Study on Adjustment Mechanism for Concession Price of Traditional Village Conservation PPP Project

Jun Fang, Fei Chen and Yiyuan Guan

ABSTRACT

At present, the financing gap seriously restricts the comprehensive and orderly promotion of traditional village protection work. Introducing the PPP model into the construction of traditional village protection projects has become one of the effective ways to solve the financing gap. In order to improve the efficiency of the concession price adjustment of the traditional village protection PPP project, and coordinate the relationship among the multiple stakeholders of PPP model, this paper uses the least government subsidy, the largest net present value, and the lowest franchise price as the income adjustment target to build the quasi-operability. The linkage adjustment model for PPP project concession period, concession price and subsidy. By adjusting three variables, several schemes are obtained, and finally, according to the max-min synthesis algorithm, the scheme with the greatest degree of multi-objective satisfaction is selected.¹

INTRODUCTION

With the acceleration of the new urbanization process, the contradiction between traditional villages protection and rural economic development has gradually deepened. The state supports the protection of traditional villages by providing subsidized funds, but the subsidy funds are simply not sufficient to cope with large-scale demand. Therefore, adopting the PPP model has become the development trend of implementing traditional village protection projects in recent years. The PPP project franchise price is one of the key factors for the success of the project, and many scholars have conducted useful research on this.

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Ye pointed out that when exchange rate risk, capital recovery index, demand change and raw material price exceed a certain range, the franchised price affected by it should be adjusted [1]. Duan and others used the method of constructing structural equations to explore the influencing factors of franchise price, and concluded that the government, economic conditions, project characteristics and so on are the positive correlation factors of the concession price [2]. Zhao and others designed an adjustment mechanism to change the price adjustment and the limit of the price adjustment, so that the project company can adapt to and respond to economic changes more quickly [3]. Xu and others proposed a model for adjusting the price of PPP road projects based on system dynamics theory, so that the project company and the government can achieve a win-win situation [4]. Song and others proposed the basis for the adjustment of the concession period based on the net present value of the project. If the expected level of the project is much lower than the net present value of the concession period to maximize the public interest model, on the contrary, the use of private investor income maximization as the goal of the concession extension model [5]. Shen combined the bargaining game idea with the NPV method to improve the validity of the concession period decision [6]. Yang targets government restriction, government subsidy, public tolerance and reasonable profit, builds a multi-objective model that maximizes social benefit and obtains the best adjustment space of the price [7].

The purpose of the PPP price adjustment mechanism is to adjust project profits, prevent private companies from making huge profits or losses, and maximize social welfare. Scholars’ Research on PPP project concession price adjustment mechanism is mostly concentrated in highway, sewage treatment and other industries. Therefore, establishing a price adjustment mechanism that is scientific and suitable for traditional village protection PPP projects. The price adjustment mechanism of the project is the inevitable requirement to study the traditional village protection PPP project.

CONCESSION PRICE ADJUSTMENT MACHANISM DESIGN

Principle of Concession Price Adjustment

The concession price adjustment of the traditional village protection PPP project balances the reasonable demands of the government, social capital and tourists. It also needs to ensure the reasonable profit of the PPP project company, and encourage the project company to improve the efficiency of operation and management, and promote the healthy and sustainable development of the project. Specifically, the price adjustment of traditional village protection PPP projects should follow the following principles: (1) The principle of stakeholder satisfaction. The focus of price adjustment should coordinate the interests of social capital, government and tourists to adjust the scope of concessionary price disaggregation reasonably. (2) The principle of sustainable development of the project. The
traditional village protection PPP project is affected by the environment during the operation process. The unsound price adjustment mechanism will directly or indirectly affect the project's survivability. Therefore, it is necessary to establish a reasonable price adjustment mechanism to ensure the healthy and sustainable development of traditional village protection PPP projects. (3) The principle of operability. As there are many factors influencing the franchise price of traditional village protection PPP projects, relevant factors should be selected. At the same time, the change data of influencing factors should be observable, controllable and predictable, and the redundancy among influencing factors should also be considered to ensure the operability of price adjustment of traditional village protection PPP projects. (4) The principle of dynamic adjustment. Frequent adjustments to the price of traditional village protection projects can lead to market price instability and dissatisfaction among users. Therefore, the price adjustment start-up mechanism should be set to realize the dynamic adjustment of the price of traditional village protection PPP projects.

