Discussion on the Application of Demand Analysis to Guide the PPP Model to Cross-regional Water Markets

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Abstract. There are successful and failure cases of PPP financing model projects in China. Combined with the respective interests of the two main participants of the PPP project, the government and social capital, the application analysis of the PPP model in China's infrastructure sector put forward the view that demand analysis plays a key role in the success or failure of the PPP project. Based on this, combined with the characteristics of infrastructure, the characteristics and production of infrastructure rigid demand and elastic demand are briefly analyzed. The typical basic resources of water resources are taken as examples to analyze the rigid demand and elastic demand of water resources, and how to analyze the demand analysis of PPP projects, and explore them in cross-regional water markets.

1. Research Background
With the development of society and the improvement of the level of urbanization, the population, production and social activities have gradually concentrated into several regional centers to form urban agglomerations in China. Correspondingly, the problem of regional natural resources, especially the uneven distribution of water resources and the regional economic and social development in China, has become increasingly prominent. To solve this problem, one approach is to reduce expenditures which improves the efficiency of water resources utilization, the other one is to increase supply which redeploy water resources from relatively abundant areas to other areas. Both of these approaches involve a considerable amount of infrastructure construction. The PPP project financing model can introduce social capital in the field of infrastructure and public services, give play to the basic role of market allocation of resources, and diversify investment risks. In China, the PPP model is being used more and more.

In 2017, commissioned and funded by the Zhejiang Provincial Department of Water Resources, we continued to study the introduction of market mechanisms to improve the efficiency of water resources based on previous research. This paper synthesizes the previous research results, combined with the analysis of the application of China's PPP mode, and explores the combination of the establishment of the water market and the PPP model from the perspective of demand.

2. Application Analysis of PPP Mode in China
PPP (Private-Public Partnership) is a cooperation model formed between the public sector and private enterprises based on a certain project in the field of infrastructure and public services. The definition and meaning of the PPP model will not be repeated here, but only a brief analysis of its key attributes. Firstly, it is based on the construction of infrastructure or public service fields. Secondly,
the feature is the participation of social capital in construction and operations. At this stage, the two key attributes are specifically unified on a certain construction project.

2.1. **Analysis of characteristics of infrastructure and public services**

This article must first make clear that PPP project financing is aimed at construction projects in the areas of infrastructure and public services. This type of project is a construction and facility built to guarantee the normal production and living needs in a limited area and under a specific economic development level. The construction and operation are implemented in accordance with the process of project. Usually, such projects are initiated by the government. In China, infrastructure and public services have certain administrative rights and obligations. For example: road transportation and corresponding transportation charges and road maintenance charges (now included in fuel prices); water supply and power supply and corresponding water and electricity charges; education surcharges included in the tax, urban construction surcharges, etc.

This is different from European and American countries. In China, infrastructure and public services reflect certain characteristics of administrative rights. In Europe and the United States, infrastructure and public services reflect the characteristics of natural monopoly management.

2.2. **Reasons for China's PPP Model**

The main reason why China promotes the application of PPP project financing models is mainly because of excessive local debt. Intuitively, because the local government's fiscal revenue is limited, the infrastructure and public service areas in the jurisdiction are under great pressure on construction funds, which has led to the generation of local debt \[1\]. In fact, it is that the working method and organization system of the local government, that is the administrative organ, are more suitable for the execution and evaluation of the implementation process of administrative power, rather than the construction and operation of a specific project, and the government-led infrastructure and public service investment is easy ignoring economic pressures and focusing on political achievements, causing investment to get out of control.

Social capital pays attention to return on investment. Adopting the PPP model in infrastructure and public service construction introducing that can control the problem of out-of-control local construction from the source, prevent soft budget constraints, and also play a role in the market's more efficient allocation of resources. At the same time, it is also possible to transfer part of the risks previously invested by the government in infrastructure and public service construction, and the transfer is borne by social capital, effectively isolating risks \[2\].

2.3. **Analysis of problems and countermeasures**

2.3.1. **Impact of PPP Mode on Infrastructure Construction and Operation.** The instinct of capital is proliferation. Social capital introduced in infrastructure and public services will continue to meet this instinct. Capital invested in the infrastructure and public service areas needs to be multiplied, usually through fees or franchise rights. After a certain amount of income has been accumulated, it is invested in other projects to achieve multiplication.

