# Government Allocation, Market Allocation and Government Intervention in China's Water Policy Reform

JIANG, MIN
Centre for Environmental Law
Macquarie University
North Ryde 2109, Sydney
AUSTRALIA
E-mail: min.jiang@hotmail.com

*Abstract: In order to fight against the severe water crisis, the Chinese government has initiated a water policy reform under which market allocation mechanisms are to be promoted and facilitated within the framework of the traditional government (administrative) water allocation. This paper explores the reform of China's water allocation institutions. By analysing and evaluating current practices in government allocation and market allocation in China, the paper calls for a mix of government and market in water allocation in the specific context of China's water policy reform. To allocate water in a sustainable, equitable and effective manner, market allocation mechanisms need adequate but not overreaching government intervention.*

## 1. INTRODUCTION

It has been well-known that China is faced with a severe water crisis. Although it is one of the first six countries in the ranking list of total water availability of the world, its water resources are far from adequate to satisfy the increasing water demand of crowded cities and booming industries. As a result, many river systems are being exhausted with extremely high utilization ratios. Wastewater disposal increases, and millions of tons of wastewater flow into water bodies every year without treatment. Unsafe or even poisonous drinking water is a big threat to human health, which has already resulted in some notorious cancer villages (such as those besides Shaying River in the Huai River Basin).

Water pollution and unsustainable use have caused serious environmental and ecological problems such as rivers running dry, wetlands shrinking and biodiversity being damaged. Conversely, water pollution and ecological degradation are worsening the already limited water availability. With the increasing water demand, the competition over scarce water resources among different users becomes more and more severe. Unfortunately, China's water policy fails to solve the problem. Under its traditional government allocation approach, industrial and municipal shortfalls have been filled by administratively diverting water from agriculture without compensating farmers simply because the economic advantages of those water uses weigh heavier than those of agriculture. These practices are not only inequitable for farmers but also give no incentive for them to conserve water. As a response to the urgent situation in water resources, the Chinese government has initiated an ambitious water policy reform, "Building a water-saving society", to integrate water management and promote the implementation of market-based mechanisms, especially water rights trading in water allocation.

In many societies around the world, water rights trading has been applied in various patterns to allocate water among competing water users. Its function of reallocating water from lower valued uses to higher valued uses is widely recognized in the international water field. However, under China's traditional water institutional arrangements, water resources are administratively allocated. The market allocation was explicitly prohibited by China's water legislation. In the context of the new reform initiative, water rights trading as a market-based allocation instrument has been explored. Indeed, establishing a national water rights system, which combines government and market in water allocation, is one of the major targets of China's ongoing water reform.

This paper aims to explore the institutional arrangements for this combination in the context of China's water reform. Following the Introduction section, Section 2 reviews the heated international debate on water allocation mechanisms at the centre of which is the discussion about the roles of government and market in water allocation. Section 3 evaluates current practices of government water allocation by looking at several typical cases. Section 4 observes the current practices of water rights trading occurring in several parts of China and examines how governmental intervention works in those practices. Based on theses analyses, the paper concludes with some brief recommendations for China's water policy reform.

# 2. A REVIEW OF THE INTERNATIONAL DEBATE ON WATER ALLOCATION MECHANISMS

## 2.1. The debate context: "water crisis"

As a mobile and fugitive resource, water does have some unique characteristics. It is essential for life. Life here not only refers to humans but also includes other life forms. Within the integral water cycle, all users are interdependent and interrelated. Despite the fact that water resources are renewable, water availability within a country or a smaller region is finite. More use in one water-using sector could mean less availability for another. In other cases, the downstream users suffer from the pollution problem while upstream users discharge their wastes into a river. Understanding water in the context of the hydrological cycle is helpful to appreciate that the nature of water and water use has a significant impact on shaping water policy.

As water resources become scarcer with the world changes in population, urbanization and industrialization, competition among water users is getting more intense. Increasingly, "water crisis" has become one of the most popular words in water area despite continuing debate over its very existence. (WWAP, 2003) One may disagree that there is a world water crisis, but the fact is that water problems are happening and worsening in many local areas around the globe. The worsening water crisis has raised challenges to water governance. In fact, many argue that the water crisis is essentially a crisis of water governance or policy. (WWAP, 2003; Segerfeldt, 2005) The nature of water and multiple uses of water complicate water governance. It is a necessity to deal with water's variability and uncertainty, to balance multiple values of different uses, and to solve conflicts that are very likely to occur among those increasingly competing users. At present, water reforms are evolving in many countries to improve water governance. Treating water as a social and economic good is one of the policy responses to the water crisis.

## 2.2. Water as a social and economic good

### 2.2.1. The human right to water: water as a social good

Water is of unique importance to human being. It is an indispensable social resource upon which humans rely for survival. Despite the fact, recognizing water as a human right has experienced a slow and difficult process. Fortunately, there are many encouraging developments. By looking at the evolution of the international legal regime, it can be sure that the human right to water is gaining more international recognition. (WWAP, 2006)

In international law, recognizing the right to water has been used as a means to achieve other human rights, such as the right to food, health, well being and life. In other words, the human right to water has been implicitly recognized as a subordinate right necessary to achieve those fundamental human rights. (Bluemel, 2004) On the other hand, water as a human right has also been explicitly recognized in a number of international instruments. Among those, the General Comment No. 15 of the UN Covenant on Economic, Social and Cultural Rights remains the clearest and most explicit recognition of the right to water as an independent human right in international law. (Salman, 2004) It states that "the human right to water entitles everyone to sufficient, affordable, physically accessible, safe and acceptable water for personal and domestic uses".

