

Based on Marketing Economic Mechanism Sustainable Water Resources Management in China *

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Abstract: The average perennial precipitation depth in China is only 648 millimeters and total precipitation of 6.19 trillion cubic meters, but it's distribution is much uneven not in time but in space. China's water resources per capita in 1993 were only 2340 cubic meters and equaled to one fourth of the whole worlds, so china belongs to the country of water resources shortage. Now China is confronted with the crises of flood, drought, water resources shortage and the environmental pollution. To resolve the problems, the existing water price must be reformed to found the new system of the marketing economic mechanism in China. From the view of the water macro-ecosystem, the comprehensive policies and strategies for water resources management by the lever of water price should be took into practice, for example, exploiting the potential of water resources, inducing expenditure, scientifically protecting and utilizing water resources, in order to come true the basic balance of water resources between supply and need and guarantee the sustainable co-development among population, resources, environment, society and economies in China.

Key words: China Water resources Water price Marketing mechanism

1. Background

The problems of population, resources, environments and development are the important problems that have a bearing on the future and fortune of human being and are close paid attention to at large by the international society today. It has become a global and arduous task that value and save the natural resources, protect and better the eco-environment to the social and economic sustainable development. Water resources are not only one of the essential factors which human being exists, and the indispensable and irreplaceable natural resource which human being lives and develops.

With the population swelling, economy developing and material and cultural level improving, water resources are demanded more and more, and many countries or regions have fallen into a woeful predicament of water resources shortage. In August 1995 the World Bank reported that 80 countries with a population of 40 percent in the world were confronted with water resources crisis, which severely threaten their agricultures, industries and livings. An investigation report from the United Nations raised the warning that water resources shortage would strictly restrict the economic and social development even could lead to the conflicts among countries or regions in the next century.

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Although the total water resources in China place the sixth in the world, the amount per capita only equals to one fourth to the entire world average. China's water resources per capita arrays at the 109th among the 149 statistical countries and belongs to one of the countries with a serious short of water resources. Because the temporal and spatial distributions of water resources in china are terrible uneven, which does not harmonize with population, arable lands and mineral resources, which exploiting and utilization are not seasoned with the demand from the social and economic development, it causes the damned contradictions between the supply and demand to water resources.

China has been demanding more and more water resources with the social and economic swiftly developing, population continuous swelling and urbanization level gradual improving in the long period of time in the future. How to use the means of the marketing economic mechanism makes the co-development between water resources and population, society, economy and environment in line, right treats the relationships among the exploiting, utilization, protection and management of water resources, ensures the stable long-term supply of water resources, that is one of key problems that realize the social and economic sustainable development in China.

2. The characteristics of Water resources in China

China, one of the biggest developing countries with the territorial area of 9.6 million square kilometers and a population of 1.3 billion, is situated in southeast of the Eurasia, going deep into the hinterland of the Asia in northwest and connecting with the India in southwest. Owing to the influences from the monsoon and landform and unstable climatic factors among years, China is one of countries that frequently take place the disasters of drought and flood. So China's water resources have the characteristics of themselves.

2.1 More total water resources and fewer amounts per capita

Total water resources in China reside at the sixth place in the world and follows in Brazil, Russia, Canada, U.S.A and Indonesia. The water production per area from the Yangtze River and its' south rivers is not less compared with other rivers in the world. China's water resources per capita were only 2340 cubic meters and equaled to one fourth of the whole worlds. In the international parlance, the region holding 2000~10000 cubic meters of water resources per capita should appear the water resources shortage in the drought seasons; one holding 1000~2000 cubic meters of water resources per capita should be able to the phenomenon of water resources shortage; one holding water resources less than 1000 cubic meters per capita should come forth the complexion of severe water resources shortage. The tension situation of water supply in the most parts of Haihe, Huaihe, Yellow and Liaohe River would exist in the long-term period, because the average annual water resources per capita in the watersheds of Haihe, Huaihe and Yellow River only vary from 350 to 750 cubic meters, and one in Liaohe River does 1700 cubic meters.

