

## Research on the application of PPP model based on REITs in urban regeneration practice

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**Abstract.** With the development of urbanization level in China getting deeper, urban regeneration becomes an inevitable trend for Chinese cities in this background. However, when urbanization is at high tide, here comes a series of problems and challenges in the aspects of financing and practical operation. In response to these troubles, this paper constructs a PPP model based on REITs in which REITs and PPP model could make most of their merits, and by applying and analyzing this new model with Shapely method and Nash equilibrium method, it would drive every party to contribute in urban regeneration and share urban development fruits. Hopefully, this model would bring some new thoughts to aid the promotion and development of urban generation in China.

### Introduction

Urban regeneration is an indispensable process when a city develops to a certain level. Currently, China is at deepening phase of urban development. On the one hand, it requires us to expand urbanization scale properly. On the other hand, it also requires us to improve the development quality of urbanization. "Deepening" means that the city's comprehensive indicators of service capability, innovation ability, environmental benefits, industrial structure, knowledge level are upgrading altogether, rather than only focusing on expanding city scale. How to improve the quality of urbanization development is quite significant for today's China. Now China's urban development structure encounters a series problems such as the lagging behind of its industrial capacity level, the seriously aging problem of the old city center, the lagging behind of its infrastructure construction and so on, many city's planning design are still retain the level in the eighties and nineties of the last century, which are in need of prompt updates. Some cities, for example, in the process of accelerating the expansion of mergers and acquisitions, due to the unreasonable planning and design, result in a phenomenon where a large number of villages are emerging in the city. Some old industrial cities need to promote its production capacity structure in order to guide its economic development to a sustainable mode. The emergence of these problems, making the structure of city unable to service the development process of new industrialization and urbanization, and it will not only cause the negative effect on the city's promotion, but also bring many problems in living environment, social security, urban traffic.

### Background analysis of urban renewal in China

At present, urban renewal is an inevitable trend to promote the level of urbanization in China, especially in the last two years, the exploration of urban renewal mode has been attached great importance by some local governments. In December 2014, the country's first urban renewal authority was established in Guangzhou city. [1]2015 in August, Guangzhou City published a introduction of the "Guangzhou urban renewal measures" for public comment, and is the first time to introduce the PPP model to promote urban renewal. [2]2015 in September 10th, the Shenzhen

Municipal Planning and Land Commission promulgated the "Shenzhen comprehensive renovation of the old industrial areas to upgrade the operational guidelines (Trial)", and was approved of its recent establishment of the urban renewal authority. [3]

The concept of urban renewal firstly appeared in western countries, which refers a process that with the upgrading and transformation of a city's development, in accordance with different characteristics in different historical stages, formulates corresponding development strategy, and system implementation, management and maintenance. P. Roberts set a preliminary definition: urban regeneration is aimed to solve the problem of the comprehensive urban development plans and to seek the change in the regional economic, physical, social and environmental conditions. [4] In order to solve the problems in the process of urbanization in China, urban renewal has been carried out in some cities and regions and has achieved some remarkable results. Take "Knowledge and Innovation Community" (KIC) in Yangpu District as an example, the complex project has transformed the original single heavy industrial structure of Wujiaochang, and made full use of the advantages of sub city center position in traffic, education resources, commerce, to create a students, researchers, entrepreneurs and residents pooled communities, parks, campus and has achieved remarkable social benefit, economic benefit and environmental benefit. [5]

However, under the trend of urban renewal, some significant problems begin to emerge:

The first problem is the shortage of funds. Currently China's urban renewal is mainly rely on the government's public finance expenditure, but public expenditure usually is not enough to fully support the funding needs of urban renewal, because the issue of sustainable urban renewal is a system of large integrated projects, involving the demolition of old urban areas, public transport, construction of the park, network communication, water and electricity facilities, landscaping and other a series of problems, but also to consider the urban renewal after the regional connection, residents' employment, energy saving, the maintenance of facilities, etc. The settlement of these problems requires a lot of capital. And if only the real estate development company to carry out urban renewal, the ordinary real estate companies simply cannot cope with the huge demand for funds, even for some big real estate companies, because to devote sufficient funds to carry out urban renewal is too risky that the company to is unwilling to rush into that risk.

