water were consumed by the domestic sector, and in 2009 this volume amounted to 74.8 km³. Today domestic water consumption accounts for 12.6% of total water consumption in

[126] Ross (1988), 94; Smil (1993), 156f; Yang et al. (2005), 5; Xie et al. (2009), 26.
[127] Xing (2010), 160f.
[128] Ross (1988), 93; Xing (2010), 160, 164.
[129] Finger et al. (2006), 25.
[130] Ross (1988), 94.
[131] Xie et al. (2009), 26.
[132] MWR (2011a), 19.
[133] Gleick (2009), 93; Xie et al. (2009), 26.
[134] National Bureau of Statistics (2009), chapter 11, explanatory notes; This definition is based on the definition by the National Bureau of Statistics (ibid.) for "living consumption" (ibid.); Yang et al. (2005, 3) specify that domestic consumption also comprises schools and hospitals.

China, compared to only 0.9% in 1978.[135] It thus seems to be essential to consider domestic water consumption when concerning oneself with water scarcity.

Figure 5: Population, urbanization and domestic water consumption



Source: Created by the author; data on water consumption see Figure 3; data on population 1953-1970 from Sharping (2007, 60, 67); data on population 1978-2008 from the National Bureau of Statistics (2009, chart 3-1).

This rise of domestic water consumption is associated with population growth, rising incomes, and urbanization. China's population has grown tremendously since the People's Republic was founded in 1949, due to falling mortality rates and rising life expectancy.[136] However, population growth cannot be the only reason for rising domestic water consumption, because consumption has increased much faster than the population has grown, as is also indicated in Figure 5. Between 1978 and 2008 the population has grown by a factor of 1.4, and domestic water consumption has increased by a factor of 16.2 during this period.[137] Ross (1988) and Yang et al. (2005) establish a positive relationship between rising incomes and urbanization on the one hand and domestic water consumption on the other hand.[138] Ahlheim (2009) also explains the upward trend in per capita domestic water consumption in Beijing with "changes in lifestyle"[139]. Figure 5 also shows a correlation of urbanization and rising domestic water consumption. Urbanization and rising incomes thus seem to have a positive relationship to domestic water consumption. Domestic water consumption is facilitated by a rising number of

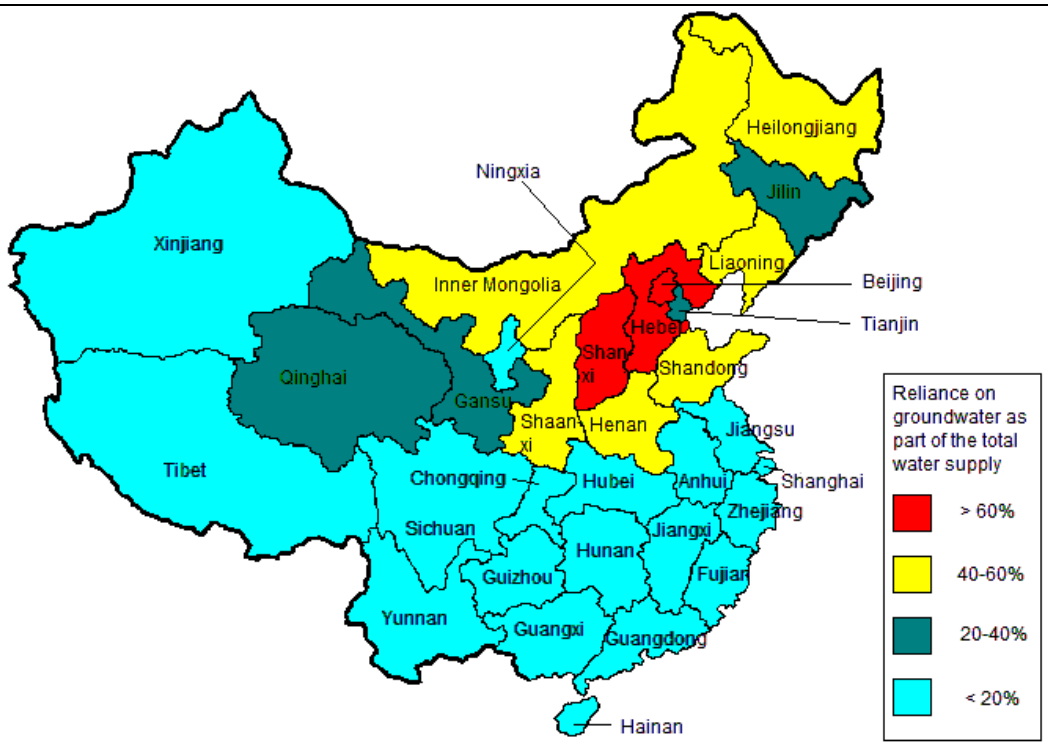
[135] Ross (1988), 93; MWR (2011a), 15f.
[136] Scharping (2007), 60f.
[137] Calculated with data from the National Bureau of Statistics (2009), chart 3-1; 11-18.
[138] Ross (1988), 94; Yang et al. (2005), 5, See Scharping (2007, 67f) for more information on urbanization.
[139] Ahlheim (2009), 6.

households with access to tap water. In 1978 only 48% of the population had access to tap water, and by 2008 this percentage had reached 95%.[140]

As in agriculture, not all of the water which is withdrawn for domestic water consumption serves its original purpose. The reason is the deficient water supply system of Chinese cities. The pipelines are old or constructed with inferior materials and building techniques. The daily leakage rate amounts to 50-75 m³/ km of urban water supply network, which is one of the highest worldwide. The leaks amount to the loss of 18% of the total urban water supply.[141] By improving the public water supply system, water could be used less wastefully.

The analysis of water consumption by sector explains who the main water appropriators are and why total water consumption has risen. The rise in water consumption during the first 30 years of the People's Republic can mainly be attributed to the expansion of cropland and a rise in agricultural demand. Since 1978, industrial and domestic water consumption has been increasing rapidly due to economic growth, associated social developments, and population growth. The explanation also discovers that efficiency of water consumption in these three sectors is imperfect and that water conservancy could be improved.

Map 1: Reliance of ground water as part of the total water supply by province 2008



Source: created by the author; data from National Bureau of Statistics (2009, chart 11-18).

[140] National Bureau of Statistics (2009), chart 9-1.
[141] Xie et al. (2009), 26.

In the arid North of China, this rising human water demand and the ecological water demand cannot be fully satisfied anymore, which qualifies the condition to be called water scarce. In 2004, water shortages in 108 cities, among them Beijing and Tianjin, were serious. Due to a drought, 160,000 people in Liaoning Province in China's Northeast experienced drinking water shortages as reservoirs dried up in 2009.[142] Not all cropland that needs irrigation can be sufficiently irrigated, due to water shortages.[143] The rising water demand has caused the drying up of surface water bodies in the North. Examples are China's largest fresh water lake Baiyangdian (白洋淀, Baiyangdian Lake), in Hebei Province,[144] and the lower reaches of the Talimu He in Xinjiang Autonomous Region.[145] The Huang He has dried up before reaching the sea for part of every year between 1985 and 1997, causing water shortages for Shandong's farmers, who are major corn and wheat producers in China.[146] To satisfy the mounting water demand and to compensate for a lack of surface water resources, northern provinces rely heavily on groundwater resources, as can be seen in Map 1: Reliance of ground water as part of the total water supply by provinceMap 1. The provinces Hebei and Shanxi and Beijing obtain more than 60% of their consumed water from aquifers. Many of these northern provinces consequently suffer from considerable groundwater depletion, especially Hebei Province. Hebei satisfies 80% of its water demand with groundwater and its groundwater resources have shrunk by 3 billion m^3. Major consequences of groundwater depletion are surface subsidence, desertification and drying lakes and rivers, all of which can be observed in northern China.[147]

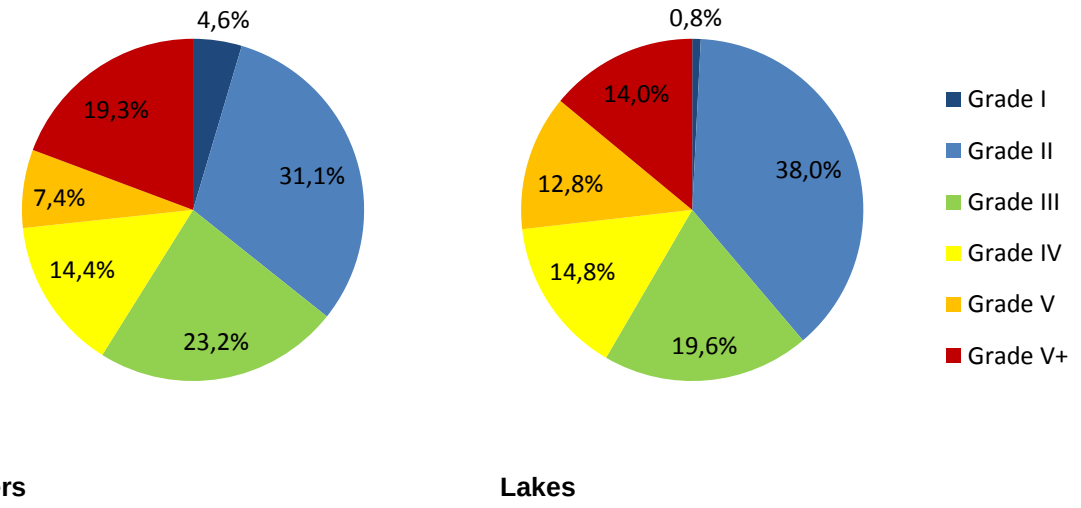
Regarding the framework of this thesis, this chapter shows the impact of aggregated outcomes of human actions on the physical water environment concerning water scarcity. This condition of water scarcity can be assessed as dissatisfying using the three evaluation criteria environmental friendliness, fairness, and sustainability. The situation is not environmental friendly, as the ecological water demand remains partly unmet, which manifests itself in the drying of water bodies. Moreover, the situation is unfair to many actors, if their water demand is not satisfied due to the high water demand of others. This happened, for example, when the Huang He dried up and deprived farmers downstream of water. Finally the condition is not sustainable in the sense that water supply is heavily based upon non-renewable groundwater resources in some areas in the

[142] China Daily (2009).
[143] Xie et al. (2009), 1, 21; China Daily (2009).
[144] Gleick (2009), 86; MWR (2011a), 20; Economy (2004), 68f.
[145] Wouters (2004), 265f.
[146] AQUASTAT (2010a).
[147] Xie et al. (2009), 17-19; National Bureau of Statistics (2009), chart 11-18; Gleick (2009), 86; AQUASTAT (2010a); Wouters et al. (2004), 252.

north of the country. This evaluation sheds light upon the necessity to improve the situation.

4.2. Water pollution

Figure 6: Water pollution in China 2009



Source: created by the author; data from MWR (2011, 19f).

Water pollution has been a serious problem in China, as can be seen in Figure 6. When 160,000 km of rivers were tested in 2009, almost 20% of the water samples failed to reach grade V standard, which means that water is unsuitable for any use. Around 22% of the samples were classified as grade IV and V, which is water that can be used for irrigation and industrial purposes only. The remaining 59% of samples contained water of the grades I-III, which is suitable for human consumption after treatment.[148] Similar results were found when the water quality of 71 lakes was tested. Approximately 42% of the lakes' total surface was covered with water of grades IV, V or V+. In addition, 46 out of the 71 lakes tested were considered eutrophic and only one lake was considered oligotrophic.[149] The nutrient concentration in Chinese lakes is thus very high, and it seems likely that this condition is caused by human activities.[150] Water pollution also extends to the

[148] The data is taken from MWR (2011a, 19f) and is visualized in Figure 6. The explanation to which grade qualifies water for which usage is taken from Xie et al. (2009, 14).
[149] MWR (2011a), 20; The trophic classification of the lakes in this Chinese source was translated with Wang et al. (2002, 3).
[150] Eutrophic lakes show a high concentration of nutrients and algae and low concentrations of oxygen, which in extreme cases might cause fish kills. A clear sign of eutrophic lakes is algae blooms, which is a sudden outbreak of algae growth. As the oxygen concentration decreases and toxic substances like ammonia accumulate, the number of species in the water decreases in the process of eutrophication and fish kills are likely. Humans can cause eutrophication of lakes by leaking nutrients like nitrogen and phosphor, for example in the form of fertilizer, into the lake. Oligotrophic lakes, on the other hand have high oxygen content and low nutrient and algae content. The water is clear and is living space for fish with high oxygen demand (RMB Environmental Laboratories, 2007a and 2007b; Oberheitmann, 2007, 92f.).

groundwater resources. In 2009 water from 562 wells in 8 provinces was tested and 72% of these samples were classified as grade IV-V. In Ningxia Province even 90% of all wells contained water of grades IV or V.[151] This data gives an idea of the extent of water pollution in China today. Earlier data on water pollution reveals that water pollution has remained largely unchanged on the nationwide average since the 1990s.[152]

It is noticeable that water pollution is much more serious in the North than in the South of China. In 2005, 45% of tested river water in the North was classified as grade IV or V and only about 10% was rated with grade I or II. By contrast, the southern river water achieved much better results, with approximately 55% of the tested water rated grade I or II and about 10% grade IV-V. Moreover, water quality has improved in the South since the early 1990s with more river sections improving from grade III to grade I or II. This trend cannot be detected in the North and the proportion of river sections with poor water quality has even increased in some years.[153] Similar to water scarcity, water pollution is a problem which is more extensive in the North.

In the next section, the sources of water pollution are revealed. At first, the agricultural sector is analyzed, followed by industrial and domestic wastewater discharges. Agriculture derogates water resources with fertilizers, pesticides, and livestock waste, which seep into the ground and are washed into water bodies. This type of pollution is called nonpoint pollution, as the site of waste discharge is widely scattered.[154] Farmers have used animal and human wastes to fertilize crops and when the country experienced a shortage of chemical fertilizers in the 1960s and 1970s, farmers also planted green manures to increase production.[155] Chemical fertilizer was hardly used before 1960.[156] Since the 1980s, the usage of chemical fertilizer and pesticides has been promoted by the agricultural offices of local governments to increase grain output to feed China's large population.[157] The volume of chemical fertilizer used each year has risen steadily from 8.84 million tons in 1978 to 52.39 million thirty years later, and the cereal harvest per hectare of farmland has consequently been increased considerably since the 1950s.[158] The amount of livestock has also increased markedly, which leads to more livestock waste. The larger amounts of fertilizer and animal waste have partly been washed into water bodies and increased the nutrient concentration in the water, which accelerated the

[151] MWR (2011a), 22.
[152] Xie et al. (2009), 14-15.
[153] Xie et al. (2009), 14-15; World Bank (2001), 48.
[154] Xie et al. (2009), 1, 13; Sanders (2004), 200f; Water Quality Association (WQA) (2011), term "nonpoint source".
[155] Smil (1993), 184f; Ross (1988), 150f.
[156] Ma et al. (2000), 2.
[157] Yang (2007), 1.
[158] Smil (1993), 179; National Bureau of Statistics (2009), chart 12-13, 12-15, 12-16; Smil's (1993) graph shows the increase of grain output per hectare of farmland between 1950-1990. The increase between 1990 and 2008 can be calculated with the statistics of the National Bureau of Statistics (2009).

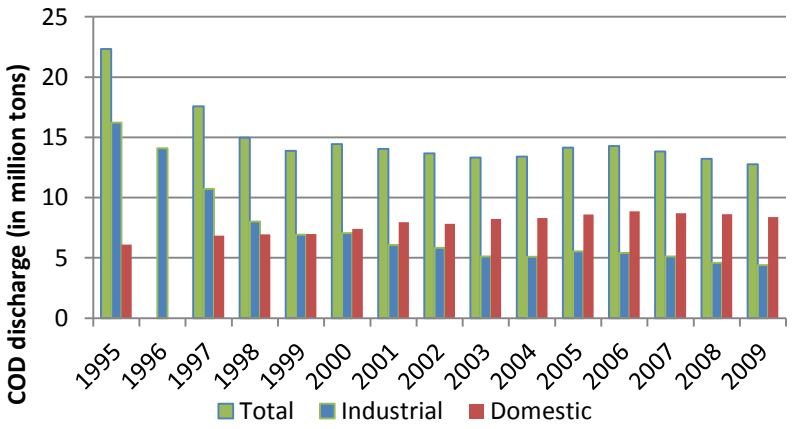
eutrophication of many lakes.[159] Moreover, China uses about 1.2 million tons of pesticides a year - more pesticides than any other country in the world. These pesticides also contaminate water bodies and kill fish. The high amount of fertilizer and pesticides used on Chinese fields also comes about, as farmers frequently over apply these substances, because they want to increase production and sometimes lack knowledge of how to properly apply these chemicals.[160] Overall, agricultural nonpoint pollution is increasing and is beyond control. Agricultural pollution has contributed to the eutrophication of lakes and the contamination of fresh water resources.

Industrial wastewater discharge is also an important source of water pollution, but China has made progress in treating industrial wastewater. In 1984 only about 10% of the total industrial and domestic wastewater discharges were treated and industrial wastewater discharges in the beginning of the 1980s are estimated to have been between 23.9 and 40.0 billion tons. At that time the industrial wastewater contained large amounts of toxic substances like heavy metals, phenols and cyanides. As the industrial wastewater was mixed with domestic wastewater, which farmers used to manure their fields, this industrial waste ended up on the fields and contaminated crops, creating health risks for the population.[161] The amount of wastewater discharged has remained largely the same since the 1980s. It decreased slightly in the 1990s and increased during the early 2000s due to rising wastewater discharges by township and village enterprises (TVE).[162] Meanwhile, the quality of the wastewater has improved as the proportion of wastewater that receives treatment has increased. In 1991 63.5% of all industrial wastewater received treatment and until 2004 this proportion increased to 90.7%. Accordingly, but at a slower pace, the proportion of industrial wastewater discharge meeting discharge standards has been rising, and the chemical oxygen demand (COD)[163] of industrial wastewater has been decreasing.[164] Even though this development is positive, the condition could be further

[159] Xie et al. (2009), 13; Sanders (2004), 201; World Bank (2001), 58.
[160] Yang (2007), 1f; Economy (2004), 71; World Bank (2001), 61.
[161] Ross (1988), 133-135; 150f; Smil (1993), 47; AQUASTAT (2010a) suggests that this still occurs today.
[162] Ma et al. (2000), 3; Xie et al. (2009), 11f; National Bureau of Statistics (2009), chart 11-19; Oberheitmann (2007), 93; Township and village enterprises are rural enterprises, which were owned by communes and brigades before the reform era (see chapter 5) and were owned by village committees and township governments after the reforms. Besides these collectively owned TVEs, privately owned TVEs proliferated during the 1990s (Ma et al., 2000, 40f, 48).
[163] Chemical oxygen demand (COD) is used to measure the oxygen demand to decompose organic and inorganic substances (WQA, 2011, "Chemical Oxygen Demand"). The COD is a measure for water quality, as the COD of water increases with the pollutants and nutrients dissolved in the sample. Usually the COD describes the concentration of oxygen demand in mg/l (Ma, 2000, 19f). However, Xie et al (2009, 12f.) and the National Bureau of Statistics (2009, chart 11-22) measure COD in tons and thus as mass. This is possible, if the total volume of effluent is given and multiplied with the COD concentration of the effluent. COD is a better measure for pollution discharges than the volume, because it considers the concentration of pollutants, and the "quality" of wastewater discharges can vary considerately.
[164] Ma et al. (2000), 3; Xie et al. (2009), 11f; World Bank (2001), 54f.

improved. A major source of industrial water pollution stem from TVEs, which still discharge most of their wastewater untreated and do not have treatment facilities for hazardous waste. Among these TVEs are small chemical fertilizer plants, coal power plants and paper and porcelain manufacturers. In the early 2000 these TVEs have accounted for more than half of industrial wastewater discharged.[165] Some of the industries with a relatively large amount of wastewater discharge are the paper industry, chemical industry, and textile industry, all of which discharged more than 2 billion tons of effluent in 2008.[166] In some cases industrial companies have their own wastewater treatment plant, but do not operate it to save costs.[167] Hence, industrial wastewater and COD discharge is still significant, but has seen a positive development since the 1990s. Some problems, however, remain and should be solved to improve water quality.