**Concession price Adjustment Strategy**

The price adjustment strategies of traditional Village Protection PPP project mainly have the concession period, the concession price and the government subsidy adjustment. These three strategies directly affect the project company's income, so that social capital can achieve reasonable investment returns without generating excessive profits. In fact, the basis of the above three strategies are the same, and the three are not isolated, but interrelated, all to make the price of traditional village PPP project to achieve satisfaction under the constraints of the stakeholders of all parties, and avoid the interest conflicts of all parties.

It can be seen from the factors influencing concession period and concession price that there are many overlapping parts between them. For example, the main factors influencing the concession period include total project investment, concession price, operation and maintenance costs, transportation and operating income, etc. The main factors that influence the franchise price include total project investment, concession period, operation and maintenance cost, traffic volume and government subsidies. Deng built an endogenous feedback mechanism based on the satisfaction equilibrium and dynamic price adjustment and subsidy model of the government, the private sector and the public for PPP project to deal with various situations that may arise during the operation period of the project [8]. Ye confirmed that government subsidy is directly proportional to the cost of construction. The larger the passenger traffic, the smaller the government subsidy; on the contrary, the greater the government subsidy. Duan constructed the structural equation summarizes the influencing factors of franchise price, and obtained 7 influencing factors that are positively correlated with the franchise price of the project, including government, economic condition, project's own characteristics, etc. The following year, system dynamics was used to find a negative correlation between government
subsidies and PPP project prices. After the project is put into operation, subsidies are required to cover the project company's deficit in order to ensure the normal operation of the project. At the same time, the subsidy has a greater impact on the price than the operating cost [9].

Price adjustment is the most direct regulation strategy. Social capital expects to quickly recover investment and make a profit by increasing prices, but the increase and frequency of prices are limited by the demand of tourists. In 2007, the notice issued by the National Development and Reform Commission clearly stipulated that "the frequency of price adjustment of tourist attractions should not be less than three years", and the international general ticket price accounted for no more than 1% of per capita income. Since the traditional village tourism development relies on natural endowments or historical relics and has public attributes, the price adjustment method is not only subject to many restrictions, but the price increase is likely to cause social dissatisfaction and harm the interests of consumers. However, the amount of capital required for the construction and repair of traditional villages is large, tourism income alone may be difficult to protect the interests of social capital. This can be achieved through government subsidies or adjustment of the concession period, the sum of government subsidies and user-paid income should be controlled within a reasonable range. When the price is higher, the amount of government subsidies will be smaller, and vice versa.

Overall, the three regulation strategies of concession period, concession price and government subsidy appear to be antagonistic. In fact, they are complementary. Their purpose is to ensure the protection of traditional villages PPP Project price can meet the constraints of various stakeholders, so that the project can be successfully implemented, and sustainable development. To achieve this goal, the three strategies need to be highly coordinated, as shown in table I. Consider the possible external environment changes and emergency response strategies in the actual operation process, and select different combination methods to establish an efficient and scientific price adjustment mechanism.

| Concession price adjustment criteria | Adjustment strategy |
|--------------------------------------|---------------------|
| The project income is lower than the lower limit of the reasonable interval, but meets the requirements of recycling investment. | Extended concession period |
|                                       | Increase license price |
|                                       | Increase government subsidy |
|                                       | Concession period, concession price, government subsidy linkage adjustment |
| Project income is within a reasonable range | No adjustment required |
| Project revenue exceeds the reasonable range limit | Shorten the concession period |
|                                                     | Lower the franchise price |
|                                                     | Reduce government subsidy |
|                                                     | Concession period, concession price, government subsidy linkage adjustment |
CONSTRUCTION OF FUZZY MULTI-OBJECTIVE LINKAGE ADJUSTMENT MODEL