The second problem is that the construction cycle of the urban renewal project is long, thus fund mobility is poor. In order to solve the funding gap problem, there have been some countries in the large-scale public construction projects using the PPP mode of multi-party financing and joint management, such as the world's famous British the Severn River Second Bridge project, the mode is cooperated by government and a number of real estate companies, to ensure adequate funding, but the drawback is that the cycle is long, the financing side liquidity is poor. [6] for the urban renewal projects, the construction period of the project tend to be longer than a large-scale engineering project, just as example of KIC that has been mentioned before, the development of the project KIC began early in 2002 the, and is expected to be fully completed until 2016. [7] In some of the larger area for greater urban renewal, the construction period of the project may be even longer. In this way, the liquidity of financing parties involved in urban renewal is greatly reduced, and in the course of the project construction, once the capital chain rupture occurs, the risk borne by the parties to the project will be significantly increased.

The third problem is the lack of incentive for urban renewal. In urban renewal projects, if only the government take the lead, due to lack of funds, market operation and research on the sustainability of the project, the efficiency of urban renewal is easy to be reduced. A worse scenario may even occur when a project is completed but still needs to be updated, because of the construction time is too long. If we let real estate developers to form a union for urban renewal funds supply and operation of the project, without the participation of government, due to the excessive pursuit of investment returns and other market regulation of malpractice, urban renewal is easily to fall into a vicious cycle of ill quality, coordination, excessive commercialization, negative external environment, and unsustainability.

The fourth is the lack of professional operation of institutions on the urban renewal. Urban renewal is a systematic redevelopment process, but also a comprehensive management project, we need to set up and organize specialized agencies and departments to develop and operate. Although the concept of urban renewal has already had a mature application and development in foreign countries, but in China, the concept of urban renewal has yet to be extended and deepened. Because urban renewal requires us to complete the project according to a certain area's geographic, cultural, historical conditions, so the urban renewal in China cannot simply copy the mode of western countries, and it must make efforts to explore a suitable way for our own urban renewal. At present, specialized agencies on urban renewal in China can be described as very few, urban renewal projects are mostly by the general real estate companies bidding or selected by the government for the establishment of a temporary working group to promote. Their usual practice is to outsource project due to lack of professional and technical experience, but the outsourcing company, due to its missing in the pre planning participation, cannot ensure the quality of the engineering and the management, resulting in the confusion of project management after the completion of the planning.

In view of the above problems, this paper discusses a new solution in recent years -- PPP model based on REITs (to make it simple, we call it PPP-REITs model). The model introduce REITs as a tool in project financing stage, in order to widely attract social capital inflows, and to promote universal people to participate in urban renewal, sharing results of urban renewal; in the stage of the operation of the project we adopting PPP model to promote effective communication between the government and enterprises, improving the efficiency of project construction and management specialization, in order to enhance the sustainability and continuity of the urban renewal. The model had earlier been proposed to solve the problem of affordable housing. [8], this paper, however tries to utilize this new model to provide some new ideas on solving the urban renewal problems encountered in the financing difficulty and the operation difficulty, and hopefully to help China with its transformation reform on the urbanization.

### **Analysis on the PPP-REITs model**

Now, we are going to discuss on the establishment and the operation of our model, then furtherly analyze its application in the urban regeneration field.

In the PPP model based on REITs, we make REITs institutions as the funding party under the PPP model instead of private sectors. In this way, the government can avoid looking for private investor or companies as its partners and only needs to invite those REITs institutions with good credit status and proficient management skills. After the necessary selection and bidding procedure, they can

cooperate to make pre-construction decision and contribute together on establishing a SPV (Special Purpose Vehicle) to master the whole project. Because REITs has its innate advantage in financing and PPP in the cooperation with both the public and private parties, they can fully make use of their merits and overcome each other's demerits then effectively solve the problem in the urban regeneration. In the SPV, it involves the parties from developer, property management company, environment- building company to facility-building company and so on. According to the uniqueness of the urban area and each regeneration project, the type and ratio of the companies in the SPV may vary.

Now, to further illustrate our PPP-REITs model, we take Liwan district of Guangzhou, the capital city of Guangdong Province of China as an example.