Figure 7: COD discharge (in million tons)



Source: created by the author; data 1995 from MEP (2000); data 1996 from MEP (1996); data 1997 from MEP (1998); data 1998-1999 from MEP (1999); data 2000-2005 from Xie et al. (2009, 13); data from 2006-2009 from MEP (2009).

Domestic wastewater and COD discharge has risen as the volume of domestic water consumption has increased. In the 1980s domestic wastewater discharges are estimated to have been low compared to industrial discharges.[168] In 1984 there were only 27 municipal wastewater treatment plants throughout the country.[169] In the 1990s the volume of domestic wastewater increased and in the mid 1990s only 7% of domestic wastewater received treatment.[170] The sector has seen some recent improvements. According to the state news agency Xinhua, in the end of 2010 about 75% of all municipal wastewater received treatment. The aim of the eleventh Five-Year Plan was to increase the capacity to 70% by 2010, and the

[165] Xie et al. (2009), 12; Smil (1993), 47; Economy (2004), 70; Sanders (2004), 200f; Wang et al. (2008), 651.
[166] National Bureau of Statistics (2009), chart 11-20.
[167] Ross (1988), 162; Xie et al. (2009), 38; World Bank (2001), 56.
[168] This can be calculated from Ross' (1988, 135) estimates. Total discharges were estimated at 33.9 billion tons, of which 23.9 billion tons were industrial discharges. Domestic discharges can thus be estimated at 10 billion tons. Ross (1988) underlines that these data are only rough estimates. It seems logical, however, that domestic wastewater discharges were low, as domestic water demand was very low at the time.
[169] Ross (1988), 133f.
[170] Ma et al. (2000), 3; Ministry of Environmental Protection (MEP) (2000); MEP (1999).

twelfth Five-Year Plan aims on further increasing the capacity to 85% by 2015.[171] However, in the early 2000s an estimated 200 million people lived in towns with no sanitation system.[172] One difficulty for municipal wastewater systems has been the rapid urbanization and the increasing volume of wastewater that municipalities cannot keep pace with. One example is the Pearl River Delta, where rapid industrialization was followed by an enormous population growth. Between 1996 and 2003 the population in the region grew from 26 million to 48 million.[173] In China, domestic COD discharges have increased and surpassed industrial discharges in 1999 as can be seen in Figure 7. Since 2006 the domestic COD discharges slightly decreased to 8.4 million tons in 2009,[174] which is likely to be due to recent improvements in the municipal sewage treatment systems. However, the domestic sector is a major source of water pollution in China today.

The account of the three sectors shows that there has been some progress, especially in the industrial sector, and some shortcomings with regard to water pollution. While the COD discharge of industrial and domestic sources has decreased in the 1990s and has been at least stagnant in the 2000s (see Figure 7), the agricultural nonpoint pollution remains out-of-control due to the excessive usage of fertilizers and pesticides. The poor quality of water resources reflects these shortcomings. The fact that the water quality in the North is poorer than in the South can be explained by the lower quantity of water to dilute the pollutants.[175] Moreover, AQUASTAT (2010a) reason that the pollution is worse in the North because of the concentration of heavy industry in the region.[176] The North China Plain is also the most important agricultural region in China and produces large amounts of cereals. Accordingly, the provinces in the region use large amounts of chemical fertilizers, namely 32.4% of the total in 2008.[177] These factors contribute to the more serious water pollution in the North.

The negative consequences of water pollution affect the environment, the society and the economy. Water pollution destroys living space of fresh water species. The pollution has impinged on biodiversity of Chinese rivers. For example, the endemic Yangtse Dolphin was found to be exterminated in 2006.[178] The eutrophication of lakes

[171] Tang (2011); Twelfth Five-Year Plan (2011), section 24, article 1; Eleventh Five-Year Plan (2006), section 24, article 1.
[172] Economy (2004), 71.
[173] Welford et al. (2006), 155f; Nickum et al. (2007), 89.
[174] MEP (2009).
[175] Ma et al. (2000), 6; Xie et al. (2009), 1f.
[176] AQUASTAT (2010a).
[177] Taubmann (2007), 21f; National Bureau of Statistics (2009), chart 12-6. Taubmann (ibid.) subsumes the provinces Hebei, Henan, Shanxi, Shaanxi, Shandong, Beijing and Tianjin under the term North China Plain. These provinces consumed a total of 16.99 million tons of chemical fertilizer in 2008, which was 32.4% of the total.
[178] Golding (2011), 400.

impinges on the biodiversity and, at an advanced state, causes fish kills.[179] Moreover, water pollution aggravates the problem of water scarcity, because polluted water is not suitable for some or even all uses. Xie et al. (2009) estimate that 25 km³ of water are held back from water supply because of pollution.[180] If farmers use contaminated water to irrigate their fields, the crops are contaminated and damage people's health.[181] Pesticides pose health risks to farmers and consumers.[182] Moreover, water pollution affect the drinking water supply of the population. In 2005, 300 million people in rural areas were supplied with contaminated water, which contained hazardous substances, fluorine, or salt. In 2006 almost half of major cities supplied water below the drinking water standard. Contaminated drinking water has posed serious health risks to the population and causes illnesses like diarrhea, liver and stomach cancer.[183] This makes clear, that water quality conditions in China are dissatisfying when evaluated with the criteria of environmental friendliness and fairness. As described above, pollution clearly damages the environment. Moreover, water pollution is unfair to those who suffer from it. Water pollution can be interpreted as a negative external effect, which means that actors bear part of the costs of a good without sharing its benefits. This is an unfair relationship between water appropriators. This unsatisfactory condition calls for improvement, which can be reached when wastewater is treated properly and less fertilizer and pesticides are applied in agriculture.

This chapter describes the extent of water scarcity and water pollution and shows that this condition is the aggregated outcome of the actions of agricultural, industrial, and domestic sector actors. It becomes clear that the outcomes can potentially be changed for the better by using water more efficiently, by abandoning activities with high water demand in arid areas, by transferring water to the arid North, by treating wastewater, and by using fertilizers and pesticides more sparingly. This situation meets the conditions to be called a dilemma, as described in chapter 2.1, because the water issues can theoretically be eased or even solved. This is also the prerequisite for this thesis, as an unsolvable problem could also not be solved by a government. However, as this chapter describes a dilemma, chapter 6 elaborates on how the government governs the actors in the agricultural, industrial, and domestic sector to solve the problems of water scarcity and pollution. Before that, the next chapter takes into account the Chinese historical and political background, which impacts water governance in China.

[179] AQUASTAT (2010a); Oberheitmann (2007), 92f; RMB Environmental Laboratories (2007b); Van Rooij (2006), 55.
[180] Xie et al. (2009), 21; AQUASTAT (2010a).
[181] Gleick (2009), 81.
[182] Sanders (2004), 201.
[183] Xie et al. (2009), 14; 19; Gleick (2009), 81; Ma et al. (2000), 3.

5. Political and economic background on the People's Republic

The changes and continuities of the political and economic system have affected water governance in China. Regarding the IAD framework, this chapter serves as the factor community, which influences the action arenas on all three levels. It briefly introduces several aspects of Chinese politics and history, which influence public water governance.[184]

A continuity in Chinese politics since 1949 has been the one-party rule of the CPC. The CPC is the *de facto* sovereign of the country and stands *de facto* above the Constitution.[185] The highest leadership in China can be identified as the Standing Committee of the Politburo of the CPC.[186] The National People's Congress is *de jure* the "highest organ of state power"[187]. However, important decisions are made within the party leadership and are then submitted to the National People's Congress.[188] The state apparatus is paralleled and penetrated by the CPC at the central and the local level. In the central government and its ministries, a group of party members crucially determines the decision-making process and almost all ministers are members of the CPC.[189] At the local level of government, comprising the province, county and township levels, the state institutions are matched with party organs, which also play an important role in governance at the local level.[190] This entanglement of CPC and the state apparatus is to be kept in mind when analyzing public water governance and affects, of course, the question of which actor decides the various rules in water governance.

Although the ruling party has remained the same since 1949, there have been tremendous changes in governance. After the CPC came to power, the party established a politically and economically centralized system following the soviet model. The first Five-Year Plan was launched in 1953 to centrally map the road of development, especially the development of heavy industry.[191] After the discord with the Soviet Union in the second half of the 1950s, the Chinese leadership decided to equip the local authorities with more economic power and thus to decentralize the economy. The provincial governments and prefectures[192] level gained extensive authority over local enterprises, but not the

[184] The chapter is not intended to give a comprehensive overview of Chinese modern history or the Chinese political system. The description is limited to aspects, which majorly impact public water governance.
[185] Heilmann (2004), 19, 21, 80; Saich (2004), 125.
[186] Heilmann (2004), 38; Saich (2004), 101.
[187] Constitution of the People's Republic of China (2004), Article 27, p. 27.
[188] Saich (2004), 127.
[189] Heilmann (2004), 99-101.
[190] Saich (2004), 156f; Heilmann (2004), 102f; Heberer (2008), 66.
[191] Saich (2004), 35f.
[192] Prefectures are jurisdictions below the province level, but are not considered a local government because they do not have political power. Prefectures do not have people's congresses and

enterprises themselves. The Chinese economy was dominated by state planning and the market had remained highly restricted since the 1950s.[193] A major turning point in Chinese governance was the death of Mao Zedong in 1976 and the takeover of power by the second leadership generation under Deng Xiaoping at the Third Plenum of the Eleventh Central Committee in 1978.[194] The period after this leadership transition is referred to as the reform era.[195] The new leadership implemented a more pragmatic economic policy by releasing the market mechanism. Through decollectivization, the individual households and enterprises became more autonomous actors in the economic sector and became led and incentivized by the maximization of individual benefits on the newly opened markets. At the same time, decentralization occurred not only in favor of individual enterprises, but also in favor of local governments. Local governments have gained more leeway to adapt central policies to the local conditions and handle central plans in a more flexible manner. Province and county governments partly gained administrative power over state-owned enterprises, and have since given them incentives to further economic development in their jurisdiction.[196] Similarly, township and village enterprises (TVEs), which have grown in number and in terms of economic output since the 1980s, pay taxes and extra-budgetary revenues to local governments. This provides local governments with incentives to foster economic development.[197] The reforms since 1978 thus gradually unleashed the market and strengthened the power of local governments. On the one hand, local governments are thus agents of the central state, which implement central policies with considerable scope for local policy design. On the other hand, local governments advocate local interests and economic development in their jurisdiction. Heberer (2008) accurately refers to this condition as "*Doppelidentität der Lokalregierungen*" [198] . Decentralization also has fiscal implications, as the financial capacity of the central government has decreased and policy implementation has increasingly relied on local budgets. This is one reason for the growing regional inequality in economic development in the reform era. The coastal provinces have experienced high economic growth and accumulated most of the country's foreign direct investment, outpacing the inland provinces in the economic race. The provinces with high economic achievements have also received more tax revenues, and due to the fiscal decentralization, this inequality of

governments of their own, but are administrative organs of the province level governments (Saich, 2004, 156).

[193] Saich (2004), 32f, 35, 37f, 51; Heilmann (2004), 173; Ross (1988), 20.

[194] Heilmann (2004), 45-47; Saich (2004), 54f, 57; Deng Xiaoping did not just rise to power after the death of Mao Zedong, but at times rose to major positions within party and state before 1978 (Heilmann, 2004, 48).

[195] Heilmann (2004), 21; Heilmann (ibid.) differentiates in German between the "Mao-Ära" and the "Reform-Ära". This is translated as reform era and Maoist era.

[196] Heberer (2008), 48, 109; Saich (2004), 59-61, 167.

[197] Ma et al. (2000), 41, 48-51.

[198] Heberer (2008), 50; This quote can be translated as dual identity of local governments.

local revenues has not been sufficiently compensated by central funds. Local governments in poorer regions have hence experienced fiscal pressures.[199] Water governance is markedly impacted by these developments. This condition shows that one cannot refer to the Chinese government as one homogenous actor with uniform preferences and capacities – such as financial capacities –, but rather as a group of actors with diverse preferences and capacities.

When analyzing water governance by the use of rules, as envisioned in this thesis, it seems worth mentioning that the legal and bureaucratic system has been undermined periodically by ideologically motivated campaigns in the Maoist era. Especially the Cultural Revolution, which started in 1966, had devastating outcomes for the capacity of the bureaucratic system. In the reform era, the administrative and legal system has been rebuilt and the leadership has relied increasingly upon a functioning state apparatus and legal provisions in governing the country.[200] The Maoist past can, however, still be felt in two ways in today's governance which are important for this thesis. Firstly, the legal provisions, being fairly young, show many imperfections, as can be seen when analyzing water governance in chapter 6. Secondly, campaigns have not completely been abandoned by the leadership, but are still employed, although with smaller scope and different objectives.[201] As campaigns should not be ignored, they are discussed as a policy instrument in chapter 6.2.2.4, following the example of Ross (1988).[202]

The relationship of state and society has also undergone changes. When the CPC came to power, it began governing the country by extensively penetrating society. The CPC became the undisputed first organization in the country, and the people were requested to simply follow the commands and campaigns of the party officials. Saich (2004) compares the relationship of officials and the people with teachers and children, as they assumed to know what was best for the people.[203] This governance style, which actually abased people to a state of immaturity, changed in the reform era. The influence of the party and the state over society has been reduced, and society has become more pluralistic as the opportunity for individuals and organizations to take action outside of direct state control has increased.[204] However, "it is also clear that no coherent alternative vision has emerged that would fashion either a civil society or a rapid construction of a

[199] Saich (2004), 164-167, 170f, 173; This picture of fiscal decentralization is simplified, as the reform era has also seen reforms of the fiscal system. For instance, there was a major fiscal reform in 1994, with which the central government aimed at increasing the central share of total tax revenues compared to the locally kept revenues. In fact, the share of centrally earned tax revenues has increased since then. This tax reform has, however, not eased the fiscal pressures in poorer regions, but rather exacerbated them (Saich, 2004, 167-173).
[200] Saich (2004), 45, 136, 138-140; Heilmann (2004), 21, 95, 101, 194; Heberer (2008), 31.
[201] Ross (1988), 15-17; Heilmann (2004), 195.
[202] Ross (1988), 15-17.
[203] Saich (2004), 110; 213f; 219.
[204] Saich (2004), 222f; Heberer et al. (2008), 51.

democratic political order"[205].[206] Although the number of NGOs has increased since the 1990s and there are also environmental NGOs in China now, the non-state sector is tightly regulated by the government. Although Chinese citizens have developed a sense of environmental awareness, they are restricted in initiating environmental projects themselves.[207] With the government and the CPC still assuming such a strong position in society, the responsibility of the government for water resource management is underlined, which is also founded in Public Goods Theory in chapter 2.1. If the government further opened the field for NGOs, these organizations could, of course, play a more important role.

[205] Saich (2004), 223.
[206] Heilmann (2004), 19f; Saich (2004), 223.
[207] Saich (2004), 226-228; 231; Klein (2004), 170f, 173; Heilmann (2004), 179.

6. Public water governance and its impact on the water dilemma

This chapter is the main part of this thesis, as it answers the questions of why the Chinese government has not solved the problems of water scarcity and pollution, and where progress has been made. To answer these questions, the chapter first analyzes the action arena on the constitutional-choice level before moving on to the collective-choice level of policy making. The outcomes of these action arenas are laws and regulations from the Chinese government, which govern the water appropriators and polluters on the operational level.

6.1. The constitutional-choice level of water governance

As described in chapter 2.2, on the constitutional-choice level, actors make rules which define the scope of decision-making on the collective-choice level and the actors, who are entitled to participate in decision-making on that level. At first, the Constitution is analyzed regarding water governance to find out how it frames the decision-making on the collective-choice level.

The People's Republic has had four Constitutions since it was founded in 1949. These Constitutions were ratified in 1954, 1975, 1978 and 1982 respectively. The Constitution from 1982 is still in force today.[208] In all four versions of the Constitution, the state has claimed ownership of all water resources.[209] The 1954 Constitution states the following:

> "All mineral resources and waters, as well as forests, undeveloped land and other resources which the State owns by law, are the property of the whole people."[210]

First of all, this shows that the state exercises power over its water resources and can thus can decide how to manage them. This underlines the fact that the Chinese government is an important actor in solving the problems of water scarcity and pollution. Secondly, Article 9 of the Constitution shows that the state passes the ownership on to all Chinese citizens. Accordingly, water is shared by all nationals.[211] The Constitution thus labels water with a low excludability, which is one of the two features of a common-pool resource. The other feature – rivalry in consumption – is a physical property of water. The Constitution thus identifies water as a common-pool resource.

[208] Heilmann (2004), 74.
[209] Ross (1988), 95; 1954 Constitution of the People's Republic of China, Article 6 (p. 155); 1975 Constitution of the People's Republic of China, Article 6 (p. 189); 1978 Constitution of the People's Republic of China, Article 6 (p. 209); Constitution of the People's Republic of China (2004), Article 9 (p. 11).
[210] 1954 Constitution of the People's Republic of China, Article 6 (p. 155); Xin (1979, 155) offers this translation of Article 6.
[211] Wouters et al. (2004), 281.