At the domestic law level, the implementation of a right to water has shown disparities among different countries. Most countries have not made formal legal commitments to acknowledge a human right to water. (WWAP, 2006; Bluemel, 2004) However, a legally enforceable right to water does exist in a few countries based on domestic law. (WWAP, 2006) Some have included an explicit right to water in their constitutions or laws with actual implementation such as South Africa. In other cases, the right to water has been implemented in various ways although there is not an explicit human right to water available in legislation. For example, courts in Brazil, India and Argentina have reversed disconnections of water supplies to the poor who cannot afford to pay. (Centre on Housing Rights and Evictions, 2004; World Water Council, 2006; Anonymous, 2006)

### 2.2.2. Water as an economic good

Water serves multiple uses and users. As the resource becomes scarcer, its economic value among its competing uses has gained wider recognition in international forums. The fourth principle of the 1992 Dublin Statement expressly states that "water has an economic value in all its competing uses and should

be recognized as an economic good." Emphasizing the drinking water supply and sanitation, Chapter 18 of Agenda 21 also addresses the concept of water as an economic good in the context of the integrated water resources management.

Traditionally, water has been supplied as a public and free resource and water users have been charged only a certain proportion of the costs of water supply, if it is not totally free of charge. However, the costs of water supply do exist and vary in different water-using sectors. There is also an issue of opportunity costs associated with the alternative use of water. By consuming water, the user is depriving another user of the water. (Rogers et al, 1998) Opportunity costs exist if the other water user has a higher value for the water. Moreover, because water links all users with each other within the hydrological cycle, it is very likely to cause externality problems. In economic parlance, externalities refer to mutual interferences by which one's action can impose positive or negative impacts on others. (Bromley, 1991) The water cycle is the same place not only from which water is abstracted and diverted but also to which wastes are dumped. As a result, when upstream users divert water or dispose wastes, externalities occur on downstream users.

Like various costs of water in alternative uses, the values of water also vary from sector to sector. According to the framework that Peter Rogers had developed, the value of water consists of economic values and intrinsic values. Intrinsic values are associated with environmental, social, cultural and other benefits gained from water that are generally difficult to define and estimate. (Rogerset al, 1998)

The cost and value of water are closely linked to the price or the tariff of water to be charged for the water services. (Rogers et al, 2002) Previously, water was made available to all without charge and financed by from general public revenues as a result of treating it as a public good. (WWAP, 2006) But these revenues are far from sufficient to ensure access to safe drinking water supplies and sanitation facilities for everyone. As a response to this situation, water pricing policy is changing towards cost recovery. In many cases, water pricing policy has been influenced by specific social and political goals of a given country rather than the economic criteria. It makes water pricing reform a controversial issue. The biggest challenge is how to meet the needs of the poor and disadvantaged members of society. At this point, water as an economic good seems to come into conflict with water as a human right. This is mainly because the two notions have different implications pertaining to the roles of government and market in water allocation. However, it should not be understood that they are against each other. The Dublin Principle No. 4 further states that "within this principle, it is vital to recognize first the basic right of all human beings to have access to clean water and sanitation at an affordable price". Treating water as a human right and as an economic good should be integrated into water governance.

## 2.3. Water Allocation Institutions

### 2.3.1. Alternative property regimes as a water policy instrument

Bromley pointed out the instrumental role of property rights. According to his arguments, property is "a social relation that defines the property holder with respect to something of value against all others". (Bromley, 1991) Property regimes therefore are policy choices that are made to allocate resources and to control the uses. (Bromley, 1991) Alternative property-rights regimes include: non-property regimes (open access), common property regimes, state property regimes and private property regimes, which can be viewed as a spectrum, with private property at one extreme, public property at the other, and various mixes of the two in between. (ACIL Tasman in association with Freehills, 2004)

It is interesting that water property rights regimes can be found to be vastly different in different countries or even in different jurisdictions within a single country. (Scott, 1995) Different water availability and water use in a given country or a smaller boundary play a role here in shaping their water property rights regimes. The choice of institutional arrangements depends on different ecological circumstances and cultural, political and economic contexts. (Bromley, 1991; Livingston, 1993) Those dominant factors also influence the evolution of water property rights regimes as they change. (Bromley, 1991) Accordingly, there is no one single perfect solution to suit all circumstances. The choice of a certain regime depends on the local context in various aspects and works for particular purposes. At present, many places around the world are faced with a water rights reform. In the spectrum of property rights regimes, different options involve different levels of government involvement in water management and allocation. (ACIL Tasman in association with Freehills, 2004) As a result, water rights reform is often related to the debate on the institutional arrangement of water allocation mechanisms. The question normally is: Government or Market, which one should be responsible for allocating water resources?

### 2.3.2. Institutional alternatives for water allocation

Heated debates on water policy reform emerge in the international community, which reflects the increasing scarcity of water resources. The fluidity and integrity of the water cycle as well as the complexity of water use complicate the institutional arrangements for water resources. Traditionally, water has been provided, managed and allocated with substantial involvements of governments mainly because of its essential importance to humankind. (Dinar et al, 1997) In the dimension of water as a social resource (water as a human right), government involvement is the logic necessity. Its economic dimension, on the other hand, favors market force in water allocation.