Liwan district, which lies in the heart of Guangzhou, is a representative old district in Guangzhou comparatively to other districts. Due to the aging of the facilities and the industrial structure, also the problem of the aging population, its living condition is poor and it is now face the predicament of urban hollowing. As the origin of Guangzhou culture and the location of the once glorious Thirteen-Trades Monopoly, however, the old district is in the opportunity of revitalization. Apart from its cultural heritage, there are several big traditional whole-sale markets which have a wide range of commodities. Particular in recent years, the rising of the e-commerce has seen the birth of the Vipshop and the Moonbasa, which are both the famous e-commerce companies regionally.<sup>[9]</sup> So, for Liwan District, the theme of urban regeneration should not only concentrate on improving the public services but also to focus on building an e-commerce zone and upgrading the traditional whole-sale market, in order to bring up more e-commerce enterprises and attract more young people to settle down, finally making it a thriving district again.

So, in the PPP-REITs model, we can derive its organization pattern from the funding perspective and the operating perspective respectively:

#### A. Funding pattern analysis

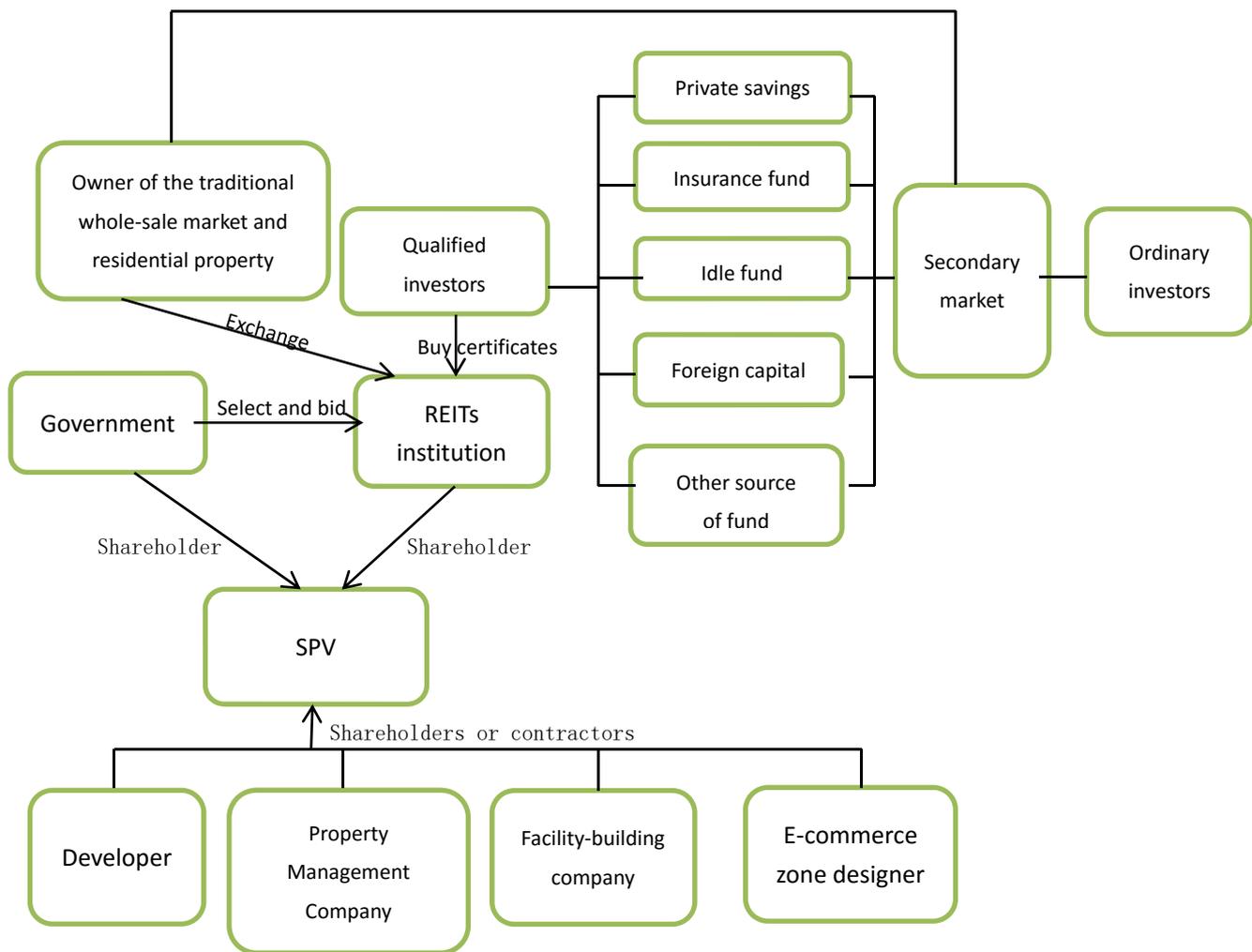


Figure 1: Funding pattern of PPP-REITs model

The figure above is the funding pattern of PPP-REITs model, and under this model, REITs institution sells investment certificate to the qualified investors to attract the inflow of funds from general public. At the same time, it also offers certificate in exchange for the ownership of the old properties and traditional whole-sale market. The qualified investors and original property owners can trade their certificates in the secondary market in case they are short of money. In the SPV, those parties who share the equity of it may allocate the profit in the Shapely Method according to Cooperative Game Model.

Assume the cooperative profit is defined as the real-valued function of any set  $S$  which is the subset of  $N = \{1, 2, \dots, n\}$ .  $\varphi$  represent the null set and fits the following conditions: Eq. (1)

$$\begin{aligned}
 V(\varphi) &= 0 \\