2.2 Great variation of river runoff in inter- and inner-years

There are obvious differences of river runoff in inter-years in different regions of China, which extreme annual value of river runoff is up to more than 10 times. In addition, some main river on time sequence of annual runoff flow occurred the continuous high flow years

or low water years. For example, Yellow River presented itself the continuous low water years from 1922 to 1932 and its average annual runoff flow decreased by 24 percent to the usual years; one did the continuous high flow years from 1934 to 1951 and its average annual runoff increased by 19 percent, did the phenomenon in Haihe River in the 1980s too. The phenomena are the important reasons why the drought and flood disasters frequently took place, agricultural production was unstable and contradictions between water supplying and demanding are becoming increasingly acute. The runoff in inside year is unbalance and mostly concentrates on flood seasons, which accounts for about 60 percent to the total from April to July in the south of Yangtze River and for more than 80 percent to one from June to September in the North-china Plain.

2.3 No matching of the water resources distribution and its' productivity layout

China's water resources in the different regions awfully unevenly distribute and have six to one with much more in the southern and very fewer in the northern, which are not speaking on terms with the distribution of population, arable lands and economy in China. 1993's statistical data showed that population, arable lands and GDP in the big 5 watersheds of the northern respectively accounted for by 46.5, 65.3 and 45.2 percent to the total amount, but water resources did for by 19 percent; on the contrary, they in the 4 big watersheds of the southern respectively did for by 53.5, 34.7 and 54.8 percent to the total amount in China, and water resources did for by 81 percent. The average annual water resources per capita in the northern were 1127 cubic meters and only equaled to one third in the southern (table 1).

Table 1 Water and land resources, social and economic status in China in 1993

| River name or watershed | Accounting for total china(percent) | | | | Water resources | Water resources |
|----------------------------|-------------------------------------|------------|----------------|------|--|-------------------------------------|
| | Water resources | Population | Arable land | GDP | per capita (m ³ /person) | per hectare (m ³ /ha) |
| Song-liaohe R. | 6.9 | 9.7 | 20.2 | 11.3 | 1704 | 9915 |
| Haihe River | 1.5 | 10.0 | 11.2 | 11.3 | 358 | 3885 |
| Huaihe River | 3.4 | 16.2 | 15.2 | 13.7 | 505 | 6555 |
| Yellow River | 2.6 | 8.5 | 12.9 | 7.1 | 749 | 6000 |
| Yangtze River | 34.2 | 34.3 | 23.8 | 32.7 | 2388 | 41925 |
| Zhujiang River | 16.7 | 12.1 | 6.7 | 13.8 | 3327 | 72630 |
| All Southeast Rivers | 9.2 | 5.5 | 2.5 | 7.5 | 2962 | 80190 |
| All Southwest Rivers | 20.8 | 1.6 | 1.8 | 0.8 | 31914 | 346335 |
| Inner Rivers | 4.6 | 2.1 | 5.7 | 1.8 | 5270 | 23850 |

3. Main existing problems of water resources management in China

Since the founding of P. R. China, a number of water conservancy projects have launched, which primarily control and exploit the main rivers, improve the capacity of the preventing disasters from flood and drought, bring into the comprehensive play of irrigation, water supply, generating electricity and shipping, and better the level for the integrated exploitation and utilization of water resources. But, the exploiting and utilizing status in quo of water resources in China still has some problems, which will be resolved.

3.1 Slower water supplying and rapider economic developing

The average annual supplying water increased 6.1 billion cubic meters and the average annual increasing rate was 1.27 percent in the whole country from 1980's to 1993's, which flexibility coefficient to GDP obviously was lower than the international index from other countries in the same economic developing stages. The result expressed that water saving was high effect, and water resources restricted the social and economic development owing to short of water supply. For instance, China occurred middling drought in 1993 and was short of water resources 22.5 billion cubic meters, it is considered that the water supply included some of overexploiting groundwater and directly irrigation of polluted water over it's standard, therefore the total water resources shortage in fact were 30~40 billion cubic meters. It has roughly estimated that the industrial production value lost 230 billion yuan(RMB) by short of water supply and agricultural reduction of output were 20~30 billion kilograms because of drought and water resources shortage in 1993.