This distinction can be found as well in the alternative water rights property regimes, among which the state property regime requires government control while the private property regime calls for market allocation of water resources. (Bruns et al, 2005) In between, self-governance of water users (user group management) based on common property is another institutional option. (Bruns et al, 2005) Like the property rights regimes, the institutional alternatives for water allocation can also be viewed as a spectrum from complete control by the government at one end to a mixture of market and government allocation, to predominantly market allocation at the other end. (Dinar et al, 1997) Additionally, user-based allocation plays a part as well, which may be combined with market and/or government allocation. Such combination or mixture of institutions may be necessary and more effective to address dynamics of complexity of water and water use. (Bruns et al, 2005; Livingston, 1993) In this sense, water reform is a process of exploring an appropriate institution mix for a particular context. Among these three forms of water institutions, self-governance of joint users is of course very important, but “government versus market” is at the centre of the debate.

## 2.4. Government allocation, market allocation and government intervention

It is needed to point out the difference between government allocation as an institutional alternative and government involvement. Besides performing a direct control over water and water use under the “government allocation institution”, government is involved in water allocation under other two institutions (user-based allocation and market allocation). (Bruns et al, 2005) Even the purest market allocation requires government support and intervention, which establishes and regulates institutional frameworks for users’ self-governance and market exchange. (Dinar et al, 1997; Bruns et al, 2005)

Government allocation here is a form of water institution in which water is owned by the state, with “a mandate authorizing bureaucratic agencies to control water directly”. (Dinar et al, 1997; Bruns et al, 2005) The notion of water as a human right tends to favor government allocation for water resources that intends to promote equity in water allocation. In addition to that, there are some other public values that water serves, such as sustaining the environment or preventing floods. These values again need government to take control of water resources. Due to these and other reasons, government allocation of water has been applied as the main mechanism in many countries. (Dinar et al, 1997; Segerfeldt, 2005)

However, incentive structures within government can generate “government (public) failure”. (Terry, 1983) In practice, government allocation mechanisms often cause the problem of waste and misallocation of water, for example, through subsidies and irrational water pricing. Based on this fact, some writers went to the conclusion of “privatizing” water allocation for improving economic efficiency. (Dinar et al, 1997; Segerfeldt, 2005) Water markets and tradable water rights are two forms of this privatization, whose function in directing water allocation from lower valued uses to higher valued uses has been widely recognized.

One should note that there is a difference between water markets and tradable water rights although there are some overlapping areas. (Perry et al, 1997; Bruns and Meizen-Dick, 2000) As a response to the failure of government water allocation, water markets can exist in an informal way in the absence of the formal definition of water rights. (Holden and Thobani, 1996) Tradable water rights, on the other hand, require “both the formal definition of entitlements, and the specification of the conditions under which the entitlement may be traded.” (Perry et al, 1997) They are central to the development of formal water markets. (Bruns and Meizen-Dick, 2000; Perry et al, 1997)

As mentioned earlier, some level of government involvement is needed even for the predominantly market mechanisms for water allocation. In the case of tradable water rights, two most important forms of government intervention are defining and allocating the initial water rights, and establishing the “rule of the game”, which refers to the institutional and legal frameworks for trade. (Holden and Thobani, 1996; Dinar et al, 1997; Livingston, 1993) Because of the unique characteristics of water, its market allocation would

not be the same as those of other goods. (Anderson, 1983) Indeed, it might need more government intervention based on the fact that externality problems and market failures are more likely to occur in water allocation. In the body of literatures, writers have done a plenty of work on externality and market failures. (Anderson, 1983; Bromley, 1991; Livingston, 1993; Perry et al, 1997) Those in water allocation are more linked with the nature of water cycle and interdependence among users.

Therefore, there is an issue of mixing market and government or balancing these two in water allocation institutions. Institutions pertaining to government intervention in market should be responsive to those externalities and market failures for optimal water allocation. Since water problems tend to be localized in a given country or region, these institutional arrangements should be established to fit the specific contexts. That is why practices of water policy reform in different places around the world have displayed a distinctly difference.

## 3. CHINA'S GOVERNMENT WATER ALLOCATION

As mentioned in the previous section, government control is traditionally a main water allocation approach in many countries. As for China, water resources had been completely managed and allocated by the government on the grounds of its traditional planned economy. China's water legislation explicitly prohibits market water allocation even if few exceptions have been provided in accordance with the implementation of water rights trading as a market-based allocation mechanism under its current water policy reform.

China's Constitution and Water Law both have stated that water resources are the state property. On behalf of the whole people, the government is responsible for managing and allocating water resources within and among different regions and sectors in order to achieve its economic and social goals. When it's development strategy changes or some specific concerns such as drought and severe environmental problems take place, reallocation of water over space, uses and time might become necessary. Then the administrative mechanism is to be used to make such modifications in China. The following subsections analyze three typical cases regarding China's administrative water allocation. By looking at the results of these cases, advantages and disadvantages of this mechanism can be clearly evaluated.

### 3.1. Beijing: Paramount Priority

Beijing is one of the most water-short cities around the country, with its per capita water availability as low as 151.2 cubic meters. (NBS, 2007) Its water resources are far from adequate to support its 15 million residents and over 10% of its annual GDP growth rate. (Statistics Bureau of Beijing, 2007) It has been projected that water shortage of Beijing would be more than 1.2 billion cubic meters by 2010. (Jiang, 2004) As the capital city of China, Beijing is of the unique importance among China's political, economic, cultural and educational centers. Therefore, its water demand has been put in paramount priority by the government.

