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A Framework to Protect Vulnerable Groups in Water Resource Conflicts

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Abstract: With the rapid development of economy and society in China, water shortage and water pollution have become more serious. As a result, water resource conflicts have become prominent problems in water resources management of China. The water resource conflicts are caused by such factors as inadequate water quantity, poor water quality and improper timing of water usage. This study firstly points out that neglecting to protect the interests of the vulnerable groups often aggravates water resource conflicts. Then, the characteristics of vulnerable groups in water resource conflicts and their harm to the society are illustrated and the current research on vulnerable groups in various fields is briefly reviewed. Finally, a framework to protect vulnerable groups in water resource conflicts is proposed. This proposed framework combines economic compensation and capacity building to prevent water resource conflicts from their source.

Key words: Water resource management, conflicts, vulnerable groups

INTRODUCTION

The rapid change in the social and economic environment drastically increases the imbalance between supply and demand of water resources. As a result, water resource conflicts occur frequently particularly in countries like China and India. In 2009, the problem of cross-border river basin water resources conflicts in China was mentioned on the global agenda on the "world water day". In recent years, the Chinese government has been quite active to develop strategies and systems to mitigate the effect of water resource conflicts caused by the shortage of water resources and an increase in water pollution. Since the seven river basins in China flow across several provinces, the conflicts between regions are quite frequent because of sharing the water originating from the same river basin. The water resource conflicts are more prominent in Yellow River, Black River and DaLing River. Since 2005, more than 100,000 water disputes and 15 significant water pollution accidents in China have been reported (Luo and Zhang, 2008).

On Feb. 16, 2012, in view of the overdevelopment, water resource wastage and serious water pollution issues, Chinese government implemented a most stringent water resources management system. In doing so, the Chinese government defined water quantity, efficiency of water usage and water pollution as "three red lines." The first red line is to strengthen the development, utilization and control of water resource, and to strictly control the total amount of water to be used. The second red line is to improve water use efficiency and to promote the creation of water-saving society comprehensively. The third red line is to strictly control the total amount of sewage into rivers and lakes by restricting the volume of sewage. These three red lines aim to strengthen the management of water quantity, to create a water-saving society and to implement the strictest water resources management guidelines suggested by the 18th National People's Congress. Therefore, the problem of water resource conflicts, which seriously affects the societal and economic development, must be handled appropriately so that it does not adversely affect those who are vulnerable to their adverse effects.

The purpose of this study is to review the existing literature related to the vulnerable groups in various fields and to propose a preliminary framework to develop a mechanism to protect vulnerable groups in water resource conflicts.

THE CHARACTERISTICS AND HARM OF VULNERABLE GROUPS

The causes of water resource conflicts: Water resource conflicts mainly refer to the conflicts of interest in the process of development, utilization, distribution and protection of water resources. Scholars generally discuss the conflicts related to the initial water rights conflict, water pollution conflict and the time of water using conflicts, etc. (Rong, 2009; Li *et al*., 2010; Dong and Miao, 2013). The initial water rights conflicts and water pollution conflicts are particularly prominent in China. Wolf *et al*. (2005) identified three key factors that cause water

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resource conflicts, namely inadequate water quantity, poor water quality and lack of opportunity to enhanced economic status in society. They further divided water conflicts into three levels: international, domestic and local. Ansink and Weikard (2009) suggested that the root cause of water resource conflicts in the international trans-boundary river basin is the dispute on the ownership of water resources.

In the management of water resources within a river basin, there are many conflicts. The type and reason of classic water resource conflicts are listed in Table 1. It is clear that the causes of water resource conflicts have many kinds, such as quantity, quality, time, space and so on. Some water resource conflicts are mainly the disputes about the initial water rights, such as in Yellow River, Black River, Daling River and Zhang River. Some are mainly because of water pollution, such as in Tai Lake. In addition, each river basin has varying degrees of conflicts among industries, for example, conflicts between industrial water and agricultural water, especially during the agricultural irrigation periods. In all kinds of water resource conflicts, it is necessary to find the root causes of water resource conflicts and to protect the interests of vulnerable groups who are most affected by such water resource conflicts.