Most of China's infrastructure and public service charges, such as road maintenance fees, water fees, and electricity fees, have some administrative rights. The rational operation of the PPP model and the introduction of social capital can not only solve the problem of shortage of funds for infrastructure construction, but also focus on the characteristics of investment income through capital, control unnecessary construction scale and functions to reduce costs, and bring projects into use as soon as possible to increase investment effectiveness. This is a favorable side of the PPP model, and it is also the origin for China to use the PPP model to solve the shortage of infrastructure construction and public service funds and improve the efficiency of capital utilization.

When using PPP project financing, allowing the invested social capital to obtain corresponding benefits or even multiply it is the price that society should pay. This is the prerequisite for China to be
able to use the PPP model to build infrastructure and provide public service, for win-win cooperation between the government and social capital [3]. When using the PPP model, it should also be noted that the executive power of administrative power cannot be transferred out (infrastructure, public service charging standards, age determination, review; industry standard determination, review).

At the same time, the different concerns of the government and social capital have also brought some constraints to the development of the PPP model. The government pays more attention to the improvement of infrastructure and public services brought by PPP projects, and sometimes also considers issues such as political performance and social impact. Social capital is a type of capital, and the only concern is the project's income and capital proliferation. The different concerns of the two parties [4] have led to many failure cases in the actual operation of PPP projects in China.

2.3.2. Analysis of Reasons for PPP Project Financing Failure in China. The introduction of social capital into the infrastructure and public service areas in the PPP mode should ensure that it has corresponding benefits. The process of realizing such gains is best achieved through market mechanisms as far as possible, avoiding excessive interference in administrative power. Reasonably arranging the PPP model and incorporating it into normal market behavior. Executive powers performing routine market supervision and law enforcement functions can ensure the balance of interests of social capital, the public, and local governments, and theoretically can maximize public interests.

However, the infrastructure and public service fields have natural monopoly characteristics, and the market mechanism is more likely to fail. Implementing the PPP model entirely in accordance with the market mechanism is prone to problems. The failure cases of the PPP model in engineering practice in China account for a large proportion due to government actions. Among them, except for a few PPP projects that failed due to the international situation and force majeure event such as disasters and corruption, other reasons caused the project to be interfered by administrative rights and redeemed by the government, and ultimately caused the failure of the PPP model: policy changes, price changes, unequal contract terms, public impact caused by fees and environmental protection, etc. [5] all of these can be traced back to the decision-making issues of the PPP project establishment stage.

For PPP projects established to meet infrastructure construction, the initiator is usually the government. So the problems that arise in the decision-making of projects should also mainly be the responsibility of the government. Regarding the problems in project decision-making, the author of this article believes that the most important thing is that the demand analysis of PPP projects is not done well.

The initiation of market behavior is first of all to analyze the market demand of the product, and the market decision made is reasonable under the premise of predictable market demand. The infrastructure and public service infrastructure provided in a specific area have considerable regional exclusivity and natural monopolies. From the perspective of market demand analysis, the demand for it is actually less difficult than products that can be fully competitive. To a certain extent, the construction of infrastructure and public services has the characteristics of self-generating demand. For example, if a city has good infrastructure and public services, it will attract more talents to enter, which will generate new demand for infrastructure and public services locally and form a virtuous circle. Therefore, on the basis of analyzing and demonstrating the needs of PPP projects, and according to the demand to lengthen the industrial chain and form a related industrial chain [6], it is expected that PPP projects will obtain long-term stable returns.

However, as the decision-maker of a PPP project, the government is an administrative agency that exercises administrative rights. It is more accustomed to top-down administrative documents, orders, rules and regulations and other behaviors that regulate the individual's behavior and solve problems. The model, rather than the bottom-up market behavior, first statistically analyzes individual differences and then summarizes and summarizes the general common thinking method, which leads to problems in the decision-making of PPP projects.
2.3.3. Relationship and countermeasures between demand analysis and PPP mode. Since China's reform and opening up, social and economic development has actually followed the general direction of "demand guidance." For example, the first "three major pieces" of bicycle, radio, watch, to the "new three major pieces" such as TV, refrigerator, washing machine are representative. During this period, China was still in a relatively scarce economic stage, including the construction of infrastructure and public services, which still belonged to the rigid or semi-rigid needs to meet basic living needs and improve living needs, and had the experience of other leading countries for reference. The analysis is relatively simple. At the same time, due to the level of economic and social development at that time, infrastructure construction had not been rolled out across the country on a large scale, and local governments had relatively little financial pressure in this regard.

At this stage, China's economic development has reached a new level. The scale of infrastructure construction has also greatly increased, and the financial pressure on local governments has greatly increased. At the same time, there are fewer and fewer places where China can learn from other countries' experience. The next development direction and how to develop will mainly depend on China's independent innovation. In terms of infrastructure construction, China's different national conditions also determine that we cannot copy the experience of developed countries. We must proceed from the immediate needs of China and even specific regions, analyze specific infrastructure capacity needs, and make reasonable project decisions.