For several decades, two of its neighboring provinces, Hebei and Shanxi have provided Beijing with plenty of their water without being fairly compensated even though their waters are nearly exhausted and thus suffer from severe environmental deterioration. In spite of its own water shortage, Hebei has hardly obtained the appropriate financial return for its sacrifice. Indeed, its water supply to Beijing has almost been voluntary. For instance, it used to share Guanting Reservoir and Miyun Reservoir with Beijing since 1950's. From early 1980's, however, its annual water usage quota of 0.9 billion cubic meters from these two reservoirs had been given to Beijing for free so as to relieve the capital's growing water shortage. (Hu, 2004) In addition, Hebei has undertaken the drought emergency water supply for Beijing together with Shanxi Province between 2003 and 2007, accounting for a total amount of more than 0.3 billion cubic meters. (Xinhua Net, 2007) And again, there is no compensation for it.

Besides water supply, Hebei takes other responsibilities, such as industry restructuring to conserve water and ecological restoration to protect water quality. All these loads have inhibited the local economic development and have exacerbated poverty of local people. Chicheng County of Heibei, for instance, is one of the poorest counties around the nation. All of its annual runoff of 0.347 billion cubic meters has been supplied to feed two reservoirs of Beijing. (Beijing News, 2005) The rice cultivation acreage of the county has been reduced by 90% to save water. Grazing and livestock husbandry have been completely prohibited to prevent water pollution, resulting in the annual income loss of local farmers as much as 50 million yuan. In contrast, the county had not obtained its first compensation of 300,00 yuan for water supply to Beijing until 2004 after more than three decades of its voluntary water supply. (Beijing News, 2005) It is not rare to see that water disputes rise from time to time between Beijing and Hebei and can hardly be appropriately solved.

The good thing is that the tradition of sacrifice for the capital is to be broken within the context of China's water policy reform, which has introduced the concept of water rights. To secure water use of Beijing 2008 Olympics, Beijing government and Hebei government signed a memo in 2006, in which Heibei is obliged to assure its capacity of supplying 0.4 billion cubic meter water for the Olympic Game. Beijing, on the other hand, needs to invest 0.1 billion yuan to support Hebei's agricultural production shifts and ecological restoration. (Yang 2006) Farmers in Hebei whose rice cultivation is shifted into other less water-intensive crops to save water will be partly compensated for their income loss. (Xinhua Net, 2007) Although two parties are both favored by the cooperation based on the consensus of prioritizing the 2008 Olympics, the memo is just an expedient for the specific political purpose. (Yang, 2006)

## 3.2. Ecological Emergency

Another administrative water transfer of China is applied to rescue the damaged ecosystem such as drying rivers and shrinking wetlands. Lots of water systems of China, especially those in the arid North, are being exhausted due to the extremely high utilization ratio (some even exceeding 80%). Upstream users take water as much as they need and leave nothing for downstream areas. Aware of the environmental degradation, the government has undertaken the administrative measure to restore the ecosystem at the lower reaches of these rivers. The restoration of Tarim River is one of the successful examples.

Located in Xinjiang Uygur Autonomous Region of China, Tarim River is the longest inland river of China. Because of the high evaporation rate and the low precipitation in the basin area, the ecosystem of Tarim is quite weak and fragile. Since 1970's, irrigation land in the upstream area had been dramatically expanded with the population growth and economic development. Over 300 kilometers of its lowstream including its end Taitema Lake have dried up for 30 years, accounting for one forth of the total length of the river. (Zhou, 2002) As a result, natural vegetation around Taitema Lake had been almost swallowed by neighboring deserts.

From 2000 to 2005, the government had operated seven ecological emergency water transfers to rescue the damaged ecosystem of lower reaches of Tarim. (Jia, 2006) 2.45 billion cubic meters of water had been supplied by upstream users of Tarim River to hydrate the dying ecosystem. Five among those transfers had reached Taitema Lake and had restored it after several decades of dryness. The ecosystem around the lake has shown a very positive response to the emergency hydration with recovering natural vegetation and biodiversity, higher water level of aquifers and better groundwater quality. (Zhu et al, 2003)

Because of its effectiveness, the same instrument has also been employed in other northern rivers such as Yellow and Hei (he) to address the problem of environmental deterioration in their downstream areas. Upstream areas have used water for a long time without considering the needs of downstream users. It is fair for them to pay back. During those emergency water transfers, their water supply had been shut down to make them use less water. In addition, those upstream users waste lots of water by their low use efficiency. The administrative water transfer has effectively stimulated the investments in water saving technologies. Compared to the Beijing and Hebei case, the equity issue between upstream users and lowstream users within an integral water system has been better addressed here.

## 3.3. Less Favored Agriculture

As the traditional industrial sector of China, agriculture has played a unique role in its economic and social development. In spite of the rapid urbanization since 1980's, there are still more than 0.7 billion rural people making a living in the agricultural sector, accounting for 56.1% of the total population of China. (NBS, 2007) More importantly, it is of great significance to China's and the world's food security. More than 20% of the world's population needs to be fed with 7% of the world's cultivated land. (Xinhua Net, 2007) If China fails to do that and thus has to increase its food import, the world's food security would be greatly threatened. At present, China keeps its grain self-sufficiency rate above 95%, which is also the target of China's food policy. (Xinhua Net, 2007)

However, the contribution of agriculture to the national GDP is much less than those of other industries. For instance, the agricultural production of China only accounted for 11.8% of the national GDP in 2006 by using 63.2% of the total water usage. (NBS, 2007; MWR, 2007) Economic efficiency is the major reason why the agricultural use of water is less favored and less prioritized than industrial and municipal use of water. With the economic growth in China, the agriculture use of water shows a decreasing trend while

industrial and municipal use of water keeps increasing. Under the traditional water allocation approach, industrial and municipal shortfalls have been filled by administratively diverting water from agriculture without compensating farmers simply because the economic advantages of those water uses are more than those of agriculture.