In the traditional village protection PPP project, the interests of the government, social capital and tourists are different or even at odds. From the perspective of social capital, it is to obtain the corresponding return of economic benefits. From the perspective of the Government, the use of PPP Financing model to make the traditional village protection project smooth development, to a certain extent to ease their own capital pressure. And the introduction of advanced technology and management level of social capital, through subsidies to the social capital concession pricing constraints, coordination of the interests of the main parties. From the perspective of tourists, traditional village franchise pricing should not exceed its own maximum willingness to pay. In addition, the government, as the regulator of the project, should strike a good balance between the interests of social capital and the public interest, and safeguard the public attributes of the project. Therefore, the traditional village protection PPP Project should adopt the adjustment scheme which can satisfy the concession period and concession price and government subsidy under the condition of the balance of government, social capital and tourists' interests, and select the optimal adjustment scheme which can meet the interests of the three parties simultaneously in many options.

Traditional Village Protection PPP project concession price linkage adjustment model is constructed based on system dynamics and fuzzy logic method. When there is insufficient income or excess income in the actual operation of the project, the corresponding multi-group government subsidy can be obtained by adjusting the concession period, concession price and government subsidy to a certain proportion. The target value of concession period and concession price, the optimal solution in many schemes is the optimal solution of linkage adjustment. Because the target decision involves the different interests of the three parties, the actual operation can set up the corresponding weight set according to the agreement of the franchise agreement in advance, and put more emphasis on the interests of one party.

The decision to adjust from the government's point of view is the least subsidized by the Government. The project company is most concerned about whether the investment can be recovered and earns the expected return, so maximizing the net present value is the goal of its adjustment decision. Visitors are hoping to get a quality level of service at the same time, the fee price can meet the majority's willingness to pay. In the context of the above analysis, multi-objective decision-making issues constructed from the perspective of project stakeholders with three different identities of government, social capital and tourists can be expressed as:

\[
\begin{align*}
\min & P_s \\
\max & NPV \\
\min & P
\end{align*}
\]
Among them, Ps represents government subsidies, and it is necessary to minimize subsidies to reduce government financial pressure. NPV represents net present value, ensuring maximum return is the goal pursued by social capital. P is the concession price, and the public’s goal is the lowest concession price.

The bounds of the object attributes described by many fuzzy concepts are not clear, and the degree of membership of the fuzzy set elements to the fuzzy set can be represented by a value between 0 and 1. Let X be a collection of all objects x with a certain attribute, then the fuzzy set A on set X is represented as:

\[ A = \{(x, \mu_A(x)) | x \in X\} \]

Where \( \mu_A(x) \) is a membership function, indicating that the element x belongs to the fuzzy set A, and the value range is [0, 1]; \( \mu_A(x) = 0 \) means that x completely belongs to A, and \( \mu_A(x) = 1 \) means that x does not belong to A at all.

Since the optimal solution size requirements of different targets are different, some target hope variable values are larger as possible, and some target hope variable values are as small as possible. Therefore, the optimal solution of multi-objective decision problems cannot be obtained by simple mathematical calculation:

\[
\min/\max_{i=1,2,3,...n} \left\{ f_i(x) \left| x \in X \right. \right\} \tag{1}
\]

Where \( f_i(x) \) represents the value of the decision variable of the i-th target, and \( f_i(x) \in [f_i^S, f_i^B] \), the minimum and maximum values of \( f_i^S \) and \( f_i^B \) respectively represent.

Obfuscate the multi-objective function, expressed as:

\[
\max_{i=1,2,3,...n} \left\{ \mu_{f_i}(x) \left| x \in X \right. \right\} \tag{2}
\]

Where \( f_i \) is the fuzzy set on set \( X_i = \{x|f_i^S \leq f_i(x) \leq f_i^B, x \in X\} \); \( \mu_{f_i}(x) \) is the membership of x to \( f_i \).