There has been a considerable change in the minds of the leadership about how to manage water resources, and this change is reflected in the development of the Constitution. Ross (1988) writes that water resources remained basically unmanaged in the period of planned economy because of a lack of planning capacity over an enormously large economy and because water is not a good which is produced by human labor. This ideologically induced bias towards products of human labor in the planning process [212] left water resources merely as "a gift of nature or a free good. So long as [the] water supply appeared ample to satisfy the needs of favored economic sectors, especially heavy industry, there was no need to plan water consumption."[213] Wouters et al. (2004) also write that the state ownership did not lead to water management, but that water resources were "quasi-open commons subject to over-use by subordinate units of government" [214]. Today, by contrast, water resources are managed by the state, as reflected in the Constitution. Environmental protection found its way into the Constitution for the first time in 1978.[215] The 1978 Constitution establishes the following in Article 11:

> "The state protects the environment and natural resources and prevents and eliminates pollution and other hazards to the public." [216]

As water is a natural resource, this Article also applies to the protection of water resources and to combating water pollution. The idea of the state protecting the environment is even clearer in the 1982 Constitution. Article 9 in the 1982 Constitution, which is the Article that also claims ownership of water resources, states the following:

> "[…] The state ensures the rational use of natural resources and protects rare animals and plants. Appropriation or damaging of natural resources by any organization or individual by whatever means is prohibited."[217]

According to this Article, the state is thus not only the owner of water resources, but is also responsible for managing them. This responsibility of the state is not mentioned in the previous versions of the Constitution[218] and is to be seen as the first step to solve the problems of water scarcity and pollution on the constitutional-choice level. [219] It also

[212] Ross (1988), 85.
[213] Ross (1988), 95.
[214] Wouters et al. (2004), 281.
[215] Song (2002), 227.
[216] 1978 Constitution of the People's Republic of China, Article 11 (p. 208); Xin (1979, 155) offers offers this translation of Article 11.
[217] Constitution of the People's Republic of China (2004), Article 9 (p. 11); This quote is taken from the translation offered in this publication.
[218] 1954 Constitution of the People's Republic of China; 1975 Constitution of the People's Republic of China; 1978 Constitution of the People's Republic of China; The 1954 and 1978 versions merely establish the duty of the citizens to "respect and protect public property" (1954 Constitution of the People's Republic of China, Article 57, p. 227) or to "take care of and protect public property" (1978 Constitution of the People's Republic of China, Article 57, p. 227). A similar Article was not found in the 1975 Constitution.
[219] Wouters et al. (2004), 281.

establishes the possibility of excluding actors from using water. In addition, Article 26 of the 1982 Constitution is solely dedicated to environmental protection:

> "The state protects and improves the environment in which people live and the ecological environment. It prevents and controls pollution and other public hazards. […]"[220]

These changes in the Constitution mean that the government is now instructed to manage water resources and to therefore prevent their overexploitation as well as to take care of water pollution within its jurisdiction.[221] Song (2002) criticizes the Constitution for not granting each citizen the right to an intact environment, but admits that it still creates a basis for national environmental protection laws.[222]

However, the Constitution only has limited influence on policy-making in China. Even though the 1982 Constitution for the first time establishes that the Constitution "is the fundamental law of the state and has supreme legal authority"[223], the supremacy of the Constitution is limited by the leadership of the CPC, which is also established in the preamble of the Constitution. In practice, the CPC stands above the Constitution.[224] Saich (2004) writes, that "the Constitution cannot be taken at face value"[225], but interprets it as a "useful guide to the leadership's thinking about the present situation and gives an indication of the way in which they would like to see it evolve"[226]. The National People's Congress is *de jure* the "highest organ of state power"[227] and formally has adopted the Constitution.[228] However, important decisions are made within the party leadership and are then introduced to the National People's Congress.[229] This explains why the Constitution reflects the thoughts of the leadership. As such, the change in the Constitution concerning the water governance implies a change in the party leadership's thinking on the issue. Since the party leadership impacts the state apparatus and is instrumental in China's politics,[230] the aims of the Constitutions are decisive for the decision-making process on the collective-choice level, even though the Constitution *de facto* is not. One can also go so far as to say that the rule as in the IAD framework is not the Constitution itself, but the political direction the leadership indicates, which is manifested in the Constitution. One can also say that the implementation of the

[220] Constitution of the People's Republic of China (2004), Article 26 (p. 17); This quote is taken from the translation offered in this publication.
[221] Song (2002), 225, 227.
[222] Song (2002), 227.
[223] Constitution of the People's Republic of China (2004), preamble, (p. 7); This quote is taken from the translation offered in this publication.
[224] Heilmann (2004), 74f, 80.
[225] Saich (2004), 124.
[226] Saich (2004), 124.
[227] Constitution of the People's Republic of China (2004), Article 27 (p. 27).
[228] Constitution of the People's Republic of China (2004), p. 1.
[229] Saich (2004), 127.
[230] Saich (2004), 125.

Constitution is not properly monitored and sanctioned as would be expected in a constitutional state and as is visible in the IAD framework (see Figure 2).

Since the CPC plays a crucial role in Chinese politics, it seems reasonable to also mention the Party Statute as a *de facto* part of the constitutional-choice level rules. The current Party Statute was adopted by the party in 1982. Changes in the leadership's ideology have been incorporated in the Party Statute in form of revisions. For instance, the Deng Xiaoping Theory was added to the Party Statute in 1997.[231] Hence, the Party Statute can also be interpreted as a guide to the leadership's general political course, and indeed the current party statute does stipulate that the party aims at a harmonious relationship of humans and nature and at fostering the sparing use of resources and environmental protection.[232] Besides the Constitution, the Party Statute thus also testifies that the leadership shows interest in water resource management that is environmentally friendly and efficient. Such management would ease water scarcity and water pollution.

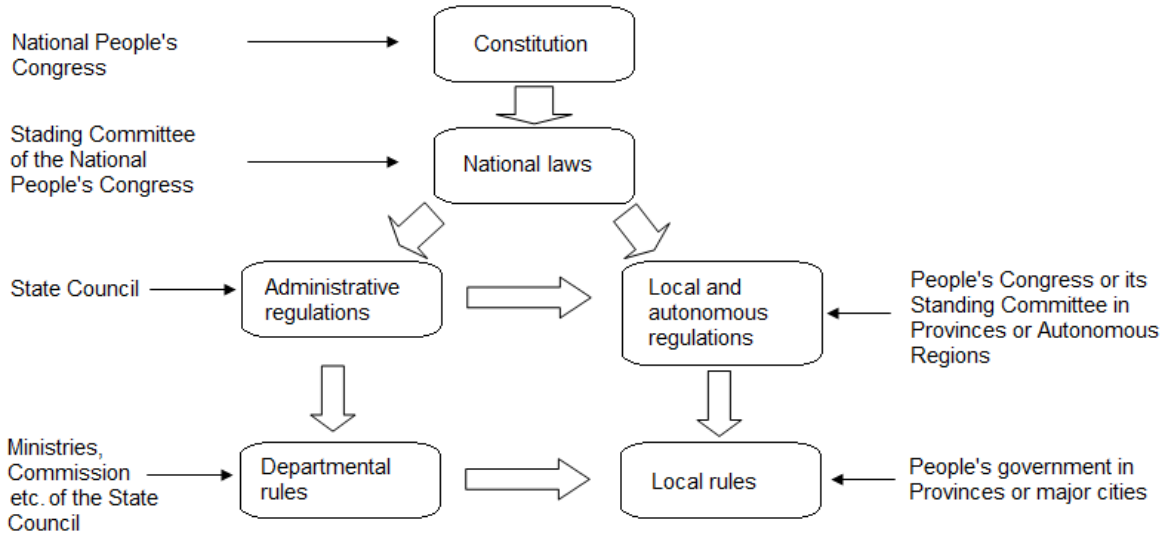
The secondary literature confirms that the Chinese leadership has become more concerned about environmental issues since the 1970s and lists various reasons for the leadership's conversion. Firstly, the environmental problems became aggravated at the time, which induced the government to step in. Among the issues considered were two water pollution incidents. In 1972 the water in the Dalian Bay turned black because of untreated wastewater. In the same year, a fish kill occurred in Beijing's reservoirs due to a high concentration of heavy metals in the water. The pollution caused by industries became especially obvious. Secondly, the costs of health care related to environmental problems, pollution cleanup, and the costs of other environmental problems, like erosion and desertification, rose to such an extent that the government became concerned. Finally, the UN Conference on the Human Environment, which took place in 1972 in Stockholm, significantly furthered the environmental awakening in China. The international conference caused environmental concerns among the Chinese leadership, especially the Premier Zhou Enlai. One year after this international conference, the first National Conference on Environmental Protection was held in China, and after the unstable climate of the Cultural Revolution was overcome, the leadership pushed forward laws to protect the environment.[233] These developments caused the Chinese leadership to rethink their position, and the new awareness found its way into the 1982 Constitution and the Party Statute. It shows that the preferences among the leadership have changed in favor of environmental issues, which include water scarcity and pollution.

[231] Saich (2004), 91; Heilmann (2004), 79; Heberer (2008), 43;
[232] Statute of the Communist Party of China (2007), General Provisions, paragraph 14.
[233] Klein (2004), 93-95. 97; Song (2004), 226; Golding (2011), 402; Sanders (2006, 200) also observes that the Chinese leadership has become more responsive to environmental problems.

This chapter shows that water was basically not governed on the constitutional-choice level and that water was defined as a common-pool resource before the 1980s. As described in the previous chapter, the appearance of water as a common-pool resource entails problems like overexploitation and pollution. This began to change with the 1982 Constitution and the Party Statute in the course of the environmental awakening among the leadership. It can be observed how the general political changes, which are captured as the community factor in the IAD framework, have induced changes in water governance at this level and how they can hinder or further governance to solve water problems.

6.2. The collective-choice level governance

Figure 8: Hierarchy of laws in the People's Republic of China



Source: Created by the author; Wouters et al. (2004, 256); Song (2004, 4).
The term local "rule" as used for decisions by provincial governments are not to be confused with the term "rule" as used in the framework, which comprises all laws, regulations and local and departmental rules.

While the last chapter analyzes the constitutional-choice level of water governance, this chapter addresses the collective-choice level of decision-making. The rules which belong to this level have to adhere to the provisions of the Constitution. Actually, this one level of decision-making in the framework of this thesis comprises three levels of Chinese law. The second level of Chinese law, which is below the first level provisions of the Constitution, is comprised by national laws, which are enacted by the National People's Congress or its Standing Committee. Administrative regulations, which are issued by the State Council, form the third level of laws. Regulations by the People's Congresses of the Provinces and Autonomous Regions also belong to this level but have to adhere to the national laws and administrative rules and regulations. Finally, rules issued by Chinese

national ministries, commissions, and agencies under the State Council and provincial governments make up the forth level of Chinese law.[234] An overview of the different levels of rules is provided in Figure 8.

The following subchapter gives an overview of the national laws concerning water resources and the actors which are involved in the central level of governance in China.

6.2.1. Water governance at the national level

The major decision-making bodies at the central level are the National People's Congress, its Standing Committee, and the State Council, as can also be concluded from Figure 8. The same major decision-making bodies are used for water governance. The Standing Committee of the National People's Congress passes most of the national laws. It represents the National People's Congress, which has about 3,000 delegates and only comes together once a year.[235] Although the National People's Congress is the highest legislative organ in China, it should be kept in mind that important legislation is drafted within the CPC leadership and approved by the Central Committee of the CPC before it is passed to the National People's Congress.[236] This means that national laws not only reflect the interests of the National People's Congress, but primarily the preferences of the Politburo and its Standing Committee. The State Council is the "executive body"[237] and the "highest organ of state administration"[238]. It is also called the central government of the People's Republic and headed by the premier.[239]

At this national level of water governance, there have been several indicators for the actor's interest in solving the water problem in China. The first indicators are national laws that are concerned with water governance, which have been adopted by the National People's Congress or its Standing Committee. The first national law which specifically addresses water problems is the Law on Prevention and Control of Water Pollution (中华人民共和国水污染防治法, hereafter referred to as Law on Water Pollution), which was adopted by the Standing Committee of the National People's Congress in 1984 and was revised in 1996 and 2008.[240] The law aims at combating water pollution to protect and improve the environmental conditions and public health.[241] To date it is the main law governing water pollution in China.[242] Four years later, in 1988, the Standing Committee of

[234] Song (2002), 228; Wouters et al. (2004), 229.
[235] Heilmann (2004), 77.
[236] Saich (2004), 127.
[237] Constitution of the People's Republic of China (2004), Article 85.
[238] Constitution of the People's Republic of China (2004), Article 85.
[239] Heilmann (2004), 77.
[240] Law on Prevention and Control of Water Pollution (2008); Wouters et al. (2004), 261; Golding (2011), 399.
[241] Law on Prevention and Control of Water Pollution (2008), Article 1.
[242] Wouters et al. (2004), 261.

the National People's Congress issued the Water Law (中华人民共和国水法) and revised it again in 2002. The purpose of the law is to rationally and sustainably appropriate and conserve water resource 三.[243] Hence, the law also addresses the problem of water scarcity, as it is concerned with the volume of available water resources. The law does not replace the Law on Water Pollution, but points out that the governance of water pollution is still bound to the Law on Water Pollution.[244] These are the two laws which directly address the problems of water scarcity and pollution.[245]

The aims of these two laws directly correspond with the evaluation criteria for the outcomes of water, which are used in this thesis. First of all, the laws aim for environmentally friendly water usage, as they aspire to the maintenance of ecological functions of water bodies and obviate water pollution.[246] Secondly, the Water Law aims at ensuring fairness between all water appropriation as "no unit or individual may divert, intercept (store) or drain off water at the expense of public interests or another person's legitimate rights and interests".[247] The Law on Water Pollution establishes that polluters have to compensate actors, which have been harmed by water pollution caused by them.[248] This means that negative externalities are theoretically internalized, which is defined as a fair situation in this thesis. Thirdly, the Water Law also calls for a "sustainable utilization of water resources"[249], also in the narrow sense of this thesis, as the law calls for the prevention of groundwater and surface water depletion,[250] which is the consequence of unsustainable water appropriation. This shows that the government has the goal of achieving better outcomes in terms of the evaluation criteria defined for this thesis.

Beyond these laws there are several national laws, which also but not primarily address water resource management. Among these laws is the Law on Environmental Protection, which was adopted in 1989 after being adopted for trial implementation in

[243] Water Law (2002), Article 1.
[244] Water Law (2002), Article 81.
[245] There are three more water specific laws in China, which do not directly address the problems at hand. The first one is the Law for Flood Prevention and Control, which was adopted in 1997, and the second one is the Law on Water and Soil Conservation, which was first adopted in 1991 (Wouters et al, 2004, 257). The latter law is concerned with soil erosion and its impact on soil and water resources (Law on Water and Soil Conservation, 1991). The third one is the Marine Environmental Protection Law of 1982 (Xie et al., 2009, 133; Klein, 2004, 101), which is not concerned with fresh water, however, and therefore is not central to this thesis.
[246] Water Law (2002), Articles 9, 21, 31; Law on Prevention and Control of Water Pollution (2008), Article 1, 3.
[247] Water Law (2002), Article 28; This translation is offered by the translation of the law on the government's website.
[248] Law on Prevention and Control of Water Pollution (2008), Article 28.
[249] Water Law (2002), Article 1; This translation is offered by the translation of the law on the government's website.
[250] Water Law (2002), Articles 30, 31, 36.

1979.[251] The law also addresses the problems of water pollution caused by agriculture and industry and the drying of water bodies.[252] These three national laws show that the CPC leadership and state legislation are aware of the water crisis and have tried to solve the problems with the legal instruments available. This holds true for the second leadership generation under Deng Xiaoping,[253] as these three laws were first adopted in the 1980s and thus in their period of leadership. These laws were improved[254] though revisions by the third and forth leadership generation under Jiang Zemin and Hu Jintao, respectively.[255] This implies that it was also a preference of these political leaders to solve the water problems. It can also be noted that the provisions of the Constitution, which are analyzed in the previous chapter, have been transferred into national laws, which is the first step of the implementation process.

A second indicator of the leadership's engagement in water resource management is the Five-Year Plans, which are drafted and implemented by the State Council and approved by the National People's Cogress. [256] These plans give an overview of what the Chinese leadership wants to achieve during the upcoming five years. The Ninth Five-Year Plan (1996-2000) aimed at increasing water conservancy in agriculture and industry, at providing drinking water in rural areas, at pollution control, and at transferring water from the South to the North.[257] These goals can also be found in the Tenth and Eleventh Five-Year Plans, but with new ideas on measures to achieve these goals. These two plans, among other issues, call for the development of a water pricing mechanism, raising public awareness, and integrated river basin management. [258] The Twelfth Five-Year Plan (2011-2015) calls for water conservation in agriculture, industry, and by households and the treatment and reuse of wastewater. [259] These examples from the Five-Year Plans shed light on the willingness of all leadership generations, starting with the second one, to improve water resource management.

To implement these national laws, the State Council has issued around 17 administrative regulations, 54 rules by departments of the State Council, and about 800 local rules as of 2011.[260] Among these administrative regulations is, for example, the Administrative Regulation on Water-drawing Permits and Levying Water Resource Fees (取水许可和水资源费征收管理条例) from 2006.[261] This proves that the engagement of the

[251] Klein (2004), 99; Song (2004), 233; Ma et al. (2000), 16.
[252] Law on Environmental Protection (1989), Article 2, 20, 25.
[253] Heilmann (2004), 47f.
[254] Winalski (2009), 182; Wouters et al. (2004), 274.
[255] Heilmann (2004), 47f.
[256] Constitution of the People's Republic of China (2004), Article 62, section 9; Article 89, section 5.
[257] Report on the Outline of the Ninth Five-Year Plan (1996).
[258] Xie et al. (2009), 27.
[259] Twelfth Five-Year Plan (2011), section 22, article 2; section 23, article 1; section 24, article 1.
[260] Liang (2011).
[261] MWR (2011b).

leadership does not end with adopting laws, but that they also aim on implementing these laws.

Shifts within the organizational structure of the State Council further underline the impression that the leadership is concerned about the water crisis. The State Council currently comprises 27 ministries and commissions, and one of these is the Ministry of Water Resources (中华人民共和国水利部).[262] This ministry had already been established in 1949, but was merged with the Ministry of Power Industry at times. Since 1988 the Ministry of Water Resources has existed as a separate ministry.[263] This institutional change was induced by the 1988 Water Law, which called for the establishment of departments for water administration under the state council and at the provincial, prefecture, and county levels.[264] The Ministry of Water Resources is responsible for managing the volume of water resources,[265] including water allocation and conservation, flood control and drought relief, drinking water supply and management, and protection of water bodies.[266] Another ministry which is important for water governance is the Ministry of Environmental Protection (中华人民共和国环境保护部), as it is concerned with water pollution.[267] Like environmental policy in general, this ministry has a very short history in China, which started in 1974 when the National Environmental Protection Office under the State Council was established. Its bureaucratic status was upgraded several times before it reached the rank of a ministry in 1998 and was called the State Environmental Protection Agency (SEPA).[268] In 2008 it was finally renamed the Ministry of Environmental Protection (MEP).[269] This institutional upgrade reflects that the central government has attached more and more importance to environmental protection, including the control of water pollution.[270] While the rank of these two ministries implies the importance of water resources in the central government, this description also indicates a central problem: Water resource management is split between several responsible entities in the central government. Water quantity and quality are governed by two different ministries. Moreover, several other ministries have a say in water management, including the Ministry of Agriculture, the Ministry of Housing and Urban-Rural Development, and the Ministry of Land and Resources. The involvement of many actors at the central level in water management frequently has hampered coordination and creates conflicts at the national

[262] Ministries and Commissions under the State Council (2005).
[263] MWR (n.d.).
[264] Wouters et al. (2004), 260, 263, 289; Water Law (1988), Article 9.
[265] Nickum et al. (2007), 84.
[266] MWR (n.d.); Wouters (2004), 289f.
[267] Nickum et al. (2007), 84.
[268] Mol et al. (2007), 4.
[269] Xie et al. (2009), 40.
[270] Golding (2011), 404; Mol et al. (2007), 9.

level.[271] The problem of fragmentation is replicated on the local level, as there are water resource departments, which are supervised by the MWR, and there are environmental protection bureaus (EPBs), which are overseen by the MEP on the different local levels of government. The EPBs are responsible for water quality, and the water resource departments are concerned with the volume of water.[272]

From a public goods theory perspective, it seems logical that the central government engages in water management because water resources are frequently overexploited and polluted. This means that the positive external effects of the resource are overused by water appropriators and water polluters. Alternatively, it means that water polluters pass negative externalities of their activities, in form of pollution, on to water resources and appropriators. As the central government internalizes all externalities and hence experiences the drawbacks from the negative externalities and the shortage of water resources, the leadership has an incentive to improve water management. However, it is also logical that the central government has other preferences besides water management, and these partly run counter the goals of water conservancy. A striking example is the goal of the leadership to increase grain production. The rationale behind this aim is that the government wants to ensure food security, social stability, and sufficient incomes in rural areas.[273] The then Premier Li Peng reported in 1996 that grain production was to be increased to at least 490 million tons by the year 2000 by further expanding farmland and increasing the grain production per hectare of farmland.[274] Similarly, the Eleventh and Twelfth Five-Year Plan also aim at higher grain outputs and higher productivity in this sector, to pursue the goal of grain self-sufficiency and to achieve food security.[275] In the 1990s this aim of the government was reflected in several policies, and indeed grain production in China increased subsequently. To reach this goal, the irrigated area has been expanded and fertilizers and pesticides have been used to increase the grain yield per hectare of cultivated land. In grasslands this has lead to water shortages and desertification and the use of chemicals has added to water pollution.[276] Even though the plans do not promote the use of chemical fertilizer and even call for controlling pollution caused by chemical fertilizer,[277] their application has steadily risen in the past 40 years without a sign of change in trends. Fields that are cultivated with organic fertilizer produce less grain.[278] These agricultural goals of the central government thus

[271] Nickum et al. (2007), 84f; Xie et al. (2009), 30f; Wang et al. (2008), 655f.
[272] Xie et al. (2009), 31f; Wouters et al. (2004), 300.
[273] Yang et al. (2005), 6.
[274] Report on the Outline of the Ninth Five-Year Plan (1996).
[275] The Eleventh Five-Year Plan (2006), section 4, article 1; The Twelfth Five-Year Plan (2011), section 5, article 1.
[276] Economy (2004), 77-80.
[277] The Twelfth Five-Year Plan (2011), section 7, article 4.
[278] National Bureau of Statistics (2009), 12-6; Sanders (2006), 217.

seem to be contrary to the aim of solving the water scarcity and pollution problems in the country. It shows that the leadership clearly has other preferences than only water governance, which possibly run counter to improved water governance.