But agriculture is still the biggest water user in China. Its large amount of water use coupled with its low use efficiency implies the great potential of water saving. Based on this fact, the China's government set up the goal of water saving for agriculture between 2005 and 2010, which is nil growth for agricultural water consumption. Rather than getting more water supplies, the agricultural sector has to deal with its water shortage through water saving technology, production structure shifts and irrigation infrastructure renovation.

There is nothing wrong with reallocating water resources from low valued uses to higher valued uses. The problem is whether the instrument to be used for achieving the economic efficiency is effective and also gives adequate attention to the equity issue. The administrative approach without appropriate compensations would undoubtedly gives farmers no incentive to invest in water saving and use water more efficiently. In 2006, agriculture of China used 8.4 billion cubic meters more than the last year, failing to meet the goal of nil growth. (MWR, 2007) In addition, it is not fair to take water from farmers for free, especially considering that farmers' incomes are much lower than those of urban people and there are more than 20 million rural people living in extreme poverty with their annual incomes below 693 yuan. (NBS, 2007)

To sum up, according to the three examples analyzed above, it can be concluded that the administrative allocation approach of water resources has indicated its pros and cons. It is very effective in achieving some particular political goals of the government at the macro level such as its success in securing the water demand of the 2008 Beijing Olympic Game. It also works well in fulfilling the macro economic development policy of the government. On the other hand, the equity issue has not been properly addressed with this instrument. Both the Beijing case and the agriculture case have shown its complete failure in equity. As for the case of ecological emergency, the instrument has accomplished equity to some extent between the upstream users and the downstream users, but this was just its additional effect besides its main concern about the ecosystem deterioration.

# 4. CURRENT PRACTICES OF MARKET WATER ALLOCATION AND GOVERNMENT INTERVENTION IN CHINA

## 4.1 Water policy reform: Building a water saving society

As water demands increase beyond the water availability, developing new water supplies becomes more and more difficult and expensive in China. Under this situation, water saving and more efficient water use offer a feasible solution to meet the rising water needs. Realizing that the present water policy does not relieve but worsens the water crisis, the Chinese government has initiated an ambitious water reform, "Building a water-saving society", to establish a water management system based on the theory of water rights and water markets and apply market-oriented mechanisms in water allocation.

In order to obtain the practical experience for the reform, the MWR generated a pilot project. Some water-scarce cities or regions are selected as the state-level pilots for "building a water-saving society" by the MWR. Meanwhile, local governments also decide their own pilots at the provincial level and report them to the MWR. (MWR, 2002) Under the new reform initiative, water rights trading as a market-based allocation instrument has been explored. In October 2000, the former Minister of Water Resources, Mr. Shucheng Wang presented his speech entitled "Water Rights and Water Markets: Economic Measures for Achieving Optimal Allocation of Water Resources" on the annual meeting of the Chinese Hydraulic Engineering Society (Wang, 2006), calling upon the implementation of the market-based mechanism and water rights trading in particular, in water resources allocation. From then on, a variety of stakeholders in water sector participated in this discussion. Moreover, different forms of market water allocation occurred in several areas of China, especially in those reform pilots, even though the sufficient institutional arrangements are not in place.

The Chinese government has promoted water rights trading on a pilot basis under the national water policy reform. Several attempts have been made at the local level in China despite the explicit prohibition for water rights transfer by law. This section reviews three important cases regarding water rights trading

in China, namely Dongyang-Yiwu water trading, Zhangye "water notes" transfer and water rights transfer in Yellow River Basin. Occurring in the period of China's ongoing economic and water policy reform, all these cases have shown a tradition-breaking feature. It is fortunate that these efforts have obtained support and guidance from the government because implementing market water allocation is consistent with the China's reform.

## 4.1. Water trading between Dongyang and Yiwu

In November 2000, two counties of Jinhua City in Zhejiang Province, namely, Dongyang and Yiwu, accomplished an agreement, in which Yiwu bought the permanent water use right of about 50 million cubic meters per year from Dongyang's Hengjin Reservoir by paying Dongyang RMB 200 million yuan. (Shen, 2006) This trading between two local governments broke away from the China's tradition of administrative water allocation and thus was viewed as the first water trading case in China. (Yuan, 2005)

Well known for the small commodity manufactures and wholesales, Yiwu is a well developed economy with its average annual economic growth rate higher than 15% in the past 20 years. (Shen, 2006) With the population and urbanization growth, Yiwu has faced a big problem to meet the rapidly increasing demands for water. As the biggest obstacle for Yiwu's economic and social development, water shortage has become the urgent issue for Yiwu's government to cope with. Buying water rights from its neighboring county Donyang is one of the possible options.

Located in the upstream area of the Jinhuajiang River Basin, Donyang is more abundant in water resources. (Shen, 2006) Without worries about water supplies, water use efficiency was fairly low, which caused lots of waste. Indeed, besides water supply for its own uses, Dongyang had to discharge more than 30 million cubic meter water in the flood season every year. (Development Research Centre and Department of Economic Regulation of MWR, 2001) The supply capability of Hengjin Reservoir, which is the biggest in Dongyang can be further enhanced. By renovating the reservoir project and irrigation infrastructure and exploiting another river (Zixi River), Dongyang have more than 100 million cubic meters of extra water availability, which means it is capable of selling some of its extra water to others who need more. (Development Research Centre and Department of Economic Regulation of MWR, 2001; Shen, 2006; Australia China Environment Development Program, 2006)

As Yiwu's upstream neighbor in the same river basin, Dongyang used to voluntarily help Yiwu in fighting against its water shortage. However, the administrative allocation is not always reliable. Yiwu could not be sure about how long the process would take. Waiting for an unknown result is time-costly and economically uncertain for Yiwu. In addition, even if Yiwu can successfully get the administrative allocation granted, what Dongyang would give is far from adequate to solve its water shortage problem but only help Yiwu relieve a little from temporary droughts. Instead of following the traditional approach, Yiwu is more willing to pay Dongyang for more reliable and stable water supply.