For maximizing the goal, the membership function is:

\[
\mu_{f_i}(x) = \frac{f_i(x) - f_i^S}{f_i^B - f_i^S} \tag{3}
\]

For minimizing the target, the membership function is:

\[
\mu_{f_i}(x) = \frac{f_i^B - f_i(x)}{f_i^B - f_i^S} \tag{4}
\]
The max-min synthesis algorithm can easily and effectively deal with fuzzy multi-objective decision problems, and can avoid the case where the non-inferior solution membership is the smallest, that is, the non-inferior solution obtained will be superior to other alternatives. If there is only one non-inferior solution, then the scheme is the optimal decision scheme; if there are multiple non-inferior schemes, then the non-inferior scheme needs to be further applied to the fuzzy comprehensive evaluation decision by the weighted average method. The optimal decision-making plan.

The formula for calculating the non-inferior solution using the max-min synthesis algorithm is:

$$\mu_j^* (x) = \max_{i} \min_j \left\{ \mu_i (x^i) \right\}$$

(5)

Where $j = 1,2,3,\ldots, n$ is the number of adjustment schemes to be evaluated; $\omega_i$ is the weight of the i-th target.

The calculation formula for the fuzzy comprehensive evaluation decision using the weighted average method is:

$$U = (u_1, u_2, \ldots, u_n) = (\omega_j)_{1 \leq m} \cdot (\mu_j^*)_{m \in \mathbb{N}}$$

(6)

Where $j = j_1, j_2, \ldots, j_{n*}$ is the number of non-inferior programs.

Normalize U:

$$U^* = \left( u'_1, u'_2, \ldots, u'_n \right) = \frac{1}{\sum_{j=1}^{n*}} \left( u_1, u_2, \ldots, u_n \right)$$

(7)

According to the size of $u'_i (i = 1,2,\ldots, n^*)$, the order of each non-inferior scheme can be determined, and then the optimal decision scheme is obtained.

**EMPIRICAL ANALYSIS**

A traditional village protection project is implemented using the PPP model. The concession period is 30 years. The government subsidy standard for each visitor is 100 yuan, and the project discount rate is calculated at 10%. In addition, the franchise agreement stipulates that the minimum tourist quota for the project is 600,000. If the actual total number of tourists is lower than the minimum standard, the government department will use the minimum standard as the subsidy. If the actual total number of tourists exceeds the minimum standard, the government uses
the total number of tourists as the subsidy. Based on the project feasibility study report and similar project information, through the analysis of the current people's living standards, it is determined that the fee for the project is 50 yuan/person. The simulation analysis of the project's revenue shows that the project can realize the dynamic investment of the project in the 15th year, but the franchise period of the project is 30 years, and the profit obtained by the project company is far higher than the reasonable level, which will greatly damage the public and the interests of the government.

In order to ensure the reasonable interests of all stakeholders of the project, it is necessary to adjust the income. Obviously, the concession period of the project is too long, but only adjusting the concession period will affect the willingness of the project company to cooperate, and the reduction of government subsidies and concession prices will be more. It satisfies the interests of all parties and makes the program more acceptable to all parties.

Since the government department and the project company did not declare the feasible range of the net present value of the project when signing the franchise agreement in the early stage, the adjustment function of the income decision can be constructed in the case where the actual income of the project in this case is much higher than the expected return. The government subsidized 100 yuan/person as the benchmark value, in the ratio of 8% to -24% ~ -8% (that is, the government subsidy price adjustment ratio is divided into -24%, -16 %, -8% three cases); also adjust the license price within -20% to -5% at a rate of 5% (that is, the price adjustment rate for tourists is divided into -20%, -15%, -10%, -5% four cases); the project concession period is adjusted year by year within 25 to 30 years.