Considerable progress has been made with water governance at the national level, as national laws have been adopted and revised, which manage water resources and are the first step to implementing the constitutional provisions. Water governance also benefits from the increasing environmental awareness among the leadership, which has also lead to the upgrade of the environmental department under the State Council. However, although the central government is interested in improving the water situation, which is understandable as they internalize all externalities of the good, the central government has a broad agenda and pursues other goals that sometimes run counter to their water management goals. Moreover, the institutional structure within the State Council is fragmented and the legal framework has yet to be perfected.

6.2.2. Implementation methods of water governance

This thesis differentiates between four types of implementation methods at the collective-choice level. The policies originate in the national laws, which are briefly introduced in the previous chapter. The policy instruments introduced in this chapter are assessed using public goods theory and tested for their effectiveness on the operational level.

6.2.2.1. River Basin Management Commissions

The revised 2002 Water Law pertains on the establishment of River Basin Management Commissions (RBMC) under the Ministry of Water Resources for China's key rivers and lakes defined by the State Council and for rivers and lakes, which boarder more than one province level jurisdiction. RBMCs are thus responsible for one river basin and should supervise and manage water resources in the basin together with the water resource departments at the provincial, prefecture, and county level.[279] The decision to establish RBMCs is thus more an intermediate step in water governance, as not just the establishment of the RBMCs itself solves the water problems, but the actions of the newly established RBMCs are intended to support water resource management.

The idea behind RBMCs is to govern a river basin and its water resources as a whole instead of dividing its management up between adjacent jurisdictions or sectors. Integrated river basin management has become popular internationally since the 1990s and is not limited to China. It has been implemented in several countries, including South Africa and the United States. RBMCs typically include members from federal and central governments and other actors. Ideally, the committee coordinates economic interests with environmental protection and the demands of different jurisdictions regarding water

[279] Wouters et al. (2004), 293; Water Law (2002), Article 12, 17.

resources to the benefit of all actors involved and the environment. The rights and responsibilities of the RBMCs are a first step in establishing such integrated river basin management.[280]

In China, RBMCs have a long history, as the first ones were set up as early as in the 1930s for the Huang He, Chang Jiang and Huai He. These organizations continued to exist in the early period of the People's Republic but were party dismantled in the chaotic phases of the Great Leap and the Cultural Revolution. In the late 1970s and early 1980s RBMCs were reestablished for China's six key rivers Chang Jiang, Huang He, Hai He (海河, Hai River), Huai He (淮河, Huai River), Zhujiang (珠江, Pearl River), the Song-Liao Basin[281] and the Taihu under the Ministry of Water Resources and Hydropower. [282] Hence, RBMCs have existed in China for a long time. Until the 2002 Water Law, however, these organizations had not been defined systematically by the legal framework.[283] The 1988 Water Law only states that "development and utilization of water resources as well as in controlling water disasters, overall planning shall be undertaken with river basin or region as basic units"[284]. RBMCs were also mentioned in the Flood Control Law and the Water Pollution Prevention and Control Law, but no systematic and detailed description of the role and rights of RBMCs can be found.[285] The 1988 Water Law moreover called for "a system of unified administration on water resources in association with administration at various levels and by various departments"[286]. As the decentralization process during the reform period empowered the local governments and weakened the central influence and investment to RBMCs,[287] water resource management was mainly determined by local and sectoral interests and was not unified in practice. [288] This description shows that integrated river management has a long history in China, but the according legal framework is still very young.

The 2002 Water Law is the first law to give a detailed description of RBMCs in China.[289] In Article 12 the law states that "the State applies the system under which

[280] Xie et al. (2009), 49f; Finger et al. (2006), 21.
[281] The Song-Liao Basin comprises several rivers, including the Liao He (辽河, Liao River), the Songhua Jiang (松花江, Songhua River) and the Heilong Jiang (黑龙江) (Songliao Water Resource Commission, n.d.)
[282] Shen (2004), 350-352.
[283] Shen (2004), 359.
[284] Water Law (1988), Article 11; This translation is offered by the translation of the law on the government's website.
[285] Shen (2004), 357.
[286] Water Law (1988), Article 9; This translation is offered by the translation of the law on the government's website.
[287] Also see also Heilmann (2004), 101f; 109f.
[288] Shen (2004), 354-356.
[289] Shen (2004), 357.

management of river basins is combined with management of administrative regions"[290]. The functions of RBMCs according to the 2002 Water Law are to control the construction or expansion of sewage outlets along their water body, work out water allocation plans for emergency situations to be approved by the State Council, account for ecological functions of water bodies and proper groundwater levels when drafting plans for water utilization, supervise the enforcement of the Water Law and impose fines on law violators, issue water use permits and collect water fees, and examine if waterworks construction are in line with the comprehensive river basin plans.[291] Comprehensive river basin plans are worked out by RBMCs and local governments for river basins, which cross provincial borders, and are then examined by the MWR. In this regards integrative river basin management has been strengthened with the 2002 Water Law, as the 1988 Water Law stipulates that comprehensive river basin plans are supposed to be made by the water department of local governments for all water bodies except the key rivers and the Taihu and not by RBMCs. For key rivers, these plans are worked out by the MWR before they are submitted to the State Council for approval.[292] The 2002 Water Law thus describes the role of RBMCs in a much more detailed manner than the previous version of the law,[293] and it strengthens the role of RBMCs with regard to comprehensive river basin plans.

The way that RBMCs can improve water resource management can be perfectly explained with Public Goods Theory. A RBMC is an actor that internalizes all territorial and sectoral positive externalities of water resources and all negative externalities, which impact water resources. As a government agency, it takes all sectoral externalities into account, and the law explicitly states that RBMCs are advocates of the ecological functions of rivers, which means that the actor also internalizes externalities that impact the ecological realm. In contrast to local governments, the jurisdictions of RBMCs also internalize territorial externalities because they by definition comprise an entire river basin or lake. From a theoretical perspective, RBMSs would thus prefer a fair distribution of water resources between upstream and downstream appropriators in the basin and have an interest in maintaining the water flow that is necessary to fulfill the ecological functions of water.

In practice, however, the RBMCs involvement and effectiveness is limited, and this is partly caused by shortcomings in the 2002 Water Law. First of all, local governments have a strong position in water governance, which undermines integrated river basin management. This can be explained with the resistance of local governments, whose authority on water resources is impacted by integrated river basin management. For

[290] Water Law (2002), Article 12; This translation is offered by the translation of the law on the government's website.
[291] Water Law (2002), Articles 19, 30, 34, 45, 48, 59, 60.
[292] Water Law (1988), Article 11; Water Law (2002), Article 17.
[293] Shen (2004), 360.

instance, in the process of revising the Water Law in the early 2000s, local actors have objected to the plan of giving extensive power to RBMCs in Article 19, which was envisioned in the original draft. Also the local actors have succeeded with their objection, [294] which lead to rather limited powers of the RBMCs in that article. Article 19 in the 2002 Water Law states that waterworks construction should abide by the comprehensive river basin plans. The RBMC's role in the permit process for such construction projects is to confirm the conformity of the project with the comprehensive river basin plan, if the waterworks are to be built on a major river or a river which runs across provinces.[295] This shows that bargaining has compromised the idea of integrated river basin management. Especially the provincial governments have a strong influence on national decision-making, [296] and this seems to be a deeply rooted problem in the establishment of integrated river basin management, as the empowerment of RBMCs by definition impinges on the authority of local governments. From a Public Goods Theory perspective, local governments are not the favored decision-making unit for water governance because they do not internalize territorial externalities as much as RBMCs do. In theory, local governments have an interest in using positive externalities of water in a way which is unfair to other water appropriators or has a negative impact on the environment.

Secondly, RBMCs only monitor the water quality but do not control water pollution. The underlying problem is that the authority of the MWR is limited to water quantity management, and water quality management is an issue governed by the MEP. Since the RBMCs are subordinate to the MWR, these organizations have the same limitations.[297] The separation of water resource management to separate actors at the central level thus replicates itself on the local level. RBMCs would be more suitable for internalizing the negative external effects, but whereas integrated river basin management has made progress regarding water resource allocation, this is not the case for water quality management. However, this statement requires a minor modification: The 1996 and 2008 Laws on Prevention and Control of Water Pollution stipulate that Water Resource Protection Agencies (水资源保护工作机构) for major basins should monitor the water quality in the basin and report to the MEP and the MWR,[298] which can be regarded as an advantage over the 1984 version of the law, which lacks this provision.[299] For the Huang He this Water Resource Protection Agency (黄河流域水资源保护局) exists as a unit within the RBMC of the Huang He, namely the Yellow River Conservancy Commission (YRCC,

[294] Gleick (2009), 89; Shen (2004), 362; Wouters et al. (2004), 303.
[295] Water Law (2002), Article 19.
[296] Heilmann (2004), 106f; Shen (2004, 362) similarly writes about "strong jurisdictional management traditions" (ibid.) in this regard.
[297] Xie et al. (2009), 32f; Shen (2004), 356f;
[298] Law on Prevention and Control of Water Pollution (1996), Article 18; Law on Prevention and Control of Water Pollution (2008), Article 26.
[299] Law on Prevention and Control of Water Pollution (1984).

黄河水利委员会). It is a co-operative effort of the MWR and the MEP.[300] Although according to the law its function is only to monitor water quality, it is at least a sign of cooperation between both ministries and national level involvement in water quality management.

As the water quality management remains in the hands of local governments, the territorial negative externalities of water pollution remain and hamper the improvement of water quality in China. This is a major limitation to integrated water resource management. In the case of the Wei He (渭河, Wei River), which is a tributary of the Huang He, the central government in fact tried to tackle the problem of water pollution with an integrated management model, but failed. In 2002 the State Council approved an integrated management plan for the river, because of the serious water pollution and water shortages in the basin. The central government contributed 62% of the total project budget, but only 20% to the budget for pollution control, which accounted for only 14% of the total budget. The remaining 80% of the water pollution control budget were supposed to be paid by local governments. Since the local government failed to contribute this investment, the part of the project for pollution control has been left out.[301] When comparing the reports of the MEP, the water pollution of the Wei He has remained on a high level, with the lower reaches of the river failing to meet grade V standard between 2004 and 2009.[302] This indicates that effective integrated pollution control is not in place yet. The reports also do not mention any progress on the pollution control of the Wei He.[303] In this exceptional case of integrated water governance regarding water pollution, the fiscal reliance of local governments hindered the project.

Thirdly, the functions of RBMCs and local governments as stated in the law overlap and are not clearly defined. This, however, is important in light of the powerful status of local governments in China.[304] An example for this shortcoming is Article 34, which establishes that "[c]onstruction, reconstruction or expansion of a sewage discharge outlet along rivers or lakes shall be subject to permission by the administrative department for water resources or the river basin authority"[305]. This is one example where the law does not specify which unit is responsible for issuing sewage outlet permits. Another example is that comprehensive river basin plans for rivers which cross provincial boarders

[300] YRCC (n.d. a); YRCC (n.d. b).
[301] Xie et al. (2009), 115f.
[302] MEP (2005); MEP (2006); MEP (2007); MEP (2008); MEP (2009); section (fresh-) water environment, respectively.
[303] MEP (2005); MEP (2006); MEP (2007); MEP (2008); MEP (2009).
[304] Xie et al. (2009), 45; Shen (2004), 362.
[305] Water Law (2002), Article 34; This quote is taken from the translated version of the law on the government's website.

are to be developed by the RBMCs "in conjunction with"[306] provincial level governments. As can be learned from public goods theory, the RBMCs and local governments are likely to have different interests regarding water governance, which can hamper decision-making. It is thus even more important that the rights of different public actors are specified.

In addition, RBMCs and local governments have to cooperate in order to improve water management, but there is a lack of cooperation. For example, the RBMC of the Hai He is responsible for water allocation, but most operational tasks are assigned to local governments at different levels in the basin. The RBMC, however, does not include members of these local governments, which hampers cooperation of these actors. Effective water governance also depends on the cooperation of these two types of actors because local governments are major sources of funding for water pollution control and water conservancy investment, as the central government only contributes a small percentage to the total funding.[307] Integrated river basin management thus depends on the cooperation of RBMCs and local governments, but an institutional gap hampers cooperation.

Xie et al. (2009) thus observe that water resource governance is still dominated by the traditional jurisdictions instead of RBMCs, whose authority is limited, although an integrated approach is envisioned by the 2002 Water Law. Additionally, dominance of local governments obviously has detrimental consequences for water resources as has been explained with public goods theory:

> "The existing regime of water resource management is mainly based on administrative boundaries of different levels of government rather than at the river basin level. Each level of government has its own focal points and priorities. This makes the management of transboundary rivers difficult. Sector and basin-wide objectives, such as abating pollution, balancing upstream and downstream needs, and protecting aquatic ecosystems, tend to have relatively low priority among local authorities, who have an incentive to focus local resources on meeting local needs. For example, the benefits from pollution abatement and water savings in one province will be felt farther downstream."[308]

The water volume management of the Huang He can be regarded as a successful example of integrated river basin management, even though challenges remain in the basin as well. The Huang He ran dry before reaching the sea for the first time in 1972, and since 1985 it dried out before reaching the sea part of each year because too much water was withdrawn from the river. In 1997 the river did not reach the sea for 228 days, as up to 95.6% of the river's flow was withdrawn. To improve this condition, the YRCC was

[306] Water Law (2002), Article 17; This translation is taken from the translated version of the law on the government's website.
[307] Xie et al. (2009), 33; Shen (2004, 362) also mentions the lack of representation of all stakeholders in the RBMCs, and even calls participation in a broader sense "the weakest point in river basin management in China" (ibid.).
[308] Xie et al. (2009), 32.

established and started managing water resources in 1999. Since then the RBMC allocates water resources to the adjacent provinces and ensures that the proper river flow is maintained. The management strategy was expanded to the tributaries of the main stream. Consequently, the river has not dried out since the early 2000s. However, the people in the basin still experience water shortages, and water withdrawals are still tremendous. Additionally, water pollution has not been solved by this approach,[309] especially in the tributaries of the Huang He.[310] This is thus a rather positive example of how integrated river basin management has helped to improve the problem of water allocation in China.

This subchapter introduces the strategy of integrated river basin management which has received a legal basis by the 2002 Water Law. As RBMCs internalize all externalities in a river basin, it is in theory an effective approach to allocate water resources and limit water pollution in a way that is fair to all appropriators, good for the environment and sustainable. In the case of the Huang He, it had indeed improved the local water allocation problems. However, integrated river basin management is still highly limited in its effectiveness, as the authority of RBMCs is limited by the extensive powers of local governments. Moreover, integrated river basin management is mainly envisioned for water quantity and not for water quality. RBMCs have preferences, which would help to solve the problems of water scarcity and pollution, but do not have the capacity to fully implement their preferences. This undermines the implementation of integrated water resource management, because local governments often have preferences, which contradict more effective water governance. Moreover, the Water Law does not state the responsibilities of the different stakeholders in a sufficiently clear manner. As a state actor in water governance, the RBMCs are mentioned continuously in the following chapters.

6.2.2.2. State planning and directives

This subchapter analyzes directives which are used by the central government to manage water resources through the bureaucratic system. The directives are stated in the national laws and are defined in more detail in the administrative regulations of the State Council and the rules of the ministries and local governments. By these means central directives are passed to the local level and the water appropriators.[311]

[309] AQUASTAT (2010a); Xu (n.d.); The Huang He probably dried out in 2002 which can be deduced from the fact that 95.3% of the river flow was withdrawn in that year. About the same proportion was withdrawn in 1997 which caused the river to dry out (Xu, n.d.). In what exact year the river dried out for the last time is not indicated in the sources used for the thesis.
[310] MEP (2009).
[311] Ross (1988), 11-15; This type of measure as defined in this thesis is based on the policy instrument by Ross (ibid.), which he calls “bureaucratic-authoritative implementation” (Ross, 1988, 11). Ross (1988, 11) defines the implementation type as plans and commands, which adhere to the agenda of the CPC and government leadership and are passed to the lower levels of government for implementation. However, Ross’ (1988) definition is broader than the one used in this thesis, as

This approach was very prominent during the period of planned economy in China. Ideally all goods should be regulated by the state in a planned economy, but in reality only a fraction of the large variety of goods has been controlled.[312] The management of water resources had also been neglected in the planned economy, as was shown in chapter 6.1. The approach of direct state regulation of resources is based on state ownership which has been regularized ever since the first Constitution of the People's Republic was adopted in 1954[313] (see chapter 6.1). Even though China emerged as a "'socialist market economy'",[314] water governance through direct state regulation is still important, as is shown in the next paragraphs. The overall political path as described in chapter 5 is decisive for the policy measures taken by the government to solve the water crisis.

At first, state directives concerning the volume of water resources and water consumption are analyzed before proceeding to directives, which aim at reducing water pollution. In the 1980s, when the mounting water demand could not be fully satisfied anymore, the central government aimed at lowering water consumption by bureaucratic means. Therefore, the government set water consumption norms for companies, which defined the volume of water available to the company in case of low water supply. This set incentives for companies to use less water. In times of drought, which also occurred in the 1980s, water was occasionally shut off. However, consumption norms were often neglected by the companies as higher production outputs were regarded to be more important, and these measures did not teach water appropriators how to conserve water.[315] Hence, the approach of directly curbing water consumption of individual water appropriators seems to have been unsuccessful at the time. Apparently the consumption norms were insufficient to internalize the negative externalities of water consumption, which arose in the course of industrial production.

Today the government employs a system of water allocation plans and water use permits to regulate the overall water consumption in the country. The legal basis of this approach has been the Water Law since 1988. The 1988 Water Law establishes that the state should allocate and conserve water. The MWR works out long-term plans for water demand and supply for the entire country, and the water resource departments work out long-term plans for their jurisdictions in accordance with the plan of the next higher administrative level. Moreover, comprehensive river basin and regional plans are to govern water resource utilization. As mentioned in the previous subchapter, these plans should be prepared by the MWR for major rivers and by water resource departments of

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it also comprises infrastructure projects and the idea of installing RBMCs (Ross, 1988, 99f., 102), which are regarded as separate instruments in this thesis.

[312] Ross (1998), 11f.

[313] 1954 Constitution of the People's Republic of China, Article 6 (p. 155).

[314] Saich (2004), 78.

[315] Ross (1988), 103.

local governments for other rivers and regions according the 1988 Water Law. Moreover, the law calls for the establishment of a water use permit system, which should register all actors that directly withdraw water from rivers, lakes, and aquifers, except those who only withdraw small amounts of water for household use or watering livestock. This system is supposed to be considerate of the ecological water demand and the demand of up- and downstream users.[316] This way water does not simply appear to be a common-pool resource anymore, which would allow anyone to access water. Instead the state has begun to coordinate and manage water appropriation, which can be seen as a first step to heighten the excludability of water.