A trade about water then occurred between one party with lots of water available to sell and the other with willingness and ability to buy. In January 2005, the water diversion project of this water trading had been completed after three-year construction. Hengjin reservoir began to supply water for Yiwu users. Due to the successful performance of the agreement, Dongyang-Yiwu water trade was praised as a win-win trading. The cost of water supply per cubic meter for Dongyang is less than RMB 1.00 yuan. Yiwu, the buyer would need to spend RMB 6.00 yuan for per cubic meter water if it builds a new reservoir. (Hu and Wang, 2001; Shen, 2006) The price for water rights transfer in the agreement is RMB 4.00 yuan, which means that both parties have obtained the net benefits from the trade.

Despite its rationality in terms of the two counties' specific conditions, this water trading between local governments is fairly controversial in its legitimacy. According to the Water Law, the water resources are owned by the state and the State Council exercises the ownership of water resources on behalf of the state. Local governments cannot dispose water resources in their jurisdiction without the authorization of the State Council but only have the management power. In addition, even if assuming that was a transfer of water usufruct, the trading was lacking in legal foundation since the water laws and regulations did not stipulate the tradable water rights at the time of the trading. That is why the construction of the diversion project was delayed and lagged a lot behind the expected timeline.

Another point in controversy about this trading is related to the definition of water rights. Specifically speaking, there are two levels of water rights conflicts. One is between the two counties involved in the trading. Dongyang and Yiwu have shared the same river for a long time without clearly specifying the initial water allocation quotas. Conflicts will not happen when water resources are abundant and all users

can have sufficient water supplies. As water is becoming scarcer with the economic and social development, Dongyang as the upstream user stands in a better position in water use than Yiwu. In contrast, Yiwu at the lower reaches might suffer from water shortage. However, the legal status of water rights does not come from different locations in the river basin. As the seller of so called "water rights", Dongyang does not have well specified water use rights for that 50 million cubic meter water of Hengjin Reservoir. Why the trading can be made is because that Yiwu is willing to admit that for its own good.

The conflict of water rights also exists between Dongyang government and farmers in the irrigation district around Hengjin reservoir. Like the unclear water allocation between Dongyang and Yiwu, Dongyang farmers who use water from Hengjin reservoir do have well specified water rights on a legal basis. However, farmers have historic rights to use water for irrigation because of their contribution in the reservoir construction through labor work. (Zhao and Hu, 2007; Shen, 2006) Indeed, farmers influenced by the trading have not got involved in the decision making with regard to essential elements of the trade such as the amount of water for sale. Neither have they been properly compensated by either party of the trading.

The fortunate thing is that despite those blemishes of Dongyang-Yiwu water trading, the MWR maintained a supportive and positive attitude towards it since it clearly recognized the failure of the administrative allocation mechanism. (Wang, 2001) Within the contexts of China's economic reform and water policy reform, it is not unusual to see "illegal" events according to the current legal system being justified and permitted.

Nevertheless, Dongyang-Yiwu water trading was a successful attempt of applying market water allocation in China. The advantages of water rights trading had been widely recognized even though attitudes towards the trading itself varied. The traditional administrative approach in water allocation had shown its ineffectiveness through this case. Since then, a heated debate regarding the definition of tradable water property rights in China stemmed from it. The ill-defined water rights in China's present water legal framework became a vital obstacle of developing water trading and the water market. Why Dongyang-yiwu trading could happen in this circumstance is because Yiwu acknowledged that Dongyang owned the water rights and took the initiative to propose it. However, an active water market will not appear unless the water rights are to be clearly defined and recognized as tradable by law. The other two types of water trading to be discussed in the following subsections both are practiced in the river basins whose water rights among areas and users are relatively well defined.

## 4.2. Zhangye "water notes" transfer

As one of China's top 10 grain production areas, Zhangye in Gansu Province is the biggest water user of Heihe River Basin (the second largest inland river of China). It is located in the middle stream area of the basin with 91% of the basin's population and 95% of the basin's cultivated land. (Shen, 2006) Its overuse of water from Heihe River has led to the severe ecological degradation in the downstream area. Two end lakes of the river, East Juyanhai and West Juyanhai had dried up respectively in 1961 and in 1992 so that Ejina Qi in Inner Mongolia Autonomous Region had become the main source of Beijing's sand storms. (Shen, 2006)

Since 2000, the State Council has carried out administrative water transfers to restore the ecosystem of Heihe River Basin. The Short-term Restoration Plan of Heihe River Basin approved by the State Council in 2002 has confirmed an annual water allocation for the downstream area. (Australia China Environment Development Program, 2006) It means that Zhangye has been asked to reduce its water diversion from the river runoff by 580 million cubic meter water per year, accounting for 23% of its total annual water use. (Shen, 2006) Under this background, Zhangye government had started the exploration of water rights trading so as to fulfill this challenging task. In 2002, the MWR had approved it as the first pilot of building a water-saving society.