In the whole system, by changing the input value of one of the variables at a time by the method of controlling the variable, the system dynamics model is applied for simulation, and the result is predicted by multiple operation operations. As shown in Table II, the government subsidies, the concession price, and the multiple adjustment plans of the concession period under different amplitudes and their corresponding project net present value levels. The 12 programs in the table are organized as shown in Table III below:

| [Concession period (year), net present value (ten thousand yuan)] | Government subsidy (yuan/person) |
|---------------------------------------------------------------|----------------------------------|
|                                                              | 93 (-8%) | 84 (-16%) | 76 (-24%) |
| Concession price (yuan/person)                               |          |          |          |
| 45 (-5%)                                                     | 25,150   | 26,1124  | 27,602   |
| 40 (-10%)                                                    | 26,1592  | 27,1088  | 28,488   |
| 35 (-15%)                                                    | 27,1574  | 28,992   | 29,314   |
| 30 (-20%)                                                    | 28,1496  | 29,836   | 30,805   |

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TABLE III. MULTI-OBJECTIVE SATISFACTION OF EACH ADJUSTMENT PLAN.

| Adjustment plan | B1   | B2   | B3   | B4   | B5   | B6   |
|-----------------|------|------|------|------|------|------|
| Concession price (yuan/person) | 45   | 40   | 35   | 30   | 45   | 40   |
| Government subsidy (yuan/person) | 93   | 93   | 93   | 93   | 84   | 84   |
| Concession period (year) | 25   | 26   | 27   | 28   | 26   | 27   |
| Net present value (ten thousand yuan) | 1550 | 1592 | 1574 | 1496 | 1124 | 1088 |
| B7   | B8   | B9   | B10  | B11  | B12  |
| Concession price (yuan/person) | 35   | 30   | 45   | 40   | 35   | 30   |
| Government subsidy (yuan/person) | 84   | 84   | 76   | 76   | 76   | 76   |
| Concession period (year) | 28   | 29   | 27   | 28   | 29   | 30   |
| Net present value (ten thousand yuan) | 992  | 836  | 602  | 488  | 314  | 80   |

(1) The degree of membership of the franchise price evaluation indicator in adjustment plan B1 is: \( \mu_1 = \frac{45 - 45}{45 - 30} = 0 \)
Under the government subsidy evaluation indicators, the degree of membership of the adjustment plan B1 is: \( \mu_2 = \frac{93 - 93}{93 - 76} = 0 \)
Under the net present value evaluation indicator, the degree of membership of the adjustment plan B1 is: \( \mu_3 = \frac{1550 - 80}{1592 - 80} = 0.97 \)

(2) The membership degree of adjustment scheme B2 is:
\( \mu_{21} = \frac{45 - 40}{45 - 30} = 0.33; \mu_{22} = \frac{93 - 93}{93 - 76} = 0; \mu_{23} = \frac{1592 - 80}{1592 - 80} = 1 \)

(3) The membership degree of adjustment scheme B3 is:
\( \mu_{31} = \frac{45 - 35}{45 - 30} = 0.67; \mu_{32} = \frac{93 - 93}{93 - 76} = 0; \mu_{33} = \frac{1574 - 80}{1592 - 80} = 0.99 \)

(4) The membership degree of adjustment scheme B4 is:
\( \mu_{41} = \frac{45 - 30}{45 - 30} = 1; \mu_{42} = \frac{93 - 93}{93 - 76} = 0; \mu_{43} = \frac{1496 - 80}{1592 - 80} = 0.94 \)

(5) The membership degree of adjustment scheme B5 is:
\( \mu_{51} = \frac{45 - 45}{45 - 30} = 0; \mu_{52} = \frac{93 - 84}{93 - 76} = 0.53; \mu_{53} = \frac{1124 - 80}{1592 - 80} = 0.69 \)