 V(N) &\geq \sum_{i=1}^n V(\{i\}) \quad (1)
 \end{aligned}$$

Here,  $V(\varphi)$  represents the aggregate profit without the union of parties,  $V(N)$  represents aggregate profit with the union of  $n$  parties (that is the SPV in our model), and  $V(\{i\})$  represents the profit of company  $i$ , without the cooperation in the union.

Suppose  $\Gamma = [I, V]$  is the strategy under the union of  $n$  companies and  $V$  is the characteristic function, then we have the one and only group of Shapely value: Eq. (2)

$$\Psi_i = \sum_{\{i\} \in S}^n w(|S|) \left[ V(S) - V\left(\frac{S}{i}\right) \right]$$

$$w(|S|) = \frac{(n-|S|)! \times (|S|-1)!}{n!}, \quad i = 1, 2, 3, \dots, n \quad (2)$$

Here,  $\Psi_i$  is the allocated profit for company  $i$  from the union,  $S$  is any union that contains company  $i$ ,  $|S|$  represents the scale of union  $S$  (that is, the number of the companies in the union),  $w(|S|)$  is the weight parameter for profit allocation,  $V(S)$  is the profit the union  $S$  received,  $V(S/i)$  is the profit received without the participation of company  $i$ , and  $\left[ V(S) - V\left(\frac{S}{i}\right) \right]$  means the difference between the union with and without the participation of company  $i$ .

Up to now, we did not consider each party's investment capability  $I_i$ , the contribution on the construction of the project  $C_i$ , also their risk-taking capability  $R_i$ , because we just assume they are indifferent in the contribution and capabilities (which is  $1/n$  for each party), and it is necessary for us to modify it.

Assume  $\mu_i$  is the correction factor, and  $\sum_{i=1}^n \mu_i = 1$ , Eq. (3) then we have

$$\mu_i = \frac{I_i \times C_i \times R_i}{\sum_{i=1}^n (I_i \times C_i \times R_i)} \quad (3)$$

In the above formula, we can determine  $I_i$  directly according to its amount, and calculate  $C_i$  and  $R_i$  by applying FAHP (Fuzzy Analytical Hierarchy Process) method.

Therefore, after the modification, the allocated profit for each party in the SPV should be Eq. (4),

$$V_i = \Psi_i + \left(\mu_i - \frac{1}{n}\right) \times V(S) \quad (4)$$

On this basis, we can furtherly adjust parameter  $\mu_i$  to make it more reasonable and practical then let our profit allocation plan be more suitable for the project.