3.2 Regional natural conditions restricting the water resources development

The total supplying water in the southern from 1980's to 1993's increased 50.4 billion cubic meters, that accounted for by 64 percent to the adding water supply in the whole country. But one in watersheds of Haihe, Huaihe and Yellow River only did 12.1 billion cubic meters and did by 15 percent. Even so, the actual water supply amount in the three rivers in 1993 exceeded the perennial average water resources by 50 percent, among them Haihe watershed reached up to 85 percent. In the recent decade years, the increasing water supply from the surface water in the northern was quite limited. That maintaining the social demand to water resources mostly depended on water saving and increasingly exploiting groundwater lead to overexploited groundwater in some regions. It has analyzed and predicted that the total groundwater in China has overexploited 8 billion cubic meters and the water demand should continuously increase with the social and economic development. The situation of water resources shortage in the northern regions of china would not be radically solved, even if the measures transferring water resources across the different watersheds in China would be took.

3.3 Used water of living and industries occupying the environ- and agro-water

The water consumption from the living and industries in the cities and towns has mounted up 61.8 billion cubic meters and its annual increasing rate is 6.17 percent in the recent ten years, with the distinct improvement of citizens' living standard and quick processing of urbanization in China. Owing to short of water supply, to keep the national economy developing at high speed and resolve the water demand of living and industries in cities and towns only depend on that functions the existing water engineering and establishments beyond their standard and occupy the agricultural water demand and decrease the eco-environmental water requirement, that brings about the environment gradual worsening, the drought resistance descending in some regions, the drought disaster appearing a large-scale, and must influence on the grain yield at last.

3.4 Lower water price limiting the functions of the engineering for water supply

Over a long period of time, the conveyance systems of water conservancy projects all through are built behind the main body, which affects the giving full play to the whole

functions. Most of the engineering built in the 1950s and 1960s for water supply are aging and serious disrepair, most of them is used beyond the time limit or run in spite of illness. The long-term low water price caused the investment shortage to repair or maintain the engineering of water resources. That the reservoirs, lakes and rivers are silt and polluted severely impacts on the engineering for water supply.

3.5 The regions of water resource shortage having much potentials for water saving

Since the 1980s, the work of water saving had a quite great progress in China, especially in the regions of water resources shortage, for instance in north-china, Liaoning and Shandong Province the marked effects already were obtained. Meanwhile, it should be seen that the overall level of water supply is not high and the coefficient of water utilization in agricultural irrigation with only 0.4 of national-wide average is over low, the watering rates in paddy field and glebe are more than 22.5 and 9 thousand cubic meters respectively. The water reusing rate of industries is on the low side and its' average in the whole country is about 45 percent, and the reusing rate for sewage treatment is only 24 percent. Although there are high potentials for water saving in agricultures and industries, under the present water price the mechanism of water saving is empty of. It should be by way of a long-term strategic measure that more deepen and extend the work for water saving and cooperate with the water demand management and water price reforming.

3.6 Water pollution picking up and the eco-environmental worsening

With the economic construction development at high speed and population continuously swelling, especially in cities, the china's discharge of the sewage and wastewater also swiftly has been increasing. The annual flow of the sewage and wastewater from industries and living in the whole country reaches to 44.5 billion cubic meters at present, about 80 percent among them are not treated and directly emitted into water area, which brought a great number of water pollution and caused the worsening of the water environment. However, overexploiting groundwater brought about the severe eco-environmental problems and led to the ground sinking and the seawater infalling. Overusing the surface water caused that the water surface in the part of rivers and lakes shrank and some rivers appeared the seasonal drying or cutting off, that river mouths were filled up and the flood carrying capacity decreased because of the reducing the water flow in the north regions into the seas, meanwhile, that the grassland degradation and soil desertification also are aggravated. The problems are related to water resources shortage and unreasoned water resources development and utilization at the different degrees.