The initialization of water rights was one of the essential factors to facilitate water rights trading in Zhangye's experience. Based on the reduction target, water resources allocation schemes were formulated in which the total water use volume has been allocated from higher levels to lower levels. At the same time, water use quotas for different using sectors have been fixed to promote the industrial restructuring. At the level of terminal water users, water rights certificates have been assigned that include the detailed information such as the amount of family members, the acreage of irrigated farms, types of crops, and the quantity of water supply for each irrigation round.

The well defined water rights of Zhangye help make water trading possible. Irrigators buy water notes from

Water Users' Associations (WUAs) according to their entitled water quantity on water rights certificates. Then for each irrigation round, water supply is acquired based on water notes. Those who need more water than their entitled quantity to meet their irrigation need can buy water notes from other irrigators within the same sublateral canal whose water entitlements are not fully used up. The prices of water notes transfer are bargained by trading parities with the governmental guidance that the price would not be 3 to 4 times higher than the basic water price set by the government. (Shen, 2006)

The equitability and transparency of water allocation has been greatly improved due to the clear definition of water rights. Before the water certificates system was implemented in irrigation districts of Zhangye, water charges were prepaid at the beginning of the year and evenly shared by all village irrigators. The balance of water charges should be returned back to irrigators at the end of the year. However, there was no effective supervision to village officers who were in charge of finances including water charges, irrigators never got the balance back. Farmers had no access to the information of use limits and actual use quantity for each household, free riding became inevitable. Without the clear use limits, the upstream irrigators tend to use more water. And the more influential ones could obtain more water supply than others. In contrast, irrigators pay for water that is actually used based on specified water entitlements under the new system.

Contributing in more than 87% of Zhangye's total water use, agriculture had a great potential of water conservation by means of improving use efficiency. (Zhong et al, 2003) Water notes transfer has effectively stimulated farmers to save water by utilizing the water-saving technologies or adjusting the crops structure. An investigation has indicated that water use in those pilot irrigation districts of Zhangye has reduced by 46 cubic meters per mu while farmers' average incomes has increased by RMB 100-150 yuan. (Shen, 2006; Australia China Environment Development Program, 2006)

Compared to the positive influences of water notes trading on water conservation and total water use control, its impacts on economic efficiency are pretty much limited. It is unable to significantly increase economic benefits of water use because water notes only circulate among irrigators within the agricultural sector. Individual farmers only have a small piece of land to cultivate and correspondingly their water entitlements available for trading are also quite small in number. In addition, although those pilot irrigation districts in Zhangye all operate the system of water rights certificates and provide sound trading rules, it does not necessarily mean that there exist active water rights trading markets. In another pilot irrigation district named Liyuanhe, for instance, no water rights trading happens so far. (Shen, 2006; Australia China Environment Development Program, 2006)

This situation might result from various reasons. Unlike the well developed market economy in Zhejiang Province where the Dongyang-Yiwu case occurred, Zhangye's agriculture-based economy is still pretty much influenced by the traditional planned economy. Farmers in those irrigation districts are not familiar with market dealing. On the other hand, because of poor water metering facilities, farmers' real use amount of water cannot be accurately monitored. It is not unusual that some of them keep abstracting groundwater by using their own motor-pumped wells. Since they can obtain extra water beyond their legitimate entitlements this way, there is a lack of willingness for farmers to buy water rights in market. (Shen, 2006)

To sum up, water notes transfer in Zhangye is the first case of water rights trading between terminal water users in China. Water rights are reallocated among irrigators within one single water-using sector, agriculture. Due to the specific form of China's individual household farming, the main effect of water notes transfer is more in control of total water use in agriculture rather than in moving water resources to higher valued uses. However, the case has clearly shown the potential function of water rights trading in more efficient water allocation. With well-defined water rights available for water users, water rights trading is likely to happen between different water-using sectors. In Yellow River Basin whose water rights are also relatively well defined, the paid water rights transfer from agriculture to industry in Ningxia and Inner Mongolia has been much larger in scale than Zhangye water notes transfer and has brought much more economic benefits from water use.

## 4.3. Paid water transfer from agriculture to industry in Yellow River Basin

Yellow River Basin is one of the most stressful water systems in North China. To protect the fragile ecosystems in the basin, especially in the downstream areas, the government has taken various measures to control the overuse of water from Yellow River. As early as 1987, the State Council approved the water allocation scheme of the Yellow River before the operation of the South-North Water Transfer Project. (An et al, 2007) It has defined the share of water use from Yellow River for each provinces or

autonomous regions concerned in the basin.

Ningxia and Inner Mongolia are two of the most water-scarce regions in Yellow River Basin. Ironically, the severe water shortage in these two regions is coupled with huge waste of water use. Agriculture accounts for more than 90% of the total water use with the irrigation utilization coefficient ratio as low as 0.4. (Department of Economic Regulation of the MWR, 2004) Heavily depending on water supply from Yellow River, these two regions actually had used much more than their entitled quotas by the State Council's allocation scheme. Ningxia for instance, had used 50% more than its quota from 1998 to 2004. (Tao et al, 2007)

While agriculture has occupied the most of water available in Ningxia and Inner Mongolia, other growing industries have been constrained because of no access to water resources. The abundant coal resources help the development of energy industry, especially electric power in these two regions. However, energy projects need a large amount of new water supply. For example, to support those proposed large-scaled projects in Inner Mongolia, 220 million cubic meters of water use have to be increased annually. (Tao et al, 2007) Between 2002 and 2003, Ningxia and Inner Mongolia raised several applications for more water abstraction from Yellow River in order to develop electric power plants. Unfortunately, the Yellow River Conservancy Commission (YRCC) has refused all these applications. (Tao et al, 2007) As a result, many proposals of energy projects in these two regions could not be implemented but lay in files.