The shortcomings of the water allocation system as established by the 1988 Water Law are related to the idea of integrated river basin management discussed in the previous chapter: The 1988 Water Law does not stipulate that RBMCs are involved with drafting the river basin plans, but establish the responsibility of local governments to make these plans.[317] The lack of planning is explained using the case of the Talimu He (塔里木河, Tarim River) in Xinjiang Autonomous Region, which is described by Wouters et al. (2004). The Talimu He has suffered from excessive water withdrawals for irrigation. Water management before the 2002 Water Law was implemented by the water department of the Xinjiang government and the prefectures, which favored agricultural output over the ecological balance of the river. The prefectures worked out five-year plans to manage water resources in their jurisdictions according to their water demand, not considering the downstream regions or the ecological water demand. The RBMC of the Talimu He, which was established in 1992, generally lacked the authority to change the water management in the basin and additionally only governed the main stream but not the tributaries of the Talimu He.[318] This shows that the actors, which were involved in allocating water resources, had either other preferences than managing water resources in a fair, ecologically friendly, and sustainable manner, or – in case of the RBMC - did not have the power to implement improved water allocation. The prefectures do not internalize all externalities of water and thus have an incentive to create negative externalities in the form of excessive water consumption and pass these on to their downstream neighbors. Indeed, the 1988 Water Law does not mandate that an RBMC is to allocate water in a basin but holds Xinjiang Province responsible for water allocation on the Talimu He basin because it crosses prefecture boarders, but completely lies within the province. The provincial government should consult with the local level governments on water allocation

[316] Water Law (1988), Article 7, 11, 13, 30-32.
[317] Water Law (1988), Article 30.
[318] Wouters et al. (2004), 265-268.

according to the 1988 Water Law.[319] This provision of the law was obviously not followed, as the prefectures seem to have been the primary planners in this case.[320] The provincial government theoretically internalizes all sectoral and territorial externalities and thus would be an appropriate actor for allocating water resources. In reality, the provincial government has shown interest in improving water allocation with a regulation from 1998 that authorizes the RBMC to allocate water resources in the entire basin, including the tributaries, and to set limits of water withdrawals for each prefecture in the basin.[321] However, as the flow of the Talimu He further lowered in the 2000s due to increased human consumption, the allocation plan obviously did not effectively limit the overall water consumption, because water consumption further increased.[322] The reason for the further increase in water consumption is the increase in agricultural production, especially cotton production, in the region. In 2008 Xinjiang produced about 40% of China's total cotton output and cotton production in the region has increased faster than the nation's average. Cotton production is an important source of revenue in Xinjiang and the government of the Autonomous Region has advocated cotton production, although experts have given warnings on the environmental impact of the increased agricultural activities.[323] This thus seems to be an obvious case of conflicting interests of local governments, and economic considerations seem to have offset environmental concerns. The case of the Talimu He is an example for insufficiently functioning water allocation due to conflicting interests of governmental actors and the weakness of RBMCs before the 2002 Water Law was approved.

The 2002 Water Law has improved the legal provisions for water allocation and permits. The comprehensive river basin plans for rivers that cross provincial borders are to be worked out by the RBMCs in cooperation with local governments instead of merely local governments.[324] Moreover, the central government has strengthened the permit system for water withdrawals with the 2002 Water Law, which becomes evident when comparing the wording of the two versions of the Water Law. The 1988 Water merely

[319] Water Law (1988), Article 32; The Article in the translated version reads: "[…] Water allocation plan covering different administrative divisions shall be formulated by the water administrative department of the people's government at the next higher level after consulting with the concerned local people's governments, and shall be implemented after approval is granted by the people's government at the corresponding level." (ibid.)
[320] Wouters et al. (2004), 268.
[321] Wouters et al. (2004), 271-273.
[322] Tao et al. (2011), 1, 8.
[323] Ahlheim (2009), 4; Yu et al. (n.d.); National Bureau of Statistics (2009), chart 12-15; Xinhua (2010); From the statistics of the National Bureau of Statistics (ibid.) it can be calculated that 40% of Chinese cotton comes from Xinjiang, and Xinjiang cotton only accounted for 32% in 2004 (Yu et al., n.d.). Hence, cotton production in Xinjiang has increased above the national average increase.
[324] Water Law (2002), Article 17.

states that "the State shall exercise a water-drawing permit system",[325] while the 2002 Water Law aims at a comprehensive and mandatory permit system:

> "Any unit or individual that takes water and uses water resources directly from a river or lake or from the underground shall, in accordance with the regulations of the licensing system of the State for water-taking and the system for compensated use of water resources, apply to the administrative department for water resources or the river basin authority for a water-taking license and pay water resources fees, in order to acquire the right to take water."[326]

The wording thus indicates a strengthening of the permit system. Both versions of the law make exceptions for the withdrawal of small amounts of water for domestic use.[327] The Administrative Regulation on Water-drawing Permits and Levying Water Resource Fees, which the State Council passed in 2006, specifies the implementation of the permit system. The volume, which each water appropriator is allowed to use by its permit, depends on the quota for the industry or trade. The total volume of water which is allowed to be withdrawn through the permit system has to be in accordance with the overall allocation of water resources and thus also with river basin plans.[328] Water management through state planning thus has been improved considerably over time.

An example of how the water allocation and permit system works in practice is the Huang He Water Allocation Plan, which was adopted by the State Council in 1987. Xie et al. (2009) judge that the system in this basin is "perhaps the most sophisticated example of the application of a water rights system in China"[329]. The plan determines a cap on total water withdrawal per year, which is adapted to the average annual flow of the river. A proportion of the total annual water withdrawals is assigned to each province which lies within the river basin. If the stream flow is below average in a year, the water portion of each province is adjusted to the actual volume available in that year. Actors, who directly withdraw water from the river, have to obtain water use permits, which are valid for a season or a year. This allocation scheme is in place to ensure that the stream flow is maintained and that downstream regions are not deprived of water. The plan envisions that about 36%[330] of the Huang He's natural runoff will remain in the river. The plan has been implemented since 1999. In 2002 still 95% of the river's water was extracted, but in recent years the river has not run dry, which can be interpreted as a success of the

[325] Water Law (1988), Article 32; This translation is taken from the translated version of the law retrieved from the government's website.
[326] Water Law (2002), Article 48; Water resource fees are discussed in the following chapter. This quote is retrieved from the translated version of the law, which is available on the government website.
[327] Water Law (2002), Article 48; Water Law (1988), Article 32.
[328] Administrative Regulation on Water-drawing Permits and Levying Water Resource Fees (2006), Article 6, 16.
[329] Xie et al. (2009), 69.
[330] This can be calculated from Xu (n.d.): 21 billion m^3 should remain in the basin and 37 billion m^3 are allocated to the adjacent provinces and Hebei and Tianjin.

allocation plan. However, the permit system only covers about 57% of all water users in the basin [331] and is thus not comprehensive enough.

In theory the system of water allocation and water use permits is a bureaucratic measure to achieve better outcomes regarding water appropriation on the operational level. This means that enough water should remain in water bodies to enable it to fulfill its ecological functions, and that water should be allocated fairly to all water appropriators. Water consumption should be sustainable in a sense that the level of consumption could theoretically be maintained over an infinite period of time. These aims are also formulated in the 2002 Water Law for water allocation.[332] The allocation system in theory regulates the access of all actors to water and limits the volume of water available to a basin or region. Regarding Public Goods Theory, this provides the opportunity to exclude actors from using the good. This means that water is not a real common-pool source anymore, but shifts towards a private good. It is still difficult to exclude actors from the good, but the government nonetheless aims on doing so. Water appropriators have to purchase a permit to withdraw water and are excluded otherwise, which is a property of a private good. Hence, water resources in China do not exist as pure common-pool resource today. It cannot, however, also be called a private good, as access for household use and livestock drinking is granted to everybody and does not require a permit.[333] Moreover, water could only be called a private good, if its positive externalities were entirely internalized. This is discussed in the next chapter, when analyzing water pricing.

Reality differs from these theoretical considerations on the meaning of these legal provisions. A problem of implementing the system is that it is not comprehensive and does not cover all water appropriators, as can also be observed in the Huang He basin. It seems to be especially difficult to register all groundwater withdrawals because of the large number of wells. Moreover, the coordination between the issuance of water use permits and water allocation plans is insufficient, so that the volume of water that is allowed to be withdrawn is inconsistent with the water available following the allocation plan.[334] The provision in the Administrative Regulation on Water-drawing Permits and Levying Water Resource Fees from 2006 described above is thus not fully implemented yet. These shortcomings show the difficulties of implementing the system of public water regulation as it is established in the national laws and regulations.

State directives are also an important implementation measure to ease water pollution in China. The first state directive to control water pollution was a rule, which was

[331] Xu (n.d.); Sun et al. (n.d.); Xie et al. (2009), 70.
[332] Water Law (2002), Articles 20, 21, 28.
[333] Water Law (2002), 48; In order to internalize all externalities of water resources, the price of water-drawing permits would have to reflect the real value of water. This issue is discussed in the next chapter, which broaches the issue of water pricing.
[334] Xie et al. (2009), 68f, 77f.

issued by the National Envirojnmental Protection Agency (NEPA) [335] in 1973 and specified wastewater discharge standards for industrial enterprises. This standard specified the maximum concentration of a series of pollutants that were allowed in industrial wastewater. [336] This provision found its way into national law in 1984. The 1984 and 1996 version of the Law on Water Pollution state that the State Council should establish standards for water environment quality and standards for discharge of water pollutants.[337] The first standard defines the level of pollution, which is tolerable for a certain type of water body and standards for pollution discharge determine the concentration of pollutants in wastewater. [338] The obvious deficiency of this standard was that it only limited the concentration of pollutants, but not the mass of wastewater, which gave the enterprises the opportunity to meet the standard by simply diluting the pollutants in more water.[339] Indeed, the first Law on Water Pollution from 1984 does not provide for the control of the total volume of wastewater discharges.[340] This began to change in the 1990s, as the 1996 Law on Water Pollution stipulates that if the water environment standard could not be reached although the polluters meet the standard for wastewater, the central or provincial level governments has the right to "institute a system for control of the total discharge of major pollutants" [341]. The total discharge of major pollutants solved the problem of concentration based standards at least in theory. It is an example of how national legislation has improved over time.

Another type of state directive to prevent water pollution is the complete discharge prohibition for certain substances. A list of substances has already been provided in the 1984 Law on Water Pollution and among others comprises oil, acids, arsenic, mercury, lead, cyanide, and radioactive materials. These prohibitions are also found in the two later versions of the law. [342] In order to abate agricultural pollution, the government has prohibited the application of five highly toxic pesticides by 2007, which accounted for 25% of China's total pesticide use.[343]

The Law on Water Pollution also allows for several other types of state directives. In order to combat industrial pollution, the government since 1996 has had the right to eliminate outdated industrial equipment that causes serious water pollution, and local governments have the right to force closure of small enterprises which cause serious

[335] The National Environmental Protection Agency (NEPA) developed to today's Ministry of Environmental Protection under the State Council (Mol et al., 2007, 4).
[336] Ma et al. (2000), 18-20, 31.
[337] Law on Prevention and Control of Water Pollution (1984), Article 6, 7; Law on Prevention and Control of Water Pollution (1996), Article 6, 7.
[338] Winalski (2009), 193.
[339] Ma et al. (2000), 18-20, 31.
[340] Law on Prevention and Control of Water Pollution (1984).
[341] Law on Prevention and Control of Water Pollution (1996), Article 16.
[342] Law on Prevention and Control of Water Pollution (1996), Articles 29-36; Law on Prevention and Control of Water Pollution (2008), Article 76.
[343] Yang (2007), 2f.

water pollution, or obviate their construction.[344] Although this measure definitely has decreased industrial water pollution in the past, it would considerably harm the industrial sector, if this measure was frequently taken.[345] Besides prohibiting certain toxic pesticides, the agricultural departments of local governments should instruct farmers how to apply pesticides and fertilizers to avoid water pollution. This was introduced into national legislation with the 1996 Law on Water Pollution.[346] For urban sewage, all three versions of the Law on Water Pollution mandate that the wastewater discharges are treated and that local governments should organize the construction of treatment plants and supervise their operation.[347]

For the implementation of these standards and prohibitions, the law permits EPBs to inspect enterprises and construction projects that discharge wastewater, and the polluters have to report their wastewater discharges or changes of those discharges to the EPBs.[348] If the reports are untrue or are not submitted, inspections are circumvented, wastewater treatment facilities are not used, or other violations of these laws occur, including the discharge of completely prohibited substances, the EPBs have the right to warn or fine the violators.[349] Local governments are also entitled to close polluting businesses under certain circumstances.[350] In theory this system internalizes negative externalities in the form of water pollution. Without any control, actors have an incentive to pass part of the costs of their activities to other water appropriators and the environment and to keep the benefits of their activities to themselves, for example the benefits of private good production. Through the introduction of a fine system, the costs of water pollution are passed back to the polluter, so that the polluter internalizes the costs. Additionally, the fines are an incentive for actors to not produce negative externalities in the first place, but to bear the costs of wastewater treatment directly.

[344] Law on Prevention and Control of Water Pollution (1984), Article 38; Law on Prevention and Control of Water Pollution (1996), Articles 22, 23, 51; Law on Prevention and Control of Water Pollution (2008), Articles 41, 42, 78.
[345] World Bank (2001), 55.
[346] Law on Prevention and Control of Water Pollution (1984); Law on Prevention and Control of Water Pollution (1996), Article 39; Law on Prevention and Control of Water Pollution (2008), Article 48.
[347] Law on Prevention and Control of Water Pollution (1984), Article 10; Law on Prevention and Control of Water Pollution (1996), Article 19; Law on Prevention and Control of Water Pollution (2008), 44.
[348] Law on Prevention and Control of Water Pollution (1984), Articles 13, 18; Law on Prevention and Control of Water Pollution (1996), Articles 13, 14, 25; Law on Prevention and Control of Water Pollution (2008), Article 9, 17, 21, 27.
[349] Law on Prevention and Control of Water Pollution (1984), Article 37; Law on Prevention and Control of Water Pollution (1996), Article 46, 47, 48; Law on Prevention and Control of Water Pollution (2008), chapter 7.
[350] Law on Prevention and Control of Water Pollution (1984), Article 38; Law on Prevention and Control of Water Pollution (1996), Article 49, 50, 51, 52; Law on Prevention and Control of Water Pollution (2008), 74, 77, 78, 81, 83.

Although this system makes sense in theory, it has been impeded by implementation problems on the local level. The EPBs often lack the capacity to handle the tasks of inspections and to sue companies for fines, as they are under-staffed and face funding shortfalls.[351] This is even more understandable if one considers that the polluters employ strategies to hide their law violations. In Yunnan, for example, an EPB only discovered over-standard discharges during an inspection at night.[352] TVEs are widely scattered in rural areas, which makes it difficult for EPBs to keep track of these enterprises, let alone their wastewater discharges.[353] Local governments often do not have enough financial capacity to built or operate sewage treatment plants for domestic sewage. Investment in the urban sewer system has increased recently but only made up a relatively small proportion of urban investments in fixed assets.[354] Local governments are by law responsible for collecting funds to finance urban treatment plants,[355] which allows regional imbalance of development to affect urban wastewater treatment. Hence, local government actors are partly incapable of enforcing the law and prohibiting water pollution.

Additionally, controlling water pollution is not the only preference of EPBs and local governments; the incentive structure is not always in favor of controlling pollution. EPBs have tried to maintain a good relationship with companies and thus have negotiated fines with them and have adjusted the fine to the profitability of the company in order to avoid bankrupting local businesses. With the lowering of fines the incentives not to operate wastewater treatment facilities for industrial companies increased. In other cases the enterprises are informed about inspections. Local governments often favor economic development over environmental protection and maintain close relationships to local companies. They often depend on the tax revenues of their local enterprises. Township governments and village committees extract revenues from their collectively owned TVEs, and local governments collect revenues from SOEs. Hence, their influence on EPBs can also have negative effects on pollution control.[356] Local governments thus have reasons to be reluctant to close enterprises. In a case of water pollution in Gansu in the 1990s, the local government and the EPB tolerated a fertilizer factory discharging chemicals and fuel into a river because the enterprise was a provincial level state-owned enterprise (SOE),[357]

[351] Golding (2011), 405; Ma et al. (2000), 127, 136f; Van Rooij (2006), 61.
[352] Van Rooij (2006), 56, 62.
[353] Wang et al. (2008), 653.
[354] Xie et al. (2009), 38f.
[355] Law on Prevention and Control of Water Pollution (2008), Article 44; Xie et al. (2009), 32.
[356] Ma et al. (2000), 40, 50f, 117, 119, 121f, 128f; Golding (2011), 405; Economy (2004), 20f; van Rooij (2006), 59-62; Wang et al. (2008), 650f.; World Bank (2001), 56; Mol et al. (2007), 7; SOEs operated within the public economic plan were owned by the state, supervised by state organs at different levels, and their profits were retained by the state before the reform period. During the reforms, many SOEs were privatized, and state control over SOE lessened. TVEs, by contrast, have operated outside of state planning and are privately or collectively owned (Ma et al., 2000, 36, 40-47, 49f.).
[357] Economy (2004), 86.

even though this was already prohibited by national law at the time, as is described above. In six case studies by Ma et al. (2000) in the early 1990s, the EPBs have been very reluctant to impose fines for violations of the permit system, in order to maintain good relationships between local governments, EPBs, and the enterprises.[358] It thus becomes obvious that local governments and EPBs have other preferences besides enforcing national laws, which undermines their role as local enforcers of environmental law.

Together with the incapacity to enforce the law, these conflicting preferences have adverse effects on law enforcement on the operational level. Both factors are to be seen in context of decentralization, which occurred in the Chinese reform era and which is described in chapter 5. Decentralization has equipped local governments with more discretion on policy implementation and has given them the opportunity to adjust central directives to their local needs.[359] With regards to Public Goods Theory, the problem can be interpreted as a problem of collective action within the group that provides a common-pool resource.[360] The state by law is the designated provider of water resources and is not a single actor, but rather a group of state actors at different levels of government. Local governments have an incentive to free ride and not to provide the common-pool resource water. The central government only has limited means - partly because of the decentralized system - to solve these collective action problems on the local level. It thus appears as if the central government is challenged by collective action problems on the local level although the state possesses the monopoly on the use of force.

A case study by Van Rooij (2006) shows that in some cases wastewater discharges do not at all mean a negative external effect to other actors in the area. In a small village in Yunnan a chemical fertilizer plant discharged untreated wastewater into the Tanglang River. Because farmers depended on their jobs in the plant, they did not protest against the discharges, although the water pollution harmed their crop production. The local government depended on tax revenues paid by the factory. The EPB had long claimed that the factory abided by the discharge standards until it discovered illegal discharges at night. Until then, downstream industries had complained about the pollution, even involving the media, because the acidic water severely impinged on the operating of their enterprises. After the EPB found out about the law violation, the factory paid a fine and production was temporarily stopped by officials, but untreated discharges continued. This example shows the complex interdependencies between different actors in the region.[361] As the local government and residents shared the benefits of the production of the factory, they were not affected by wastewater in the form of external effects. Instead, they

[358] Ma et al. (2000), 116f.
[359] Heberer (2003), 48; see also chapter 5; Wang et al.(2008), 657.
[360] Kölliker (2006), 212f; Rittberger et al. (2010), 357f; see also chapter 2.1.
[361] Van Rooij (2006), 55f; 59f.

are to be seen as belonging to the group that produces private goods and passes the costs of pollution on to other actor. In this case, the actors that were affected by the pollution as negative external effects were the factories downstream, as they only suffered from the wastewater, but did not share the benefits of the factory in the upstream village. The example shows how water pollution can be tolerated by actors that are not affected by it as a negative externality and how preferences of local governments can differ from those of the central government.