The characteristics of vulnerable groups: Vulnerable groups can be defined in the broad or narrow sense. The broad sense of vulnerable group, namely social vulnerable group, refers to the social members set who, due to a lack of economic, political and social opportunity are at a disadvantage in society. The narrow sense of vulnerable group mainly refers to the group that is at a disadvantage in some industries and/or in the allocation of some resources.

In water resource conflicts, a particular area or industry is in a disadvantageous position, such as in the political discourse, in economic development level, in the geographical position, or in the sustainable utilization ability of water resources. Therefore, these regions or industries become vulnerable groups during the water resource allocation process and/or in increased water pollution. On the basis of related research results (Ye and Yanping, 2011) defined vulnerable groups in water resource conflicts as those who obtain relatively few water rights in the initial water rights allocation, or those who have a lot of economic loss due to water pollution that cannot be compensated. Thus, a group may be vulnerable because of its own or social reasons or due to its economic, political, or geographical position in the country.

After accessing and analyzing the relevant data associated with typical water resource conflict cases, we found that the characteristics of the vulnerable groups are mainly related to their geographical position, level of economic development, ability of water resource sustainable utilization and/or government support. Each of these is briefly described below:

- **Geographical position:** The districts on the downstream of a river basin, or close to polluted water are easy to become vulnerable groups
- **Level of economic development:** The districts which are backward in economic, such as rural and agriculture are easy to become vulnerable groups
- **Ability of water resource sustainable utilization:** The districts with lower efficiency in water resources utilization, lagging water-saving technology and weak awareness of water conservation are easy to become vulnerable groups

Table 1: The type and reason of classical water resource conflicts

River basin	When	Type	Why
Yangtze River basin	Many times (1998, 2009, etc.)	Water pollution conflicts Water development conflicts	Because of flood protection, water development and water pollution
Yellow River Basin	Many times (1987, 1997, 2003, 2009, etc.)	Water rights conflicts Water supply time conflicts	Because of drought, agricultural irrigation water occupy industrial water
Huaihe River Basin	2005	Water rights conflicts Water pollution conflicts	Shortage of water resource
Taihu Lake Basin	2007	Water pollution conflicts	Algae incident because of high-speed economic development and seriously lagging wastewater treatment
Daling River Basin	2008	Water rights conflicts	Some regions were dissatisfied with the results of water rights allocation
Heihe River Basin	2003	Water rights conflicts	Shortage of water resource, regions were competed for water resources ownership
Tarim River	2009	Water rights conflicts	Shortage of water resource, regions were competed for water resources ownership
Songhua River	2005	Water pollution conflicts	Unexpected water pollution affected the life and production of the downstream

- **Government support:** The districts with little policy support or policy tilt are easy to become vulnerable groups

The harm of vulnerable groups: The problem of water resource conflicts in China is becoming more serious. New and more severe water resource conflicts will occur during the implementation of the most stringent water resources management system announced by the Chinese government in February 2012. During the key period of constructing harmonious society, without paying more attention to the protection of vulnerable groups, serious social problem will develop. According to the theories of sociology, in a society of strong and weak coexistence, the groups whose interests are deprived of the societal benefits may develop hostility or psychological hatred towards other groups (Bing and Taolei, 2006). Vulnerable groups, whose interests haven't been protected effectively, are the biggest threats to the creation of a harmonious society. Water resource conflicts, which are mainly caused by a lack of protection of the interests of vulnerable groups, threaten regional peace and stability, restrict coordinated basin economy development and impede the creation of a socialist harmonious society.

For example, the majority of population in the upstream regions of a river basin is vulnerable groups. The upstream regions are generally the water conservation districts and ecological protection zones, which shoulder the important task of watershed and soil conservation, ecological construction and missed developmental opportunities. Since these upstream regions were not given proper and right compensation, they became the vulnerable groups of a river basin. The upstream vulnerable groups are dissatisfied with what the downstream groups have done. These upstream vulnerable groups, therefore, deliberately damage the ecological environment by polluting water resources. As a result, frequent water disputes emerge.

The interests of vulnerable groups must be protected in solving the water shortage problem. Therefore, development of mechanisms to protect the interests of vulnerable groups in water resource conflicts is urgent and importance during the key period of implementing the most stringent water resource management system in China.