(6) The membership degree of adjustment scheme B6 is:
\( \mu_{61} = \frac{45 - 40}{45 - 30} = 0.33; \mu_{62} = \frac{93 - 84}{93 - 76} = 0.53; \mu_{63} = \frac{1088 - 80}{1592 - 80} = 0.67 \)

(7) The membership degree of adjustment scheme B7 is:
\( \mu_{71} = \frac{45 - 35}{45 - 30} = 0.67; \mu_{72} = \frac{93 - 84}{93 - 76} = 0.53; \mu_{73} = \frac{992 - 80}{1592 - 80} = 0.60 \)
(8) The membership degree of adjustment scheme B8 is:
\[ \mu_{b8} = \frac{45 - 30}{45 - 30} = 1; \mu_{b82} = \frac{93 - 84}{93 - 76} = 0.53; \mu_{b83} = \frac{836 - 80}{1592 - 80} = 0.50 \]
(9) The membership degree of adjustment scheme B9 is:
\[ \mu_{b91} = \frac{45 - 45}{45 - 30} = 0; \mu_{b92} = \frac{93 - 76}{93 - 76} = 1; \mu_{b93} = \frac{602 - 80}{1592 - 80} = 0.35 \]
(10) The membership degree of adjustment scheme B10 is:
\[ \mu_{b101} = \frac{45 - 40}{45 - 30} = 0.33; \mu_{b102} = \frac{93 - 76}{93 - 76} = 1; \mu_{b103} = \frac{488 - 80}{1592 - 80} = 0.27 \]
(11) The membership degree of adjustment scheme B11 is:
\[ \mu_{b111} = \frac{45 - 35}{45 - 30} = 0.67; \mu_{b112} = \frac{93 - 76}{93 - 76} = 1; \mu_{b113} = \frac{314 - 80}{1592 - 80} = 0.15 \]
(12) The membership degree of adjustment scheme B12 is:
\[ \mu_{b121} = \frac{45 - 30}{45 - 30} = 1; \mu_{b122} = \frac{93 - 76}{93 - 76} = 1; \mu_{b123} = \frac{80 - 80}{1592 - 80} = 0 \]

In addition, according to the agreement between the government department and the project company, franchise price, government subsidy and net present value weight are \([0.4, 0.2, 0.4]\).

\[ \mu_{a} = \max_{j} \min_{i} \left( \mu_{ij} \right) \]

\[ \begin{array}{cccccccc}
0 & 0.33^{0.4} & 0.67^{0.4} & 1 & 0 & 0.33^{0.4} & 0.67^{0.4} & 1 & 0 & 0.33^{0.4} & 0.67^{0.4} & 1 \\
0 & 0 & 0 & 0 & 0.53^{0.2} & 0.53^{0.2} & 0.53^{0.2} & 0.53^{0.2} & 1 & 1 & 1 & 1 \\
0.97^{0.4} & 1 & 0.99^{0.4} & 0.99^{0.4} & 0.99^{0.4} & 0.99^{0.4} & 0.99^{0.4} & 0.99^{0.4} & 1 & 1 & 1 & 1 \\
\end{array} \]

\[ \begin{array}{cccccccc}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.64^{0.4} & 0.85^{0.4} & 1 & 0.64^{0.4} & 0.85^{0.4} & 1 \\
0 & 0 & 0 & 0 & 0.88^{0.4} & 0.88^{0.4} & 0.88^{0.4} & 0.88^{0.4} & 1 & 1 & 1 & 1 \\
0.99^{0.4} & 1 & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 1 & 1 & 1 & 1 \\
\end{array} \]

