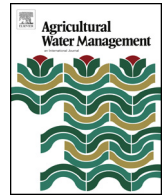




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Development of a water transfer compensation classification: A case study between China, Japan, America and Australia

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ABSTRACT

The compensation mechanism for agricultural water transfer (CMAWT) is an important method for reducing or eliminating the negative effects of agricultural water transfer. Summarizing global CMAWT experiences is important to set up a reasonable CMAWT in China. In this study, a classification theory for CMAWT is established to evaluate the CMAWT of China, Japan, America, and Australia. Results showed that China's CMAWT is converting from the bureaucratic to the market type. Japan's CMAWT is mainly the autonomous type. CMAWT of America and Australia are market type. Water transfer market in Australia is more sophisticated among the comparison countries. Government of China and Japan participated more in the agricultural water transfer than the government of America and Australia. Farmers participated least in agricultural water transfer in China than in other compared countries. The case study showed that the proposed theory can classify the CMAWT of different countries.

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1. Introduction

As a result of current water resource shortages, agricultural water transfer (AWT) is becoming increasingly significant in China. AWT is the transfer of the rights of irrigation water to others in the agricultural industry or in other industries. The compensation mechanism for AWT (CMAWT) is necessary to reduce or eliminate the negative effects of AWT (Liu et al., 2001; Rosegrant and Ringler, 2000). CMAWT is the mechanism for eliminating the negative effects of AWT by compensating for the cost of agricultural water savings and the losses incurred by losers. There are some compensation examples in China such as the compensation to farmers in the middle stream of the Hei River Basin (Liu et al., 2005) and to farmers in Miyun County of Beijing (Peisert and Sternfeld, 2004). However, whether the compensation mechanism is efficient remains a concern.

CMAWT consists of compensation bodies, compensation object, compensation approaches, and compensation methods (Dai, 2010).

Compensation bodies are the beneficiaries of AWT, while compensation objects lose. In different forms of AWT, the government may act as the “pusher,” the supervisor, or a participant. The government is generally the beneficiary of the AWT; otherwise, it would prohibit such practice. Compensation approaches include government and beneficiary compensations. Government and the beneficiaries compensate the losers. Government compensation occurs when beneficiaries cannot compensate the losers by themselves.

There are several stakeholders in AWT compensation. The primary stakeholder is the administration bureau of an irrigation district, which is responsible for agricultural water intake and water distribution in the district. Agricultural water suppliers may be either beneficiaries or losers in AWT. Meanwhile, agricultural water users include water user associations, which are small water distributors, and farmers. Farmers are the direct users of agricultural water, and they are capable of directly obtaining water. Agricultural water users may either be beneficiaries or losers in AWT.

Agricultural water acceptors are important stakeholders in AWT. They can be divided into four groups based on the properties of water users: the agricultural sector, the industrial sector, the municipal department, and the ecological environment. Acceptors can also be divided into individual acceptors, enterprise acceptors, and the government. Agricultural water acceptors are always the beneficiaries of AWT.

Third parties are very important stakeholders in AWT because they are affected by AWT although they do not participate in the

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Table 1
CMAWT modes.

Type	Bureaucratic	Autonomous	Market
Material compensation	Bureaucratic–material	Autonomous–material	Market–material
Fund compensation	Bureaucratic–fund	Autonomous–fund	Market–fund

Source: Established by the authors.

process. They include agricultural water users, enterprises, local governments, and the ecological environment. For example, these third parties may be affected in the downstream when agricultural water is transferred outside of the agricultural sector to decrease irrigation return water. Third parties are generally losers in AWT.

To determine the direction for developing a reasonable CMAWT for the country, it is important to compare China’s CMAWT with those of other countries. Chen (2001) proposed a classification theory for water management and water use, and Dai (2010) established a compensation mechanism for agricultural water rights transfer. Given that a classification theory for CMAWT is not yet available, this study aims to apply a proposed classification theory to evaluate the CMAWT of China and Japan.