CURRENT RESEARCH IN THE PROTECTION OF VULNERABLE GROUP

Protection of vulnerable groups in the field of society: Research scholars throughout the world have studied the components and causes of water resource conflicts as well as the tactics used in the protection of vulnerable groups (Bolderson, 2007; Cao, 2007). The protection on the interests of vulnerable groups is a research focus. Bolderson (2007) studied the interests of vulnerable groups without equitable access to social security and found that these groups may be at risk of being denied their due benefits. Gallie (2002) studied the interests of vulnerable groups who have been expelled by the labor market and provided a system to prevent them from the abjection of the labor market. Chinese scholars proposed to protect vulnerable groups through political participation, expression of interest, compensation of interest and policy tilt from the view of a harmonious society. Chen *et al*. (2004) proposed the compensation boundaries for the interests of the vulnerable groups that were generated from social reform: from absolute interests damaged amount to relative interests damaged amount. They also proposed a compensation principle which takes into account the moderate, hematopoietic, fairness and efficiency aspects.

Protection of vulnerable groups in the field of resource allocation: The gap between demand for resources needed for rapid economic development and the limited resource endowments is increasing. Thus, equitable resource allocation becomes a real issue. In this process, several groups have been treated unfairly because of an inn appropriate and unfair in resource allocation system. The vulnerable groups in educational resource allocation have been studied by Xu (2007) and she put forward that compensation to them was the only way to realize the balance of educational resources. The vulnerable groups in coal mining emphasized that the interests of vulnerable groups should be protected by the means of economic, juristic and administrative. The vulnerable groups in communication have been studied by Xu (2007) and she pointed out that farmer were the vulnerable groups because of disadvantage in culture resource, information resource and social status. The ecological protection mechanisms of vulnerable groups in environment has been studied by Edumunds and Wollenberg (2002) hold that negotiations among multi-stakeholder were also difficult to eliminate the existing of vulnerable groups in public resources management, because vulnerable groups had lower social status and poor negotiation capability.

Protection of vulnerable groups in the field of water resource management: Europe, United States and Japan have established legal aid system, aid policy and

compensation fund for vulnerable groups because of water pollution in river basin. The econometric method was applied to analyze the loss of water pollution conflicts and the impact to public by Reddy and Behera (2006). They put forward that through compensation to vulnerable groups and the conflicts are easy to be relieved. The interests of farmers (who are similar to vulnerable groups) in water resource conflicts and the interest of public in water resource reform have been specially discussed by Azizullah *et al.* (2011).

Chinese scholars also have recognized the importance of protecting the interests of vulnerable groups in water resource conflicts (Hu and Ge, 2004; Shen *et al*., 2006; Liu *et al*., 2013; Wang and Dang, 2006; Chen *et al*., 2011; Zhang *et al*., 2005). Hu and Ge (2004) proposed to protect the interests of vulnerable groups through democratic consultation and benefit compensation mechanism. Shen *et al.* (2006) believed that the water resource conflicts arose because of vulnerable groups having a poor game ability, so strengthen the capacity of vulnerable groups is fundamental to resolve water resource conflicts. Wang Hao stressed that in the allocation of initial water rights, the principle of protecting the interests of vulnerable groups must be adhered to. Chen *et al.* (2011) proposed that the conflict in initial water rights allocation is mainly caused by the lack of effective protection of vulnerable groups. They used an evolutionary game model to obtain a strong evolutionary stable strategy, which if used to adjust the initial water rights allocation can eliminate the conflict in initial water rights allocation.

PROTECTION MECHANISM OF VULNERABLE GROUPS IN WATER RESOURCE CONFLICTS

Scholars have proposed to use conflict analysis model, game theory model, negotiation mechanism and water resources integrated management to solve water resource conflicts. Both the game theory model and the negotiation mechanism are built on the basis of equal status and equal speaking right of both parties in the conflict. This is the only way that both parties can play a fair game or conduct fair negotiations. However, the vulnerable groups in water resource conflicts are precisely a group which does not have the equal speaking right. Because of their low social status and poor negotiation capability, vulnerable groups find it difficult to obtain equal speaking right in negotiations (Edumunds and Wollenberg, 2002). As a result, fair results cannot be achieved. Therefore, current approaches ignore the protection of vulnerable groups' interests. To overcome these shortcomings of the existing research, we propose a framework for protecting the interests of the vulnerable groups. Our proposed framework to protect vulnerable groups in water resource conflicts is shown in Fig. 1 and is briefly discussed below.