Before it is shown how these imperfections of the water pollution control system are addressed in the 2008 Law on Water Pollution, the wastewater discharge permit system is introduced. The NEPA introduced a wastewater discharge permit system in light of further worsening of water pollution in the 1980s, which also accounted for the volume of wastewater, not only for the concentration of pollutants in the discharges.[362] The major idea of this system is to control the total discharge of wastewater and to issue wastewater discharge permits to polluters, which is similar to the approach for regulating water withdrawals. Discharge permits were first introduced in China by an interim measure of the NEPA in 1988, which authorized the EPBs to establish a discharge license system and a system to control the total discharge of pollutants. The measure applied to all actors which released wastewater directly into water bodies. The original Law on Water Pollution from 1984 and the revised law from 1996 did not establish such a system. [363] This system did not function properly due to several reasons. The system generally suffered from a lack of central supervision, as local governments could decide by themselves in what cases they wanted to issue permits. As many EPB staff felt that enterprises were unable to meet the more precise volume-based permits when they were even unable to meet the pollutant concentration standard, many EPBs decided to set permit standards that were relatively easy to meet. That was possible because EPBs were not required by law to limit the maximum allowance of pollutant concentration in permits to the national wastewater standards. In addition, most EPBs did not have the capacity to determine the maximum amount of pollutants a water body could absorb to still meet the water quality standard. Therefore the EPBs did not adjust the total amount of pollutants allowed by the permit system to the water quality standards. In most cases, the EBPs tried to keep the present level of pollution while more industrial output was generated. Enterprises overstated their pollution discharges when applying for a permit in order to have scope for potential increase of pollution discharges in the future. This meant that the permit system did not correctly monitor or control the total amount of pollution discharges but tolerated further increases. Finally, the permit system was by far not comprehensive, as no permit system

[362] Ma et al. (2000), 18-20, 24, 31.
[363] Winalski (2009), 188-190; NEPA (1988), Article 3, 9, 11, 12; Law on Prevention and Control of Water Pollution (1984); Law on Prevention and Control of Water Pollution (1996).

was established in many jurisdictions, and where such a system existed, wastewater continued to be released without permits.[364] These are the reasons that explain why the problem of water pollution has not been solved by this measure. However, it can be interpreted as a step towards controlling pollution.

Today the major legal basis for these measures is the 2008 Law on Water Pollution. It has improved the system described above in several ways. As in the previous versions of the law, the MEP issues national standards which define the level of pollution which is tolerable for a certain type of water body and standards for pollution discharge which determine the concentration of pollutants in wastewater.[365] In addition, the system of controlling the total quantity of certain pollutants is strengthened as it is not optional anymore. All provincial governments have to introduce such a system and should not only control, but also reduce the total quantity of pollutants. Those provinces, autonomous regions, or municipalities under the central government that have not met the target are announced in public,[366] which obviously is introduced to use public pressure to insure compliance. This creates incentives for local governments to abide by the rules and aims at solving the collective action problems at the local level.

Another improvement is the incorporation of the wastewater discharge permit system into national law, combining it with the standard systems and the total quantity control system. Through this system, the permit system accounts for the total quantity of pollutants in a jurisdiction, and the central state establishes the pollution limits in waster bodies, which indirectly grants the central state influence over the wastewater discharge permit system.[367] This could eliminate the shortcoming of low standards for discharge permits of local EPBs and the lack of coordination between standards and permits in the future because the EPBs now have to follow central directives. Furthermore, the 2008 law explicitly extends the permit system to domestic sewage discharges,[368] which makes the system even more comprehensive.

The 2008 Law on Water Pollution furthermore aims at changing the local incentive structure in favor of pollution control. Unlike the previous versions of the Law on Water Pollution, the 2008 Law on Water Pollution specifies the fines for certain rule violations,[369] which translates into higher fines in reality. This is supposed to prevent actors from

[364] Winalski (2009), 188-200; Ma et al. (2000), 100f, 109-112.
[365] Law on Prevention and Control of Water Pollution (2008), 11, 13; Winalski (2009), 193.
[366] Law on Prevention and Control of Water Pollution (2008), 18.
[367] Winalski (2009), 190f, 194.
[368] The NEPA (1998, Article 3) only stipulates the use of the permit system for "enterprises and institutions […] that directly or indirectly discharge pollutants into water bodies" (ibid.), which would in theory also apply to treatment plants for domestic sewage. The Law on Prevention and Control of Water Pollution (2008, Article 20), however, stipulates the permit system for the above actors and to "operators of centralized treatment facilities of urban sewage" (ibid.), which implies that the former group of actors does not comprise urban sewage treatment plants and that the permit system has thus not been mandatory for urban sewage treatment plants.
[369] Law on Prevention and Control of Water Pollution (2008), chapter 7.

deciding to pay the fines instead of treating their wastewater, but apparently, the fine is still not high enough in some instances. One idea to further increase incentives would be to fine companies for the profits they have realized by not treating wastewater, but the law does not provide such a measure.[370] Besides these increased incentives for water appropriators to treat wastewater, the law also introduces measures to enlist local government's cooperation in pollution control. Article 5 of the 2008 Law on Water Pollution states the following:

> "The State implements an accountability and evaluation system for the target of water environmental protection whereby the fulfillment of water environmental protection targets constitutes a part of the performance evaluation of local people's governments or their responsible persons."[371]

The law thus employs the CPC cadre evaluation system to ensure the implementation at the local level. The system is used within the party apparatus to evaluate the performance of subordinate party members, which sets incentives to comply with the goals of the party. If cadres meet the targets, they are promoted or get bonuses, and if cadres fail to achieve targets, they are penalized with demotion or lower wages. The introduction of water resource protection into the evaluation system sets incentives for cadres in local governments to comply with the legal provisions against water pollution. It strengthens EPBs because the evaluation system has the potential to win over local government's officials.[372] These two changes in the 2008 Law on Water Pollution might thus change local preferences, which apparently is a great obstacle to the state directives to combat water pollution. In theory, the rising fines for illegal wastewater discharges are a way to fully internalize the negative external effects which private good production can cause in the form of water pollution. The incentives for cadres to effectively eliminate water pollution contrast the incentives local governments have to support local enterprises. Hence, in order to effectively change the preferences of cadres, the incentives of the cadre evaluation system have to be more convincing than the incentives in favor of tolerating water pollution. If that is the case in practice remains to be observed, as the law was only passed in 2008. It aims at eliminating the collective action problems in the local government levels.

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[370] Winalski (2009), 197f; For example, the factory in Yunnan, which was described in the case study above, paid a fine of 5,000 RMB in 2004 (van Rooij, 2006, 55). According to the 2008 law, the factory would have either paid between 10,000 and 100,000 RMB for false discharge reports or between 20,000 and 200,000 RMB for the discharge of acids (Law on Prevention and Control of Water Pollution, 2008, Article 72, 76). Van Rooij (2008, 56) writes that the water in the river became acidic. However, as the text does not specify which pollutants were discharged in this case, it cannot definitely be determined which fee would apply by the law. However, it would have definitely been higher than 5,000 RMB.

[371] Law on Prevention and Control of Water Pollution (2008), Article 5; This quote is taken from the translation offered in this publication.

[372] Golding (2011), 407f, 410, 418.

This analysis of state directives to combat water pollution shows that state directives have been incorporated in national laws since the 1980s but that these laws have not been adequately implemented. This is primarily caused by the inverted incentive structure for local governments and EPBs which are precisely those units that are supposed to implement the central directives. Another shortfall at the local level is the low financial and personnel capacity of governments and EPBs. The 2008 Law on Water Pollution seems to improve the incentives for local officials and water appropriators. Moreover, the law combines the permit and the standards for water and wastewater, which has been highly fragmented and unevenly implemented in the past. The law can thus be seen as a major step towards stronger pollution control. The more systematic system and the increased incentives for polluters and local governmental actors to stop water pollution has the potential of internalizing more negative external effects of wastewater discharges and to strengthen the role of local governments as central state agents versus their role as supporters of the local economy. The strengthening of the state planning system in the reform era has proven to have positive effects on industrial water pollution so far,[373] as it has been described in chapter 4.2.

This subchapter shows that the central government has employed the planning mechanism and directives to internalize the positive externalities of water resources by controlling and restricting access to water. Although the system has proven to help water scarcity in some instances, a shortfall of the system is the powerful standing of regional government actors which do not internalize the territorial external effects of water and thus have other preferences than to further sustainable, fair, and environmental friendly water usage on the national level. Strengthening RBMCs could solve this problem in the future. Moreover, the central government has sought to internalize the negative externalities of wastewater discharges by monitoring, controlling, and penalizing wastewater discharges, which means that negative externalities are internalized. Local inverted preferences and incapability have, however, immensely harmed the system's functioning. The 2008 Law on Water Pollution has the potential of changing the local preferences and consequently improving law enforcement. The legal provisions have left loopholes for water polluters, but these have become smaller over time, especially since the 2008 law was passed. The chapter thus shows the reasons why reality and the goals of the central government have been so different with regard to water pollution and water scarcity and that there has been tremendous improvement in water resource governance since the 1980s.

6.2.2.3. Pricing mechanism

Water and wastewater pricing is a tool which can be employed to create incentives for actors on the operational level to use water sparingly and to avoid water pollution,

[373] World Bank (2001), 55.

because it internalizes the external effects associated with water resources. In order to internalize all externalities, the water price has to cover the costs of water supply, sanitation and wastewater treatment, and the costs of depletion[374] and water pollution.

In China there are four different types of fees associated with water use, which in principle reflect this idea of water pricing. The first type of fee is the water resource fee, which is charged to all actors who directly withdraw water from a water body.[375] This fee should reflect the value and thus the scarcity of water resources.[376] The second fee is the pollutant discharge fee, which actors that directly discharge pollutants into water bodies have to pay.[377] This fee should reflect the limited capacity of water bodies to dilute pollutants. The third and fourth fee concerns actors which are connected to the urban water supply and sanitation system and thus do not directly draw water and discharge sewage into water bodies. These actors have to pay a water supply fee and a wastewater treatment fee, which should cover the costs of water supply and wastewater treatment. They also pay the water resource fee to the waterworks that initially paid the fee, when withdrawing water from a water body.[378] All of these fees are volumetric charges today.[379]

With public goods theory, the effectiveness of these fees can be explained the following way. With the water resource fee water appropriators pay for the volume of water they consume, which means that they do not rely on positive externalities. If the prices account for the scarcity of the resource, water appropriators internalize the negative external effects, which result from the overexploitation of limited water resources for the environment and other water appropriators. The pollutant discharge fee internalizes the external effects of water pollution because if the actor continues to discharge wastewater, which means that he passes costs on to other actors and the environment, he has to pay a fee, absorbing the costs of the pollution he caused. Moreover, the fees for wastewater treatment and water supply in urban areas create incentives for the actors to provide water supply and sanitation, which would otherwise be neglected due to the positive external effects of these activities. These two fees are, of course, also additional incentives for urban water users to use water sparingly because the costs rise with every additional cubic meter of water consumed.

The externalities are, of course, only internalized if the charges reflect the real costs and these can be achieved by the market mechanism. The prices of goods on a market depend on the ratio of supply and demand and thus reflect the scarcity of the good.

[374] Xie et al. (2009), 86f, 95.
[375] Water Law (2002), Article 48.
[376] Xie et al. (2009), 84, 87, 95.
[377] Law on Prevention and Control of Water Pollution (2008), Article 24.
[378] Jiang et al. (2011), 186; Xie et al. (2009), 84f; Regulations on the Management of Water-drawing Permits and Water Resource Fees (2006), Article 33; Water Law (2002), Article 55.
[379] Aministrative Regulation on Water-drawing Permits and Water Resource Fees (2006), Article 32; Law on Prevention and Control of Water Pollution (2008), Article 24.

The market participants trade goods according to changes in supply and demand, which are reflected in the prices of goods.[380] Market-based water fees would thus reflect the scarcity of water resources because the market price increases if a certain demand is met with decreasing supplies of a good. The water resource fee would thus rise if the volume of water available for consumption decreases. Moreover, the pollutant discharge fee would increase with a rising demand for wastewater discharges and a stagnant supply of water to dilute the pollutants.[381] Water fees, which are determined solely by the market, thus cover the costs of supply and sanitation because otherwise no rational actor would decide to join the market and supply water or treat wastewater, as the costs would exceed the benefits.

However, water is originally a common-pool resource. While private goods can be traded efficiently on markets, this is not true for common-pool resources and public goods due to their positive externalities.[382] If there is no regulation of access to water resources, rational actors would not pay a fee for water but find alternative, free sources of water. Nevertheless, governments can set up "artificial markets"[383] to trade privatized elements of public goods and common-pool resources, which means that all water withdrawals and discharges have to be regulated.[384] This is thus the framework which the government has to maintain in order to establish a system of market-based water prices. For the case of China, this framework is described in the previous chapter. Water pricing is to be seen as an additional tool for the state directives and planning, without which water pricing would be impossible. If volumetric water prices account for the costs of supply, disposal and treatment, and the scarcity of water, then water prices internalize the externalities of water.[385] This would in turn encourage water users to save water and avoid water pollution.

Before the Reform and Opening Policy, the Chinese leadership only marginally used market-based policy tools in general or water pricing in particular because of a general distrust in the market and reliance on central planning.[386] This can be interpreted as an impact of the community factor discussed in chapter 5. Since the 1950s water suppliers and irrigation districts were legally advised to collect water supply fees to cover the costs of maintaining the system. However, water supply fees were often flat-rate fees or calculated on the basis of the irrigated area. Most water appropriators did not pay the water supply fee because of improper regulation and disregard by the water

[380] Ross (1988), 20.
[381] Ross (1988, 165) writes that such emission fees are based on "how much of the environment's assimilative capacity a polluter consumes" (ibid.).
[382] Ross (1988), 20.
[383] Ross (1988), 20.
[384] Ross (1988), 20.
[385] Xie et al. (2009), 95.
[386] Saich (2004), 32f, 35, 37f, 51; Heilmann (2004), 173; Ross (1988), 20, 110.

appropriators.[387] Water prices therefore did not reflect the scarcity of water, which means that the prices were not oriented at the market price for water and that they did not internalize the positive external effects of water.

This has changed since the beginning of the Reform and Opening Policy. The Chinese government has in fact installed a system to regulate water resources as it has been described in the last chapter. The state allocates water resources and controls water withdrawals and wastewater discharges using state planning. This system is the precondition for the introduction of the pricing mechanism. When the leadership began to aim at water conservation in the early 1980s, several conferences were held which also considered the tool of volumetric water pricing. Tianjin and Shanghai were among the first cities to employ volumetric water charges in the 1980s, and in 1985 the State Council issued regulations which state that water resources should be regarded as a commodity and stipulate that the price of water should cover the cost of provision.[388] Shortly before this, the central government introduced pollutant discharge fees, which were authorized by the trial version of the 1979 of the Environmental Protection Law. One of the first cities to introduce the fee was Suzhou in 1979, where water quality had seriously deteriorated but apparently improved after the wastewater discharge fee was introduced.[389] The 1984 Law on Water Pollution stipulates that enterprises which discharge wastewater directly into water bodies have to pay pollutant discharge fees and over-standard discharge fees if necessary.[390] The 1988 Water Law subsequently allows for water supply fees for waterworks and water resource fees for urban groundwater withdrawals. The law also grants provincial level governments the right to decide on water resource fees for direct water withdrawals from surface water bodies.[391] These three types of volumetric water fees were introduced in national laws by the end of the 1980s. Finally, the last of the four volumetric fees that exist in China today, the wastewater treatment fee for urban sewage treatment facilities, was found its way into national law with the Law on Water Pollution of 1996.[392]

And with the four types of fees – water resource fees, pollutant discharge fees, water supply fees and wastewater treatment fees – the Chinese government has introduced a price system which is oriented at market-based pricing. However, the government not only sets the framework for a water market in the case of water pricing, but also determines the water resource fee and the pollutant discharge fee itself.[393] Government interference thus penetrates the pricing structure more than it would in ideal

[387] Ross (1988),107f.
[388] Ross (1988), 110-112.
[389] Ma et al. (2000), 21f; Ross (1988), 168f.
[390] Law on Prevention and Control of Water Pollution (1984) Article 15.
[391] Water Law (1988), Article 34.
[392] Law on Prevention and Control of Water Pollution (1996), Article 19.
[393] Xie et al. (2009), 95; Law on Prevention and Control of Water Pollution (2008), 24.

market described above. But the outcome is that the volumetric prices, in theory, account for the scarcity of water resources,[394] and the costs of supply and treatment, just as it would be the case with the market mechanism. The water pricing mechanism also implies that the government has transformed the common-pool resource water into a private good, as the positive externalities are in theory internalized. This does not imply, however, that people are deprived of this vitally important good, which would be morally unacceptable. The policy tools, which ensure social equity, are discussed below. The benefit of market-based water pricing is that it creates incentives for sparing water consumption and avoiding water pollution at the operational level[395] because it internalizes the externalities of water resources.

In the following paragraphs the fee system is analyzed in more detail to identify where progress has been made and which shortcomings have impeded the system's effectiveness. The first fee to be analyzed is the water resource fee, which by the Water Law in 1988 was mandatory for urban groundwater withdrawals. For direct withdrawals from surface water bodies, the provincial level governments could decide whether or not to introduce water resource fees.[396] The 2002 version aims on a more comprehensive implementation of the water resource fee because it stipulates that all actors, which directly withdraw water from underground or surface water bodies have to pay water resource fees.[397] This can be interpreted as progress in the water pricing system. In fact, the water resource fee was not introduced for Beijing's and Shanghai's urban residents until 2002 and 2005 respectively.[398] To date the agricultural sector is largely excluded from the water resource fee. The 2006 Administrative Regulation on Water-drawing Permits and Levying Water Resource Fees stipulates that agricultural water appropriators, who withdraw water directly from a water body, only have to pay the water resource fee if they extract over-standard volumes of water, but are exempted from the fee if they abide by the local limits.[399] Moreover, within irrigation districts the fee individual farmers pay for their irrigation water is mostly determined by the size of the irrigated land instead of the volume of water used. This practice discourages farmers from saving water,[400] and it

[394] Ross (1988), 113.
[395] Xie et al. (2009), 86f; Ross (1988), 109, 111, 165.
[396] Water Law (1988), Article 34.
[397] Water Law (2002), Article 48.
[398] Xie et al. (2009), 85; Shanghai Water Authority (n.d.).
[399] Administrative Regulation on Water-drawing Permits and Levying Water Resource Fees (2006), Article 33.
[400] Xie et al. (2009), 36; Most farmers do not hold an individual water-drawing permit. Instead, the irrigation district holds one permit. Within a district the total water available to an irrigation district is divided between the farmers. The Water User Associations, which are organizations of farmers within an irrigation district, might pay for a certain volume of water in advance of the irrigation period for all farmers, but charge individual farmers a fee based on their area of land (Xie et al., 2009, 56, 63, 68, 70). This is thus a problem within irrigation districts, which is thus not directly controlled by the state.

means that the market mechanism is annulled in the irrigation district and does not influence the behavior of the individual farmers. Additionally, the water resource fee is cheaper for agricultural uses than for other uses and even cheaper for subsistence food production than for cash crop production.[401] The low water resource fees are a compromise between the aim of the government to encourage efficient water usage in agriculture and an effort to avoid overburdening the farmers with high water resource fees, as an official of the Legislative Affairs Office of the State Council stated in 2006.[402] This is thus one example of a conflict of aims which compromises the conservation of water resources and shows that the central government also pursues aims other than water conservation. Moreover, this means that the water resource fee is not merely calculated on the basis of water scarcity and on a market-basis, but is impacted by political considerations. With a price below the scarcity price and on a flat-rate basis, not all positive externalities of water resources are internalized, which does not give farmers an incentive to use water sparingly.