2. Classification theory for CMAWT

2.1. Theoretical framework for classifying CMAWT

The CMAWT can be analyzed from a vertical and horizontal perspective. The former mainly reflects the relationship of the government with other stakeholders. The factors that influence the vertical form of CMAWT include property rights, the participation level of stakeholders, and compensation approaches.

The vertical form of CMAWT can be classified into three types: bureaucratic, autonomous, and market. In the bureaucratic type, agricultural water users have the right to use agricultural water, but not the right to transfer it. Agricultural water users and third parties do not participate in this type of CMAWT. The government determines the amount of water transferred, the terms of transfer, and the compensation amount and method.

In the autonomous type, agricultural water users possess the right to use agricultural water and can transfer those rights under certain conditions. Under the guidance of the government, agricultural water users and third parties can decide the transfer amount, the terms of transfer, and the compensation methods. The government and other stakeholders in AWT pay the compensation fee.

In the market type, agricultural water users possess the complete right to use and transfer agricultural water. AWT becomes an agricultural water rights transfer, and compensation fee becomes the transfer fee. This transfer price is decided based on negotiations between the transfer participants. Third parties participate in agricultural water rights transfers to different extents. Only the buyer

pays the transfer fee. The government only supervises the water right transfers.

The horizontal form of CMAWT involves compensation methods in AWT, which include fund compensation and material compensation. The former uses cash to decrease or eliminate the losses incurred by the losers. The latter uses materials or projects to improve the development capability of the losers. These include investments in agricultural water conservation projects, eco-restoration projects, and so on.

All CMAWT modes are listed in Table 1.

As shown in Table 1, CMAWT can be divided into six modes. We can classify the CMAWT of different countries using this approach. However, this method remains imperfect because it cannot quantitatively classify CMAWT modes.

2.2. Quantitative analysis method of the vertical form of CMAWT based on the analytic hierarchy process (AHP)

The evaluation index system of the vertical form of CMAWT (Fig. 1) can be established based on influencing factors.

Agricultural water rights include property rights, use rights, and assignment rights to irrigation water. Under bureaucratic management, farmers only possess the rights to use irrigation water, but under market management, they have the rights to use and assign irrigation water.

Regardless of the type of CMAWT used, agricultural water acceptors always participate in the water transfer process. Thus, the participation level of agricultural water acceptors is not considered. The participation level of the government decreases as CMAWT changes from the bureaucratic to market type. By contrast, the participation level of other stakeholders increases as CMAWT changes from the bureaucratic to market type.

The compensation approach changes from government to beneficiary as CMAWT changes from the bureaucratic to market type. The vertical form of CMAWT can be classified according to several indices. Table 2 presents the calculation method of these indices.

AHP determines the importance of the indices. Table 3 presents the results of the importance of first-grade indices. The consistency of subjective judgments should be checked when using AHP. This process is called the consistency check, and it employs the consistency ratio (CR). If the value of CR is $\leq 10\%$, then the inconsistency is acceptable. The consistency check of the judgment matrix indicates that the matrix exhibits good consistency ($CR = 0.033 < 0.1$).

Table 2
Valuation of indices to classify the vertical form of CMAWT.

Indices	Scoring criteria
Form of agricultural water property rights (PROPERTY)	Only possess use right = 0, possess use and assignment rights = 0.5, possess property, use, and assignment rights = 1
Participation level of stakeholders	Government (GOVERNMENT) Administration bureau of the irrigation district (IRRIGATION DISTRICT) Farmers (FARMER) Third parties (THIRD PARTY)
Compensation approach (APPROACH)	Leading = 0, partial participation = 0–1, no participation (supervision) = 1 No participation = 0, partial participation = 0–1, complete participation = 1 No participation = 0, partial participation = 0–1, complete participation = 1 Completely compensated by the government = 0, completely compensated by the beneficiary = 1, compensated by both the government and the beneficiary = the ratio of the compensation fee compensated by the beneficiary

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