Economic compensation to vulnerable groups: For the quantity of compensation, we can use Graph Model for Conflict Resolution (Zhang *et al*., 2005) to study the behavioral relationship between vulnerable groups and other stakeholders. There are three players in GMCR: a defensive player (vulnerable groups), a neutral player (government) and an offensive third player (strong groups). By building the effectiveness functions of these three players, a stable strategy of three players can be found. The GMCR can reveal the behavioral mechanism of vulnerable groups in water resource conflicts and can obtain the critical condition to resolve the conflict. According to this behavioral mechanism of vulnerable groups and the critical condition to resolve the conflict, an appropriate mechanism to protect the vulnerable groups can be established.

Vulnerable groups in water quantity conflicts are generally upstream areas, water conservation district or economically backward areas that shouldered a lot of ecological protection responsibility. So, ecological compensation should be given to them. The protection mechanism includes the compensation principles, compensation standards and the manner in which the compensation is provided. Compensation standard can be based on the internalization of externalities conversion method and Kaldo-Hicks compensation principles. Vulnerable groups in water pollution conflicts are generally those who are vulnerable to pollution, such as agriculture, urban water, or enterprises on downstream. For these vulnerable groups, compensation standard can be computed through American put option pricing model based on emission rights.

Tactics on protection of vulnerable groups: Government and watershed management agency should establish appropriate mechanisms to protect the interests of the vulnerable groups by combining economic compensation with capability building, including ecological compensation policy, water-saving incentives, pollution punishment and policy tilt. This way, the heterogeneity between the vulnerable groups and the strong groups can be gradually decreased and the outbreak of water

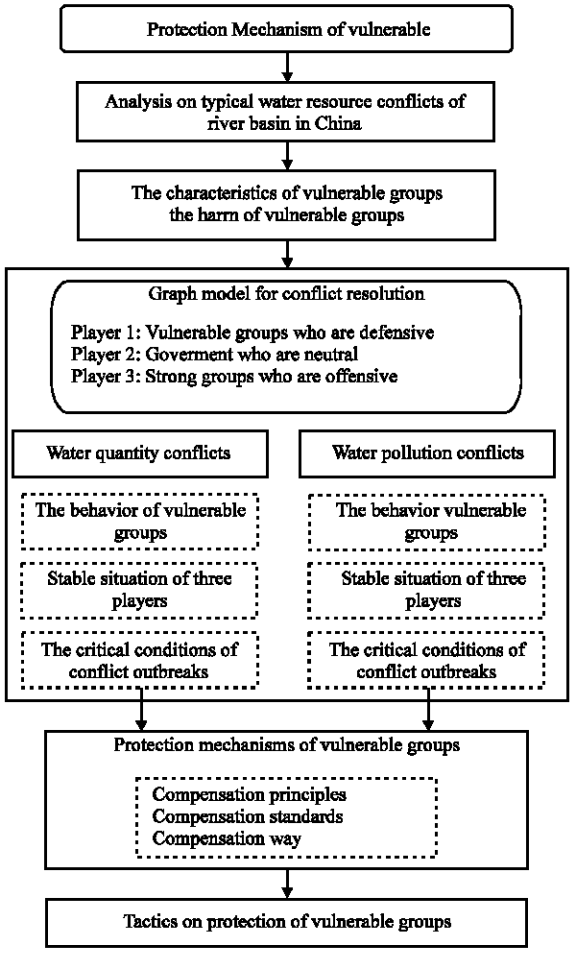

Fig. 1: Proposed framework to protect vulnerable groups

resource conflicts can be controlled from its source. Then, a good strategy for river basin management can be shaped, in which the vulnerable groups and the strong groups have joint development and common prosperity. Finally, the process of building a harmonious society can be promoted.

CONCLUSION

During the implementation of the most stringent water resource management system in China, protecting the interests of vulnerable groups while of great concern is still in an infant stage. This study discussed the causes of water resource conflicts, their characteristics and their harm to the society. Building on the existing research related to the protection of vulnerable groups' interests, a framework to protect the interests of the vulnerable groups has been proposed. We hope that the developments in this study will motivate future research to safeguard the interests of the vulnerable groups in water resource conflicts with a view to promote societal harmony by creating a water-saving society.

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