PPP mode financing is not innovation, and simply using PPP mode financing is not the innovation that China needs. This is only the introduction of social capital and solves the problem of funding sources for project construction. If it cannot be combined with demand analysis, the PPP model will also bring new problems, and the PPP project will also fail. But clearly using the PPP model to solve what needs problems, and how to implement these needs into specific products or services, and further decompose them into specific investment projects, is the innovation needed by our country to apply the PPP model.

Water resources are the basic resources for the social and economic development of a region. The projects constructed for the supply and distribution of water resources are typical infrastructures. Based on the previous work of this topic, this paper focuses on the market regulation of water resources, and analyze the demand analysis of water resources PPP projects.

3. Demand analysis of the establishment of a cross-regional water market combined with the PPP model

In the previous research, this topic proposed the use of market means to establish a water market to regulate water resources across regions, to redistribute water resources between different regions and different industries, and to improve the efficiency of water resource utilization. The basic model of the market \(^7\) (see Figure 1). The previous work results are mainly analyzed from the supply side: agricultural water is relatively inefficient, the development of water-saving irrigation and the construction of water source areas increase the effective supply, so that the new water resources can be transferred to other regions and other sectors of the national economy and society.

In the basic model, in order to increase the effective supply of water resources, new infrastructure such as water conservation and water supply must be invested. The previous research results have proposed the use of the PPP model in these links to introduce social capital, and the gain of water rights transactions in the water market to ensure the benefits of social capital.

It is obviously not enough to consider the supply side only by means of the market and the establishment of a cross-regional water market in combination with the PPP model. Market transaction behavior should be analyzed from the demand side, and demand is the starting point of the market. As a basic resource, water resources should also follow this analysis process.
3.1. Focus of demand analysis of PPP projects in cross-regional water markets
As far as the development prospects of cross-regional water market PPP projects are concerned, the most important is the demand for project products. The product of the PPP project of the cross-regional water market is generally water resources. It can be roughly divided into a certain amount of water resources and a certain quality of water resources. Therefore, the focus of requirements analysis can be divided into the following two aspects.

(1) Whether there is any need to transfer water across regions to meet the basic needs of production and domestic water for social development in the region. This type of demand is a rigid demand, which mainly solves the problem of insufficient water resources. For the water resource importer, this kind of demand is often social and public welfare demand.

Because rigid demand often reflects public welfare, there are disadvantages such as low market prices, and the target market does not have or has weak market adjustment flexibility. It is also possible to launch PPP projects for rigid demand. Generally, government subsidies or franchise can be adopted to ensure the return of social capital participating in the project. Dongyang and Yiwu water rights transaction is a typical transaction that meets the rigid demand of water resources in Yiwu [8].

(2) Whether there is a demand for better water resources in order to improve the social, economic, and living quality of the region, for example, to improve the quality of drinking water, households purchase and install water purification equipment. This is elastic demand, which is more biased towards market and economic demand.

Addressing elastic needs should be the key direction for PPP projects. Generally, with the development of society and economy, people's requirements for quality of life will gradually increase, and the demand for higher quality water resources will gradually develop. In China, the increasing popularity of household water purification equipment is a typical example. The demand analysis for elastic demand involves basic market operation methods such as market segmentation, determination of the target market, and matching of products with the target market, and is not repeated here.

3.2. Demand analysis process of PPP projects in cross-regional water markets

3.2.1. Initiator of demand analysis of cross-regional water market PPP projects. The water resource rigid demand PPP project mainly solves the problem of “quantity”. The contradiction originates from the inconsistency between the water consumption caused by regional economic, social and population development and the regional water supply. Among them, it is divided into contradictions arising from...
the actual level of development and contradictions expected from the level of development. The decision to find and solve problems needs to be controlled at a macro level. The initiator of the demand analysis should be government-driven.

Water resource elastic demand PPP projects mainly solve "quality" problems. Contradictions arise from the requirements for higher-quality water resources in production, living, and social activities, which often manifest as more microscopic and specific individual behaviors. The problem design and solution design should be more in accordance with market rules. The initiator of demand analysis should guide the participation of high-quality social capital [8]. The resulting PPP project decision-making can refer to the social capital solution design that can control the scale of construction from the source.

3.2.2. Demand analysis objects and characteristics of PPP projects in cross-regional water markets.

Rigid demand arises from the contradiction between supply and demand of water resources. It is characterized by low sensitivity to price but high social and public impact. Economic needs cannot be emphasized in demand analysis and PPP project decision-making.