4. Resolving water problems by marketing economic mechanism in China

Although the water price in China was adjusted many times, the existing water price and the situation of water resources shortage quite likes a fish out of water. Therefore, it has an important significance for guaranteeing the sustainable and stable development in china that reforms the water price, makes out the principle of marketing economy and the system of the water price with china's features.

4.1 Guiding ideologies for the reforming of water price

The founding system of water price, which accords with the marketing economic principle and the social and economic characteristics of development in China, comes true the transformations to the intensive management from extensive management and to the marketing economic system from the socialism planning economic system in exploitation and utilization of water resources. The reforming of water price should be propitious to the water saving and reasonable allotment of water resources, to the water resources protection and water pollution controlling, to the normal developing of the enterprises to supply water and its' into the markets, which keep the sustainable and stable development of china's economy and society.

4.2 Basic principles for the reforming of water price

Water price, which should reflect the water value as a special commodity and make the enterprises supplying water normally run and develop, should include the cost of water resources and embody the sparse and short characteristics of water resources. Meanwhile, it should encourage water saving and invest it's related to techniques, should contain the charge for sewage treatment and its actively reused. The establishing of the reasonable price relations by different water bodies would promote the preparation and distribution of water resources. At the aspect of adjusting water prices, it should be put into practice that the water with the most excellent quality has the highest price, the reusing water from the treated sewage is lower price, the tap water from water pipe nets in the towns or cities and from providing for itself has equal price, and the tap water has different prices from the ground waters according to it's overexploited degree. The industries that consume a lots water resources or produce mainly by means of water resources are limited by the level of water prices in China.

4.3 A tentative program for the reforming of water price

Water price reforming in Beijing as an example indicates the water price reform in China. According to the prediction of the cost changes from the surface water, tap water and sewage treatment and the supply-demand relations of water resources in the recent 20 years, considering the various carrying capacity, the planning of the water price reforming step by step in Beijing as follows: The average charge of the sewage treatment, surface water, tap water in 1999 respectively reached 0.45, 0.33 and 1.42 yuan(RMB) per cubic meter from 0.25, 0.29 and 1.22 yuan per cubic meter in 1998. During the years in 2000 to 2010, the water price is adjusted every year and each time increases about 0.40 yuan per cubic meter, which includes the tap water charge of 0.3 yuan and the sewage treated charge of 0.1 yuan. The planning water prices of the supplying water for water conservancy engineering, tap water and sewage treated show in table 2.

Table 2 Planning water prices of water supply in Beijing

| Year | | 1999 | 2001 | 2003 | 2005 | 2007 | 2009 |
|----------------------------------|---------------------------------|------|------|------|------|------|------|
| Prices (Yuan/m ³) | Water supply for engineering | 0.33 | 0.43 | 0.53 | 0.63 | 0.73 | 0.83 |
| | Tap water | 1.42 | 1.72 | 2.02 | 2.32 | 2.62 | 2.90 |
| | Sewage treated | 0.45 | 0.55 | 0.65 | 0.75 | 0.85 | 0.95 |

5.Summary

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By the lever of water price and the marketing economic mechanism, the fundamental objectives for the reforming of water price are that better the water quality, protect water resources, improve the using efficiency of water resource and build the society of water saving at last in China. The water resources management is looked as a complicated system from the exploiting water sources, inducing expenditure, water resources protection to water utilization by the natural and economic principles. The comprehensive policies and strategies for water resources management will be took into practice, which adopt the water saving, use the regenerating and recycling water, utilize the rainy and flood water, combine between the surface water and ground water and so on, to realize the basic balance of water resources between supply and need, and ensure the safety of water resources and the sustainable development of social economy in China.