Pollutant discharge fees were legalized with the 1979 trial version of the Law on Environmental Protection and implemented with the 1982 Provisional Measures for Collecting Pollution Discharge Fees by the State Council.[403] According to the subsequent 1984 and 1996 Law on Water Pollution, actors discharging wastewater have to pay a pollutant discharge fee. If the wastewater shows higher concentrations of pollutants than the national wastewater discharge standards allow, the actor has to pay a fee for excess discharge.[404] The price mechanism is thus also used to give actors an incentive to abide by the discharge standards, and the price is not simply determined by the capacity of the water bodies to absorb pollutants. This system had the shortcoming of being incompatible with the discharge permit system. Whether or not over-standard fees or only pollutant discharge fees had to be paid depended on the concentration of pollutants in the wastewater. As the permits turned out to be often more lax than the wastewater discharge standards (see chapter 6.2.2.2), it occurred that enterprises met the requirements in their discharge permit, but still had to pay over-standard discharge fees because they did not meet the discharge standard.[405] This could have been an incentive for enterprises to comply with the wastewater discharge standards and the discharge permits, but pollutant discharge fees have been generally too low to induce compliance.[406] For instance, an enterprise in Changzhou City decided to overstate the pollution discharges when applying

[401] Administrative Regulation on Water-drawing Permits and Levying Water Resource Fees (2006), Article 30.
[402] Xinhua (2006).
[403] Ross (1988), 168; Ma et al. (2000), 21.
[404] Law on Prevention and Control of Water Pollution (1984), Article 15; Law on Prevention and Control of Water Pollution (1996), Article 15.
[405] Ma et al. (2000), 106f.
[406] Ross (1988), 170; Xie et al. (2009), 39; Ma et al. (2000), 122.

for a permit in order to allow for increases in pollution discharges in the future, although this forced the enterprise to continuously pay more pollutant discharge fees.[407] Xie et al. (2009) quote an example of a chemical plant which pays over-standard discharge fees of 3.01 RMB/m³ of wastewater because it does not meet the wastewater discharge standard. This behavior appears to be rational when considering that meeting the discharge standard by treating the wastewater would cost 6.90 RMB/m³.[408] In theoretical terms this means that the pollutant discharge fee is too low to internalize all negative externalities of water pollution, which gives the actors an incentive to continue to produce negative externalities.

The two fees discussed up to this point, the pollutant discharge fee and the water resource fee, suffer from the inverted local incentive structure and are often not implemented as intended by the central government because they are set and retained by the local governments. These fees are a major source of revenue for EPBs. This means that EPBs on the one hand benefit from the overexploitation of local water resources[409] because the fee is a volumetric one.[410] Similarly, Van Rooij (2006) mentions that the EPBs depend on continuing water pollution for funds, as the pollutant discharge fee is also kept by the local government and is earmarked for pollution prevention.[411] On the other hand, EPBs and local governments often have close relationships with the local enterprises and enough discretion to collaborate with local enterprises. Ma et al. (2000) have observed that EPBs negotiated pollutants discharge fees with the enterprises or adapted the fees to the economic success of the enterprise. This is also the reason EPBs have often been found reluctant to collect more severe fees, but instead collect the less severe pollutant discharge fees .[412] This shows that the water prices are not only defined by the market, but also by other preferences of local governments and EPBs. These price distortions decrease the effectiveness of the water pricing mechanism. That the governmental actors at the local level follow their own preferences, which undermine the national policies, can be interpreted as collective-action problems within the state. These are rendered possible by the decentralized bureaucratic system.

For the pollutant discharge fee, the 2008 Law on Water Pollution appears to have the potential of alleviating this problem because it centrally streamlines the fee and limits the leeway of EPB to negotiate it with polluters. The law stipulates that the pollutant discharge fee an actor has to pay rises with the categories of pollutants and the quantity of pollutants. In contrast to the previous versions, the 2008 version also specifies that

[407] Ma et al. (2000), 109.
[408] Xie et al. (2009), 39.
[409] Xie et al. (2009), 95.
[410] Aministrative Regulation on Water-drawing Permits and Water Resource Fees (2006), Article 32.
[411] van Rooij (2006), 62; Law on Prevention and Control of Water Pollution (2008), Article 24.
[412] Ma et al. (2000), 117, 129; van Rooij (2006), 62.

actors whose wastewater discharges violate the concentration based water pollutant discharge standards or the total control target for pollutants have to pay fees that equal 200% and 500% of the pollutant discharge fee. [413] This provision also has the advantage that it is adapted to the regional variation of incomes, as it is described as a percentage of the local water price, which can be adapted to local incomes.[414]

The two remaining fees to be analyzed are the water supply fee and the wastewater treatment fee for domestic water consumption, which were introduced with the 1988 Water Law and the 1996 Law on Water Pollution, respectively. These fees are paid to waterworks and the operators of wastewater treatment plants.[415] Theoretically, if these prices were determined by the market with rational market participants, the total amount of fees would cover the costs of water supply and sewage treatment, as otherwise no rational actor would engage in these activities because the actor would incur a loss. Their activity would produce positive external effects for water appropriators. It is thus a sign of market-oriented pricing that the Laws on Water Pollution from 1996 and 2008 stipulate that the total amount of fees should cover the operation costs of the facilities.[416] Regarding the water supply fee, the 2002 Water Law states that the waterworks should be able to cover the operation expenses and even generate some profits.[417] This is not mentioned in the 1988 Water Law, which shows that the commitment of the leadership to market pricing has been increasing.

However, the water tariffs in Chinese cities often are still too low to cover the expenses of the facilities. In 36 large Chinese cities, for example, the wastewater treatment fee averaged 0.67 RMB/m³, which only covers about two thirds of the real treatment costs. In 2005, 150 cities had not introduced wastewater treatment charges at all.[418] In fact, the average profits of state-owned and private companies in the field waste disposal and water supply on average gained fewer profits than the average Chinese companies in 2008. State-owned water suppliers on average even incurred slight losses in 2008.[419] The sector remains to be subsidized by the state, although the prices for water supply and wastewater treatment have been rising over the last 30 years. Between 1986

[413] Law on Prevention and Control of Water Pollution (2008), Article 24, 74.
[414] See National Bureau of Statistics (2009, 9-15, 9-21) for regional income variations in China.
[415] Water Law (1988), Article 34; Law on Prevention and Control of Water Pollution (1996), Article 19.
[416] Law on Prevention and Control of Water Pollution (1996), Article 19; Law on Prevention and Control of Water Pollution (2008), Article 44.
[417] Water Law (2002), Article 55.
[418] Xie et al. (2009), 84; Nickum et al. (2007), 92-94; Gleick (2009), 95f; Ross (1988), 97f; Bellier et al. (2003), 61.
[419] National Bureau of Statistics (2009), chart 13-6, 13-10; State-owned enterprises on average gained 42.52 Million RMB in 2008, while state-owned waste disposal and recycling enterprises only gained 24.27 Million RMB on average and state-owned water suppliers on average made losses of 77,519 RMB.

and 1998 water prices annually increased by 18%,[420] and between 1998 and 2007 the water tariffs annually grew by 7.1% in the 35 major cities.[421] In Beijing, for example, urban residents only paid a water supply fee of 0.12 RMB/m³ of water from 1981-1991. Subsequently, the city introduced a wastewater treatment fee and a water resource fee and increased the fees, so that residents now pay 3.70 RMB/m³ in total.[422] And the financial situation of the operating companies has also improved compared to the late 1990s, as today's financial situation described above seems better than the one in 1998. Bellier et al. (2003) report that the sector incurred losses of 600 Million RMB in 1998.[423] This shows that the prices for water supply and wastewater treatment have been rising and thus have drawn nearer to an ideal type market price, but that the prices are still lower than the prices the market mechanism would provide.

The consequence of the low water supply and wastewater treatment fees is that the facilities are chronically underfunded, which leads to the deterioration of the infrastructure, low wastewater treatment capacities and the slow expansion of the water supply and sanitation system.[424] Additionally, the fees fail to convey the problem of water scarcity to the domestic water appropriators.[425] This contributes to the explanation of the high leakage losses in Chinese urban water supply systems and the relatively low wastewater treatment capacities, which are identified in chapter 4. In Xi'an, for example, the wastewater treatment fee in 2005 accounted for 0.36 RMB/ m³ and ranked among the lowest in the country, which resulted in lower wastewater treatment capacity in the city. Indeed in 2007 the city's sewage treatment capacity allowed only for the treatment of 60% of the city's sewage. Between 2004 and 2007 the water prices in Xi'an were raised in four steps. In the course of this reform, the wastewater treatment fee was raised to 0.80 RMB/ m³, which aimed on increasing the wastewater treatment capacity of the city.[426] This example shows the relationship between the wastewater treatment price and the wastewater treatment capacity. Consequently, it is not the case that the water tariffs below operation cost coverage provoke all rational actors to refuse to provide water supply and wastewater treatment services at this low tariff level, as hypothesized above for ideal market conditions. The sector is instead subsidized by the government. But it is true that

[420] Belier et al. (2003), 62.
[421] Jiang et al. (2011), 186.
[422] Xie et al. (2009), 85; Beijing Waterworks (n.d.); The website of the Beijing Waterworks shows that the price has not increased since Xie et al. (2009) published the data on the water tariffs. Since 2004 the water supply fee, the wastewater treatment fee, and the water resource fee amount to 1.70 RMB/m³, 0.90 RMB/m³ and 1.10 RMB/m³, respectively, which adds up to 3.70 RMB/m³ of tap water (ibid.).
[423] Bellier et al. (2003), 62.
[424] Nickum et al. (2007), 93f; Xie et al. (2009), 86, 89; Ross (1988), 97f; Mol et al. (2007), 10; Bellier et al. (2003), 60, 69.
[425] Nickum et al. (2007), 94.
[426] Xi'an News Agency (2007); Xie et al. (2009), 86.

the service quality and quantity suffer from the low tariffs, which at least means that some services are neglected due to cost-benefit calculations.

There are several reasons why the water tariffs are not completely market-based and do not reach market prices. One technical problem has been that water meters have to be installed before volumetric charges could be introduced. The fact that in 1982 only 58% of the households in the fifteen largest cities were equipped with water meters gives an idea of the technical deficiencies at the time. In 2004, the water supply plants in Guangzhou were opposed to the implementation of block prices, which are introduced in the next paragraph, because they did not agree to pay for the installation of water meters in households, which would have cost a total of 5 billion RMB.[427] This has, of course, hampered the implementation of volumetric water prices in the cities.

Moreover, there has been concern about negative effects on low income households by higher water tariffs. In Chongqing, for example, the poorest households with a monthly income below 200 RMB only consumed 2.4 m³ of water per month on average. With a water tariff of 2.80 RMB/m³ [428] these households have paid 6.72 RMB/ month on water or about 3.36% of their monthly income. Xie et al. (2009) report that not more than 3% to 5% of the household income should be spent on water,[429] which does not leave much leeway for further increases on water tariffs for Chongqing's poorest households. However, the poorer parts of urban areas also suffer the most from the underfunding of the system because the infrastructure is not expanded to the poorer neighborhoods. Moreover, high income households consume more water than low income households, so that especially the wealthier families benefit from the subsidies for water.[430] One way to circumvent this conflict between social equity and price incentives is to introduce block prices, which means that the water tariff for a certain amount of water, which should satisfy the essential water need of an household, is relatively low and any additional volume of water is sold for a higher price. The implementation has been hampered due to the technical difficulty of installing water meters and setting adequate quotas for water consumption.[431] Another possibility to disburden households and at the same time set incentives for water saving water appropriation is to stipulate different water tariffs for different purposes. In Beijing and Shanghai the water tariffs for residents are lower than those for industrial and administrative users. The water supply fee for operators of car wash sites, saunas and swimming pools are especially high in both cities,

[427] Nickum et al. (2007), 93.
[428] Xie et al. (2009), 85, 89.
[429] Xie et al. (2009), 90.
[430] Xie et al. (2009), 89.
[431] Ross (1988), 111; Xie et al. (2009), 91; Nickum et al. (2007), 93.

although Beijing set much more drastic tariffs for these industries than Shanghai[432] and mirrors the serious water condition in the capital. These measures show the political influence on water pricing, which theoretically enables policy makers to cover the span between social equity and incentivizing water prices. Nevertheless, cities have been reluctant to raise water tariffs because of social considerations, for example Chongqing.[433]

This subchapter shows that China has made considerable progress in using the price mechanism to internalize the externalities of water and wastewater, which in theory leads to more sparing water consumption and improved wastewater treatment. However, water prices are not yet high enough to internalize all externalities, which is one reason for the remaining inefficient water use and insufficient wastewater treatment. Impediments have been the inverted incentives of the local governments, which hampered the implementation at the local level, and technical problems like a lack of water meters and monitoring incapacities. Moreover, the government was reluctant to raise water prices for farmers and residents because they wanted to avoid overburdening these actors. Although the central government internalized the sectoral and territorial externalities of water, these were two examples where the commitment of the central government to improved water governance was impeded by conflicting goals.

6.2.2.4. Campaigns

This implementation method is one of Ross' (1988) three policy modes. Campaigns are defined as "intermittent organizations with flat hierarchies and a simple division of labor, involving mobilization of some or all of the populace by a governmental or a private entity"[434]. This implementation method is primarily related to governments which aim on shaping the political opinion of its citizens as the instrument itself is based on persuasion and coercion. It has been a popular instrument in the People's Republic, especially before 1978, which fits into the picture that the leadership saw itself in the role of the educator of the people, who were supposed to simply follow their ideas. Campaigns in China are usually initiated by the highest leadership. Prominent examples which mobilized a large part of society are the Great Leap Forward and the Cultural Revolution. The Great Leap Forward was initiated to boost economic output through mass mobilization. The Cultural Revolution aimed on reinforcing the power of Mao Zedong and the left wing of the CPC by mobilizing large parts of society to support their cause and to fight against systematically

[432] Beijing Waterworks (n.d.); Shanghai Water Authority (n.d.); Swimming pools and car wash sites in Beijing have to pay a water supply fee of 60 RMB/m³ and 40 RMB/m³ respectively, whereas households pay the modest fee of 2.80 RMB/m³ for water supply. The wastewater treatment fee is 0.90 RMB/m³ for households and 1.50 RMB/m³ for all other users (Beijing Waterworks, n.d.) and is thus relatively similar for all users. In Shanghai households pay 1.63 RMB/m³ for water supply. Saunas pay up to 15.60 RMB/m³ and car wash operators pay 5.60 RMB/m³ (Shanghai Water Authority (n.d.).
[433] Xie et al. (2009), 93.
[434] Ross (1988), 15.

stigmatized groups within society and party. Both campaigns had devastating outcomes. The post-Mao leadership came to believe that campaigns are difficult to control and are likely develop a life of their own, which leads to unpredictable consequences. In 1978 the leadership thus stated that the scope of campaigns had to be limited to specific sectors and that the intensity of campaigns had to be reduced.[435] The use of campaigns follows the broader political currents in China; in terms of the IAD framework the use of campaigns has been influenced by the community factors described in chapter 5. However, campaigns can still be found in today's water governance, although their scope and importance in governance has diminished in the reform era.

During the period of planned economy, several different types of campaigns were employed by the leadership to ease water problems. One type of campaign aimed to increase the water supply. In the 1970s, for example, there was a campaign to drill thousands of tube wells in North China in order to irrigate larger areas of cropland with groundwater. Another campaign animated enterprises to recycle the 'three wastes' liquids, solids and gases and thus would have helped to alleviate water pollution. The incentive for the enterprises to cooperate was public approval and there are some examples of enterprises which followed the aim of the campaign. The outcomes of these campaigns, however, were not only positive. The well campaign indeed led to a considerable increase in farmland, but the wells were drilled too close to one another and were used collectively, which made groundwater a pure common-pool resource. This lead to groundwater depletion and surface subsidence. Recycling rates of industrial wastewater remained very low until the 1980s in spite of the campaign to recycle wastewater because the primary goal of enterprises remained to be compliant with production plans. Ross (1988) attributes the unsatisfying outcomes of these campaigns to the nature of campaigns because they tend to neglect expert knowledge and technical innovation and are thus rather "blunt instruments"[436].The campaign which tackled industrial wastewater, for example, only considered the volume, but not the concentration of toxic substances in the wastewater.[437] From a Public Goods Theory perspective, the well drilling campaign appears counterproductive because it further lowers the excludability of the common-pool resource water, as it makes groundwater easily accessible to the public. This enables water appropriators even to overexploit groundwater resources, which are the most easily excludable water resources under natural conditions. The campaign to collect pollutants, in theory, had the potential to internalize the negative externalities of pollution, as the campaign raises the perceived costs of pollution and the benefits of collecting wastes by either punishment or reward through public opinion. However, apparently the financial

[435] Ross (1998), 15-17; Saich (2004), 39-41, 213; Heilmann (2004), 19.
[436] Ross (1988), 151.
[437] Ross (1988), 104f, 149-151.

incentives swayed stronger and offset these social incentives to collect wastes in most cases.

Even after the Reform and Opening-Up Policy started, campaigns are still used to tackle water problems. During the drought in the 1980s, a water conservancy campaign was initiated in addition to other bureaucratic measures to persuade people to cut water consumption. In these emergency situations, campaigns seem to be an appropriate measure, as they are as short-lived as the emergency situation itself.[438] Another rather short-term goal was to improve the environmental conditions in China before the Beijing 2010 Olympic Games, which also involved the cleaning up of lakes.[439] For campaigns which aimed on achieving long-term goals, the short duration of campaigns has been a major reason for their failure. The Ministry of Environmental Protection has initiated campaigns to urge local governments and EPBs to enforce environmental law since the 1990s. One of these campaigns was initiated by the NEPA in 1996 and pressured larger enterprises to achieve certain wastewater discharge standards by the end of 2000 and ordered their closure in case of over-standard discharges. Between 2001 and 2002 a campaign was launched to prevent fall-backs after the end of the previous campaign. In fact, about 15% of the large enterprises, which were targeted by the former campaign, returned to their polluting production methods after the campaign had ended by the end of the year 2000. This problem can also be observed in the example of the chemical fertilizer plant in Yunnan that is employed in the previous chapter as well. That the EPB had discovered the illegal discharges of the factory in 2004 can be ascribed to a campaign. The factory was forced to shut down, but as the campaign ended, the factory resumed production within two months. This shows that the positive outcomes of campaigns often do not last longer than the campaign itself,[440] which is a serious limitation to the effectiveness of campaigns as such.

An example of the Huai He campaign shows that campaigns sometimes fail to produce positive outcomes in the first place due to the local incentive structure. In 1994 Premier Li Peng announced a campaign to clean up the Huai He. What gave reason to the campaign was the deteriorated water quality of the river since the 1970s. Along the river only half of the industrial wastewater received treatment in 1990, as the enterprises aimed for greater profits by not operating their wastewater treatment plants. In 1994 a water incident occurred on the Huai He when numerous factories released their stored wastewater into the river at the same time. The sudden increase in pollution killed 26 million pounds of fish and impacted people's health. Consequently, Li Peng announced the campaign, which aimed at stopping industrial waste releases by January 1st, 1998 and

[438] Ross (1988), 105f.
[439] Klein (2004), 110f.
[440] Van Rooij (2006), 56, 63-66.

at cleaning the river by the year 2000. Hundreds of factories were closed in the course of the campaign. However, many factories that were supposed to be closed continued operation and untreated wastewater releases by operating at night or stopping discharges only during inspections. As factories and local governments had a common interest in minimizing economic losses, they occasionally collaborated, and local governments appealed to EPBs to take liberties with the campaign. In the year 2000, about twice as much pollutants were discharged as envisioned in the campaign, and the river water reached grade V instead of the targeted grade III. The failure of the campaign became even more obvious when heavy rain washed 144 m³ of wastewater, which had been stored behind waster locks, into the river and caused yet another pollution incident.[441] This example shows that the perverse local incentive structure can also impede the implementation of campaigns, just like it hinders the implementation of state directives. This is another example of collective-action problem within the state. The central government's campaigns are not implemented by the local governments as envisioned by the central government, and the central authorities have only limited means to control this. The common flaw of these two strategies is that both rely on local governments for implementation. If the campaign had been properly implemented, it would have temporarily raised the risk of costs for wastewater discharges and thus would have at least partly internalized the negative externalities of wastewater discharges.