With the development of society, it is a general trend that industries and populations are concentrated in central cities in the region. This has created a rigid demand for water resources in central cities. Industry and population can be concentrated in central cities. Naturally distributed water resources must meet the needs of urban development by providing infrastructure and providing corresponding water supply capabilities. Therefore, the industrial layout and urban planning of central cities have an important impact on the rigid demand for water resources, and administrative power can play a leading role in these aspects. At the same time, the industrial layout and urban planning must follow objective laws and must conform to local comparative advantages.

The analysis of the rigid demand for water resources should, on the one hand, be carried out around the regional central cities, and analyze the industrial development and population growth trends of the regional central cities. On the other hand, the rigid demand for water resources is also an important influencing factor for the development of regional central cities, which can restrict the formation and development of regional central cities to a certain extent.

Elastic demand originates from the demand for higher quality water resources, and can be divided into spontaneous demand and guiding demand.

With the development of society and economy, the population is moving into the central city clusters, generating social needs that meet basic living needs. At the same time, between different incomes and social classes, there may be some levels of demand spontaneously generated. For example, people with an annual income of 100,000 and an annual income of 1 million will have different requirements for drinking water.

The elastic demand generated by guidance is the demand generated by administrative orders or new industry standards. For example, due to the hardness of the water source and the drinking water purification project promoted by Xinjiang Autonomous Region, urban households install water purifiers at home.

The spontaneous demand for elasticity has the advantages: with internal vitality and external conditions, it can develop on its own and form a considerable market size. Disadvantages: in a non-scarce economic condition, after meeting basic living needs, spontaneously generated Elastic demand has the problems of scattered goals, changing directions, and uncertain prospects.

The elastic demand generated by the guidance has the advantages: a wide range of impacts, large demand, and can quickly form a market scale with economic benefits; disadvantages: strong administrative directives, poor flexibility, insufficient market competitiveness, short-term effects are obvious, and long-term development may lack stamina.

3.2.3. Content analysis of demand for PPP projects in cross-regional water markets. The rigid demand for water resources is the demand for quantity. The demand analysis should comprehensively consider the water-saving equipment and measures that may be used in the future on the basis of
reasonably expected regional economic, social, and population development. Balance the cost of resource supply and make decision-making on PPP projects.

Since the rigid demand for water resources is greatly affected by industrial layout and urban planning, some government behaviors and leadership consciousness will cause major changes in the analysis results. Therefore, these influencing factors should also be included in the demand analysis. For example, annual reports released by local governments, some major industrial investment projects, and so on.

The elastic demand for water resources is a qualitative demand, and it is also a differentiated demand. Demand analysis is mainly market analysis. This part of the content has mature methods, not the focus of this article, will not repeat them here. In brief, for the elastic demand generated spontaneously, the market should be refined during the demand analysis, and the most appropriate market segment should be selected for the PPP project decision-making. For the elastic demand generated by the guidance, the demand analysis should pay more attention to the water resources products. Standards and specifications, based on which the decision-making of a PPP project is made.

In addition, when doing elastic demand analysis, we must pay attention to the natural monopoly of infrastructure, which is the attribute of administrative rights of infrastructure in China. How to balance the relationship between market behavior and administrative rights, as well as the decision-making choice of existing infrastructure improvement and new infrastructure construction, is a relatively difficult content in the analysis of elastic demand for water resources.

4. Conclusions and recommendations

The PPP model is of great significance in solving the problems of insufficient funds for local government infrastructure construction and resolving local debts. At the same time, PPP projects with relatively stable and sustained expected returns also provide a viable investment channel for China's social capital. The premise of all this is that the PPP project works well, and ultimately the interests of the government, the public and social capital are maximized. To this end, the needs analysis of PPP project establishment should be done well.

Based on the results of the previous research, this article analyzes the basic water market model and the sub-model of the water market operation [7] (see Figure 2). We can find several important links among them. The main point is to introduce social capital for infrastructure construction. This is where the PPP model can play a role. The preliminary research of the subject focuses on supply-side analysis, but the premise of the occurrence of market-based water resources trading should still start with demand analysis.
The establishment of a cross-regional water market should use the PPP model to carry out the necessary infrastructure construction. Demand analysis is an important part of the relevant project establishment. For the establishment of a water market, the effective demand for water resources can be generated by government actions (rigid demand) or by the improvement of urban residents' living standards (flexible demand). With a good demand analysis, the decision-making of PPP projects will be more reasonable, and the PPP model can play a more effective role.

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