\[ \begin{array}{cccccccc}
0 & 0 & 0 & 0 & 0.64^{0.4} & 0.82^{0.4} & 0.76^{0.4} & 0.59^{0.4} & 0.47^{0.4} & 0 \\
0 & 0 & 0 & 0 & 0.64^{0.4} & 0.82^{0.4} & 0.76^{0.4} & 0.59^{0.4} & 0.47^{0.4} & 0 \\
0.99^{0.4} & 1 & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.59^{0.4} & 0.47^{0.4} & 0 \\
0 & 0 & 0 & 0 & 0.64^{0.4} & 0.85^{0.4} & 0.76^{0.4} & 0.59^{0.4} & 0.47^{0.4} & 0 \\
0 & 0 & 0 & 0 & 0.64^{0.4} & 0.85^{0.4} & 0.76^{0.4} & 0.59^{0.4} & 0.47^{0.4} & 0 \\
0.99^{0.4} & 1 & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.59^{0.4} & 0.47^{0.4} & 0 \\
\end{array} \]

\[ \begin{array}{cccccccc}
0 & 0 & 0 & 0 & 0.64^{0.4} & 0.82^{0.4} & 0.76^{0.4} & 0.59^{0.4} & 0.47^{0.4} & 0 \\
0 & 0 & 0 & 0 & 0.64^{0.4} & 0.82^{0.4} & 0.76^{0.4} & 0.59^{0.4} & 0.47^{0.4} & 0 \\
0.99^{0.4} & 1 & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.59^{0.4} & 0.47^{0.4} & 0 \\
0 & 0 & 0 & 0 & 0.64^{0.4} & 0.85^{0.4} & 0.76^{0.4} & 0.59^{0.4} & 0.47^{0.4} & 0 \\
0 & 0 & 0 & 0 & 0.64^{0.4} & 0.85^{0.4} & 0.76^{0.4} & 0.59^{0.4} & 0.47^{0.4} & 0 \\
0.99^{0.4} & 1 & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.59^{0.4} & 0.47^{0.4} & 0 \\
\end{array} \]

\[ \begin{array}{cccccccc}
0 & 0 & 0 & 0 & 0.64^{0.4} & 0.82^{0.4} & 0.76^{0.4} & 0.59^{0.4} & 0.47^{0.4} & 0 \\
0 & 0 & 0 & 0 & 0.64^{0.4} & 0.82^{0.4} & 0.76^{0.4} & 0.59^{0.4} & 0.47^{0.4} & 0 \\
0.99^{0.4} & 1 & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.59^{0.4} & 0.47^{0.4} & 0 \\
0 & 0 & 0 & 0 & 0.64^{0.4} & 0.85^{0.4} & 0.76^{0.4} & 0.59^{0.4} & 0.47^{0.4} & 0 \\
0 & 0 & 0 & 0 & 0.64^{0.4} & 0.85^{0.4} & 0.76^{0.4} & 0.59^{0.4} & 0.47^{0.4} & 0 \\
0.99^{0.4} & 1 & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.97^{0.4} & 0.59^{0.4} & 0.47^{0.4} & 0 \\
\end{array} \]

In summary, option B7 is the optimal adjustment plan for government departments, project companies and the public to determine the target weights of 0.2, 0.4 and 0.4 respectively, that is, when the license price is 35 yuan/person, the government subsidy is 84 yuan/person. The 28-year concession period has the highest degree of multi-goal satisfaction with the lowest concession price, the least government subsidy, and the company's net present value. Therefore, the three major project participants can achieve the balance of interests.
CONCLUSIONS

Reasonable PPP project concessionary price adjustment mechanism can not only alleviate the financial pressure of government departments, but also enable the project company to maintain a certain level of income and improve the investment enthusiasm of the project company. This paper focuses on the interests of the main stakeholders of the project, the project company and the public, that is, the government subsidies are the least, the net present value is the largest, and the franchise price is the lowest. The income adjustment target is constructed, and the quasi-operating PPP project concession period and license price are constructed. The linkage adjustment model of subsidies provides a more accurate direction for the adjustment of the license price of traditional village protection PPP projects. However, the adjustment scheme of the case in this paper is only a simple enumeration, and the obtained B7 scheme is only the best among these adjustment schemes, and is not optimal among all the schemes. With the continuous improvement of relevant simulation and calculation software, as well as the further research, the adjustment scheme in the future will be more effective.

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