However, campaigns can also be beneficial to water management in several regards. EPBs tend to abide by the rules more strictly during campaigns because their activities are observed more closely by higher authorities than in times of regular enforcement process.[442] It is thus no coincidence that the EBP in Yunnan discovered the over-standard discharges of the chemical plant in 2004, but it can be attributed to a campaign. Moreover, the campaigns have increased the environmental awareness of the public and this might force local governments to be more responsive to environmental problems.[443]

In fact, there have been campaigns which explicitly aim on increasing public awareness of water problems in China. One example is the water week campaign, which takes place annually along with the international World Water Day. During the week, the public is supposed to become more aware of water scarcity and pollution and to develop an understanding for the importance of water conservancy and pollution control. Moreover, the legal framework governing water resources is promoted.[444] Xie et al. (2009) also think that further educating the population on water issues is important for law enforcement and

[441] Economy (2004), 1-8.
[442] Ma et al. (2000), 121.
[443] Van Rooij (2006), 63.
[444] Liang (2011).

that this can be done with educational campaigns. Environmental education, of course, does not have to be induced by the government but can develop in a society by itself. Non-governmental organizations (NGOs) can also raise awareness of water issues. Indeed, environmental NGOs play an increasingly large role, but are still restricted by the state's oversight. Public awareness could thus also benefit from the increase of public participation in water management,[445] and not only with the tool of campaigns.

The state can thus further the awareness for water issues through campaigns. As Ahlheim (2009) points out, the utility of a water appropriator from water consumption decreases if he learns about the problem of water scarcity compared to an uneducated state. This changes his incentives in favor of water conservation.[446] Environmental education can thus change the preferences of the actors on the operational level. This idea can also be transferred to education about water pollution: If a polluter learns about the environmental impact of wastewater, this decreases the utility he gains from discharging the wastewater untreated. This in turn increases the incentives of the actor to treat the wastewater before discharge. In terms of Public Goods Theory, this means that some negative externalities of wastewater discharges are internalized because the polluter pays a price in form of what may be called bad consciousness for the negative externalities he produces for other people and the environment. One can also reason that as the public environmental awareness rises, people become less tolerant of and more concerned about water pollution. This concern can be interpreted as costs in addition to the costs the negative externalities of water pollution cause for them; if people are aware of the water pollution of other actors, they not only suffer from water pollution itself, but also from environmental concerns. This can also be understood from the negative example in the next paragraph.

The importance of environmental awareness in order to achieve environmental friendly outcomes in water policy becomes apparent in the following case study, which is mentioned in the previous subchapter. In Gansu Province a fertilizer factory discharged untreated wastewater into a river which runs through the fields of farmers from the village Dachuan. The local government and the EPB did not take action against the factory because it was a provincial level SOE. The villagers protested in 1996 until the factory agreed to provide the villagers with tap water, and they solved the problem of water pollution by constructing a pipe, which lead the factory's wastewater through the village and released it further downstream of the village. The wastewater was still led directly into the river without treatment, but it did not impact the villagers anymore.[447] This solution

[445] Klein (2004), 183-191; Xie et al. (2009), 55-57, 141.
[446] Ahlheim (2009), 9f.
[447] Economy (2004), 86f.

shows that “deeper environmental values remain[ed] to be internalized”[448] at the time. This example shows how a solution can be fair to all water appropriators involved, but not environmental friendly. The actors eliminated all negative externalities that affected the farmers because the farmers put pressure on the factory, but the negative external effects on the environment remained. If the actors involved had been more conscious about the environmental destruction of water pollution, this would have raised the perceived costs of this solution and would have made an environmental friendly solution more likely.

This subchapter analyses the instrument of campaigns in public water governance. It becomes obvious that the effectiveness of campaigns is limited due to their short duration and the problematic incentive structure at the local level. However, it appears to be an effective instrument in emergency situations and when the government aims on raising awareness of water problems and enforcing environmental rule.[449] Campaigns have the potential to internalize negative externalities of water pollution and excessive water use.

6.3. The operational level: South-North Water Transfer Project

This chapter analyzes one example where the central government has become active on the operational level to solve the problem of water scarcity and that is the South-North Water Transfer Project (南水北调工程). It is an infrastructural project which is designed and implemented directly by the central government and which will transfer water from the Chang Jiang to the water scarce North. The idea of transferring water from the South to the North was already put forward by Mao Zedong in the 1950s. The project was launched in 2002 after President Jiang Zemin underlined the importance of the project two years earlier.[450] The difference between this project and other implementation measures is that the central government does not govern the operational level by setting rule, but by producing a tangible outcome. The outcome of the project will be infrastructure that transfers water to the North. It does not produce the common-pool resource, but from a local perspective it provides water to where it has been scarce before through building the required infrastructure. This is thus one of the few cases where a common-pool resource is provided not by creating rules to govern the actors on the operational level, but by directly producing a tangible outcome (see chapter 2.1). Just like an industrial company decides to appropriate water, for instance, the central government decides to transfer water resources within its jurisdictions. Of course, the scope of this project is much bigger, but within the framework it is on the same level. In fact, just as any other actor on the operational level has to follow the constitutional and collective-choice level rules, the

[448] Economy (2004), 87.
[449] Economy (2004), 127.
[450] Yang et al. (2005), 1f, 4f; AQUASTAT (n.d.).

central government also has to follow the national legislation while carrying out the South-North Water Transfer Project. Both versions of the Water Law stipulate that inter-basin water transfers have to consider the water demand of both basins and the ecological impact of such transfers.[451] The central government acts within the legal framework but does not govern its citizens to provide water resources, which is the difference to state directives and planning in chapter 6.2.2.2. Instead, several ministries, including the MWR, manage the project and commission several companies, organizations and institutes with the execution.[452] This qualifies this project to belong to the operational level.

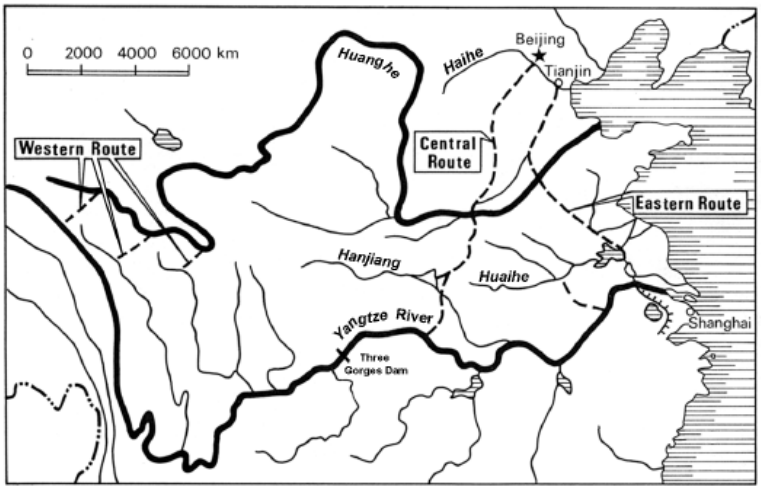
There have been other inter-basin water transfers in the past which aimed on easing local water shortages. The first long-distance projects were the water transfers from the Huang He to Tianjin in the 1970s, which helped solve Tianjin's acute water shortages. Water was transported over a distance of 850km. Subsequently, several other cities in the North of China have been supplied with water from distant rivers. For instance, Qingdao is supplied with water from the Huang He and Xi'an received water from the Heihe.[453] These projects are similar to the South-North Water Transfer Project, as they also divert water by infrastructural means. These projects had to be approved by the central government if such transfers crossed provincial level borders. If the project is located entirely within one province, the provincial level government has to approve it. In the case of the water transfer to Tianjin the central government had to approve the project because it passed though another province, in this case Hebei Province. Such expensive undertakings often rely on the funding of the central government because the local governments cannot bear all the costs. This also gives leverage to the central government in these smaller water transfers.[454] The idea of water transfers and the involvement of the central government are thus not born with the South-North Water Transfer Project.

The South-North Water Transfer Project is the largest inter-basin water transfer project so far. As can be observed in Map 2, the project consists of three different routes, which will all transfer water from the Chang Jiang to the North. The eastern route started to be built in 2002 and will transport water from the Chang Jiang to Hebei and Tianjian, which are more than 1000 km north of the Chang Jiang. The middle route diverts water from the middle reaches of the Chang Jiang and transfers it to Beijing and Tianjin. The western route leads water from the upstream regions of the Chang Jiang's tributaries into the upper Huang He. The three routes can be operated independently and are planned to be finished by 2050. The whole project costs are estimated at 62 billion US$.[455] So far, however, there have been delays in the implementation of the plan. Beijing was supposed

[451] Water Law (1988), Article 21; Water Law (2002), Article 22.
[452] Net Resources International (2011); Yang et al. (2005), 2.
[453] Smil (1993), 48f.
[454] Ross (1988), 102.
[455] Yang et al. (2005), 1f, 4f; AQUASTAT (n.d.); Net Resources International (2011).

to receive water from the central route by 2010, which has recently been postponed to 2014.[456]

Map 2: The South-North Water Transfer Project



Source: Yang et al. (2005), 4.

The difficulties of implementing the gigantic infrastructure project have been numerous. The southern provinces have articulated their disapproval of compensating wasteful water usage in Beijing with water from their jurisdictions. Provinces along the canals, especially along the middle route, have to resettle 300,000 people because of the project.[457] There have also been environmental concerns related to, for example, the risk of saltwater intrusion into the Chang Jiang because of the excessive water withdrawals from the river.[458] Moreover, the water from the eastern route is especially prone to water pollution, as the water at the mouth of the Chang Jiang hardly meets drinking water standards, and the water is subsequently lead through a region of heavy industrial water pollution. It is thus possible that the water is unsuitable for any purpose before it reaches the target region.[459] Financing this project has been a challenge, something hampering its initiation in the first place.[460] Once finished, the eastern and the middle route will presumably divert 15 km³ and 13 km³ of water per year, respectively. The whole project is designed to transfer 45 km³ of water per year. The water is supposed to serve the water scarce cities in the North to satisfy their rising water demand, to facilitate economic development in the upper reaches of the Huang He and the North China Plain, and to restore the ecological functions of the Huang He.[461] The project can thus help to ease water scarcity in the North, notwithstanding the risks tied to the project and the fact that infrastructural measures alone cannot solve China's water problems.

From a Pubic Goods Theory perspective, the project does not change the properties of water resources, but is only transported to another location. The project does

[456] Zhang (2010); AQUASTAT (n.d.).
[457] Economy (2004), 126; Yang et al. (2005), 4.
[458] Ross (1988), 102.
[459] AQUASTAT (0.J.); Yang et al. (2005), 4.
[460] Yang et al. (2005), 1.
[461] AQUASTAT (n.d.); Zhang (2010); Yang et al. (2005), 5, 7; Gleick (2009), 91.

not touch upon the problem inherent in common-pool resources and thus does not solve the major problem of water resources. One can thus reason, that the project alone is insufficient to solve China's water crises because if people would exploit the commonly used water resources that were transported to the North just like they would exploit the naturally available common-pool water resources, it would only be a matter of time until the additional volume of water would be exploited and polluted. The project is thus only useful if the access to water is regulated and the externalities are internalized. The process to achieve that goal is analyzed in chapter 6.2. An interesting aspect is also that part of Beijing's water tariffs are earmarked for the South-North Water Transfer Project[462], which means that the privatization or internalization of the positive externalities of water resources helps to finance the project. It is thus also from a finance perspective helpful that water appropriators pay for the water they consume.

The project infrastructure itself appears to be a public good[463] because it at first is not rival in consumption, as it is hardly exhausted by transporting water. Secondly, the canals have strong territorial externalities because water is transported across several provinces and river basins. The infrastructure also has considerable sectoral externalities, as a whole region and not only a specific sector is going to benefit from the water transfer.[464] Following the reasoning of the Public Goods Theory, it is thus not surprising that the project is an initiative of the central government, as it seems to be the only actor that internalizes all externalities.

This chapter describes the public involvement at the operation level with the example of the South-North Water Transfer Project. The project aims on solving the imbalance between water supply in the North and the South of the country by infrastructural means. As the project does not have an impact on the properties of water resources and thus does not solve the dilemma of the common-pool resource water, the project alone is unsuitable to solve China's water problems. However, in addition to other policy measures which aim at internalizing the externalities of water and wastewater, this public project could have a positive impact in the water scarce regions.

[462] Xie et al. (2009), 84.
[463] Yang (2005), 8.
[464] Of course, the canals could in theory be built by one company to satisfy only its own water demand, but the Chinese law prohibits water transfers over provincial borders without the affirmation of the central government (see page 93). Moreover, the immense costs of this project seem to be a perfect example for an economy of scale that Kölliker (2006, 219) mentions, which makes a centralized solution more likely (see also page 12).

7. Conclusion

This thesis analyzes where public water governance in China has been improved and where shortcomings remain with the help of Public Goods Theory and the IAD framework. This is assessed against the background of considerable water scarcity and water pollution, especially in the North of the country.

The Chinese government has made tremendous progress with regard to water resource governance. With the beginning of the reform era, the leadership has introduced a legal framework to govern water resources, which was basically nonexistent before. This includes the amendment of the Constitution to comprise provisions for water resource management and national laws, such as the Water Law. The national laws and regulations were subsequently revised to be more comprehensive and binding. These developments on the constitutional-choice and collective-choice level of the IAD framework show the willingness of the central government to tackle the problems of water scarcity and pollution. It becomes apparent that the leadership has become aware of the dilemma and that it has become one of its preferences to ease this condition. This has come about in the course of general political changes in the 1970s and 1980s which are subsumed under the community factor.

By means of rules, the central government aims at internalizing the positive external effects of water, which have led to the overexploitation of the resource. State planning mechanisms are employed to control the access to water and to limit the overall consumption of water, which has the potential of securing sufficient resources for the environment and downstream users. Strengthening RBMCs in the planning process, internalized territorial externalities of water. Water pricing is an approach to internalize the positive externalities of water resources by confronting water consumers with costs, which create incentives to use water sparingly. Campaigns to raise the awareness of water appropriators on the water crisis additionally heighten the perceived costs of excessive water consumption. Through these measures, water governance could lead to more environmentally friendly, fair and sustainable outcomes.

Moreover, the government aims at internalizing negative externalities of discharging untreated wastewater by means of the legal framework. National laws prohibit the discharge of certain substances and have created a system to limit the overall and individual discharge of wastewater. By introducing fines and fees, the costs of wastewater discharges, which otherwise would be passed on to other water users and the environment as negative externalities, are internalized by the polluter. The central government thus employs a variety of rules to internalize the externalities of water and wastewater in order to change the behavior of actors on the operational level and to ease

the water problems. From a Public Goods Theory perspective these approaches on the constitutional and collective-choice level are purposeful.

Apart from improving water governance through rules, the Chinese government seeks to ease water scarcity in the North of the country by interfering in the operational level with the South-North Water Transfer Project. Since this project does not change the common-pool resource properties of water, it does not address the underlying problem of the water crisis and would be an insufficient approach, if it was a stand-alone project. As an addition to the rules aiming at solving the dilemma, it seems to be a reasonable approach to ease water shortages in the North, assuming that the environmental risks of the project are controllable.

There are, however, a number of shortcomings which impede the rules' effectiveness. One problem is that solving the water crisis is not the only preference of all government actors. The central government, of course, pursues other goals besides improving water governance and these sometimes conflict with water governance goals. One example is the aim for larger grain outputs, which necessitates the application of chemical fertilizers, which in turn cause water pollution. Conflicting agendas are even more apparent with regard to local governments. Local governments often do not internalize all territorial externalities of water, so that they have an incentive to pass costs of excessive water consumption or pollution onto their neighboring jurisdictions. Moreover, close relations to local businesses, which are often a major source of revenue, also distort the local incentive structure. This hinders the enforcement of state directives and planning, water pricing and campaigns that ought to govern water resources. The central government is facing challenges to change the local incentive structure. This is aggravated through the decentralization processes in the reform era. This can be interpreted as collective action problems within the state apparatus.

Conflicting preferences are often the reason why the systems for water governance are not applied consistently yet. The fear of overburdening farmers of the government has slowed down the expansion of the water resource fee to farmers. Similarly, water tariffs in urban areas are still too low to internalize the positive externalities of water resources and do not sufficiently incentivize water appropriators, because the government is cautious of charging higher fees to the poor. These considerations might be legitimate, but have lead to the fact that the externalities are not fully internalized yet.

Another obstacle to water governance is that the capacities of local governments to enforce pollution control are often insufficient. With TVEs spread in the countryside and polluters trying to circumvent state measures, local governments and EPBs are often incapable of enforcing the law properly. Similarly, local authorities seem incapable in

registering all groundwater withdrawals in the countryside and including these water withdrawals into the water-drawing permit system. It is thus not only a problem of local government preferences, but also one of local capabilities to implement water governance. In the IAD framework it can be identified that the issue of “monitoring and sanctioning” between the collective-choice level and the operational level is a particularly deficient one in China.

The approach of integrated river basin management could improve law enforcement and the control over water resources, because it is a state actor that internalizes the territorial externalities of water. To date the institutions only have a very limited authority in water governance, which is also the case because local governments sought to limit their authority during the law making process. Another problem is that RBMCs are subordinate to the MWR and water quality management is thus largely out of their scope. Instead of RBMCs, from a Public Goods Theory perspective less appropriate local governments continue to have a major impact on water governance.

Finally, the legal framework has to be perfected for it to be fully functional. The first national laws which targeted water governance had to be revised several times to create more effective water governance. Shortcomings like the purely concentration based standards for wastewater discharges, have impeded the effectiveness of the system. Another shortcoming in the Law on Water Pollution was the insufficiency of law enforcement provisions, such as sanctions for water polluters and defecting local government cadres. If sanctions are set too low, actors do not have an incentive to avoid wastewater discharges or to prohibit discharges. The 2008 Law on Water Pollution shows, however, that the legal system is constantly improved by the government. Drafting effective legal frameworks is subject to a learning process, which has to be considered when analyzing the relatively young legal framework that governs water resources.

This thesis shows that the Chinese government has come a long way in governing water resources and that the government uses policy measures that seem purposeful from a Public Goods Theory perspective. The system has been improved numerous times and these ongoing efforts raise expectations for further improvements in the future. The shortcomings explained above, however, explain why the efforts on the constitutional- and collective-choice level have not always led to the corresponding outcomes on the operational level. Water governance has not yet achieved the internalization of externalities associated with water. Collective action problems within the state also undermined water governance. Until these two problems are solved, Public Goods Theory foresees the continuation of overexploitation and pollution of water resources.

Abbreviations

COD	Chemical Oxygen Demand
CPC	Communist Party of China
EPB	Environmental Protection Bureau
IAD framework	Institutional Analysis and Development framework
MEP	Ministry of Environmental Protection
MWR	Ministry of Water Resources
RBMC	River Basin Management Committee
SOE	State-owned enterprise
TVE	Township and Village Enterprise
YRCC	Yellow River Conservancy Commission

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