Since new water rights from Yellow become impossible for energy industry, the other solution is getting the present water rights from other water users. As the absolutely dominant water-using sector in Ningxia and Inner Mongolia, agriculture has the great potential in water saving by improving water use efficiency. The problem is that there is a difficulty in water conservation financing for most of old and badly maintained irrigation facilities in these two regions. Traditionally, irrigation projects heavily rely on the investment of the national and local governments. The limited governmental investment is the main obstacle of the agricultural water conservation.

Within these contexts, the YRCC initiated a pilot program of water rights transfer from agricultural to industrial use in 2003. In order to meet the water demand without exceeding the total water allocation from Yellow, developers of energy projects in Ningxia and Inner Mongolia invest in the construction of water conservation rehabilitation projects in irrigation districts and acquire water allocation saved from irrigation by the investment. A total of five projects, three in Ningxia and two in Inner Mongolia, were selected to practice water rights transfer. (Tao et al, 2007) In 2004, irrigation district management authorities came to agreements of water rights transfer with these five pilots. (Tao et al, 2007)

The pilot programs had been officially supported by the WMR through its guideline. (WMR, 2004) To promote the pilots' practices to the entire basin, the YRCC then formulated the Implementing Regulation on Management of Water Rights Transfer in Yellow River Basin (Trial) in 2004. According to this regulation, water abstraction right holders of Yellow River who has a surplus of water quota in a period of time or through water saving projects can transfer their rights with the approval of water management authorities. (YRCC, 2004) The provincial governments have two important responsibilities to facilitate water rights trading. One, initial water rights of Yellow River have to be allocated at least to the prefecture level within their jurisdiction. The other, the provincial overall plan of water rights transfer needs to be formulated for the YRCC's approval.

In 2005, Inner Mongolia and Ningxia had got their overall plan of water rights transfer approved by the YRCC, in which 74 new short term proposals of water rights transfer have been raised. (Yuan et al, 2007) More than 600 million cubic meter agricultural water would to be transferred to other industries such as electric power, chemical technology and coal mining. (Yuan et al, 2007) Both of them would be able to limit their actual water abstraction from Yellow River within their entitled quotas by 2015. (Yuan et al , 2007)

Besides the same function with Zhangye water notes transfer in water use control, practices of water rights transfer from agriculture to industry in Yellow River Basin have shown a significant improvement in economic benefits of water use. An investigation has concluded that 14 approved proposals by the end of 2005 would transfer 150 million cubic meters of water for higher valued industrial use and thus would bring a benefit of RMB 10 billion yuan. (Zhang et al, 2006)

On the other hand, farmers pay less for their water use that would be largely reduced with the rehabilitation of irrigation facilities. An annual reduction of water expenses can be RMB 682 yuan after those 14 proposals are implemented. (Zhang et al, 2006) Under the traditional administrative system of water allocation, farmers tend to be paid nothing when their irrigation water is transferred out from

agriculture to other uses. On the contrary, farmers have indirectly obtained economic benefits through water rights transfer even though no direct compensation has been given to farmers for their water rights.

The Trial Implementing Regulation limits this type of water rights trading within provincial units. (YRCC, 2004) According to the current practices, all transfers are limited within prefectures of those provinces and autonomous regions that do not have surplus quotas from Yellow River for their new water users. (An et al, 2007) It may be because it is not market but government that has oriented this type of water rights trading. The sellers are governmental agencies in charge of water administration or irrigation district management rather than farmers themselves. This fact brings difficulty in negotiation between parties from different prefectures. Inter-provincial trading is more difficult for the same reason. Despite this limitation, there exist demands for inter-provincial water rights trading within Yellow River Basin. Some certain local units have no adequate agriculture water available for trading to meet needs of industrial projects. In this case, it becomes necessary to have an integral water rights market within the basin. In order to expand water rights trading to the whole basin, the coordination capacity of the river basin commission needs to be further improved.

Based on the reviews of these three water trading cases, it can be concluded that market allocation mechanisms do have good performances in improving the economic efficiency of water resources as well as in controlling unsustainable water use. With respect to the equity issue, it also works better than the traditional administrative allocation approach. In the Zhangye case, farmers have been compensated from their disposed water rights. The other two cases are more dominated by the government and therefore farmers are not the one who gets benefits from water trading. The less effective functioning of water rights trading mainly results from the inadequate institutional arrangements of water rights and water rights trading. Tradable water rights of terminal water users, for instance, have not yet been well defined in China. It is natural for a transforming society.

## 5. CONCLUSION

Water is a unique resource with great significance to humans and the environment. Practices of water allocation in many places have shown that a mix of government and market institutions in water allocation is often necessary since both of the two can cause some forms of failures. In China's case, its current water policy reform is exploring market allocation under the framework of a dominant government allocation institution. While government allocation shows its failures both in equity and in economic efficiency, several practices of water trading have displayed the function of market allocation in directing water from lower valued uses to higher valued uses. It can be argued that market mechanisms should be further promoted in China to achieve sustainable water use. Put it another way, a complete government control of water should be transformed to a mix of government and market allocation.

Because market allocation institution is quite new for China, some adequate institutional arrangements are still absent such as the initialization of tradable water rights and the operation rules of water markets. Market allocation mechanisms would be undoubtedly inhibited without these government interventions. Furthermore, as market allocation develops, market failures should be taken into account. On the other hand, it should be noted that market allocation could be greatly undermined because of overreaching government involvement. It might be reasonable for government to orient and dominate market transactions at the early stage of development. As market grows, government is supposed to get directly involved as less as possible but to provide adequate institutional arrangements.

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