## B. Operating pattern analysis

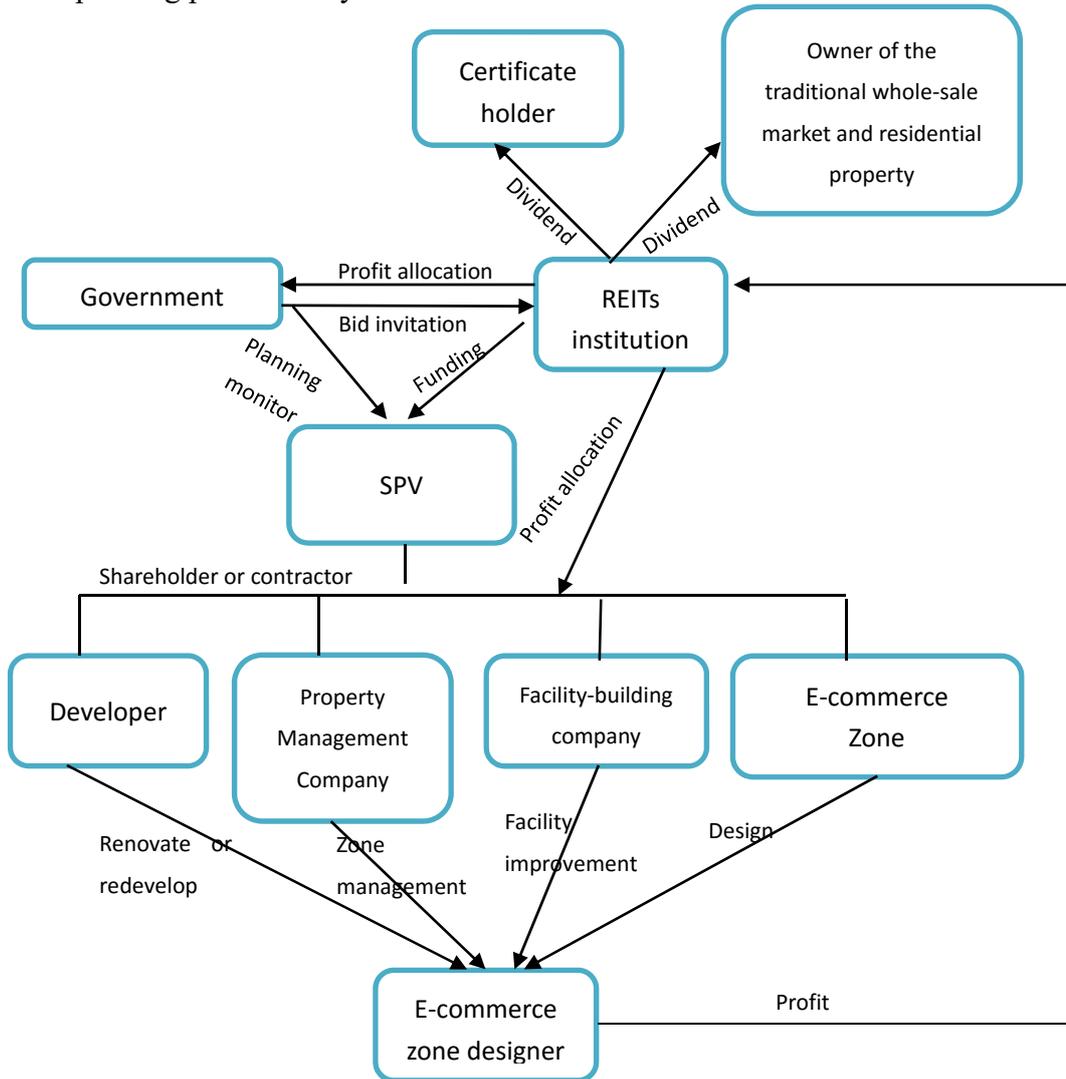


Figure 2 Operating pattern of PPP-REITs model

The figure above illustrates the operating pattern of PPP-REITs model, and under this model, the government is responsible for the supervision of the project planning in case it deviates from the public welfare and original goal and ensure the project sustainable and fit for the regulation. REITs institution is responsible for financing the SPV and monitoring its use on the fund in order to make sure its operating cash flow is stable and fit for the required rate of return. SPV in our model is composed by shareholders or contractors which are professional companies in each field and they are both responsible for the planning, the construction and the management of the whole regeneration project. The profit yield by the SPV should be delivered to REITs institution and furtherly be allocated to each party according to their contribution or equity. The certificate holders can also receive their dividend from REITs institution.

## C. The risk-sharing strategy of PPP-REITs model

In the previous discussion, we analyzed the funding pattern and the operating pattern of the PPP-REITs model and its profit allocation strategy. For any investment, however, it is necessary to consider its risk because investment is not only to find a project with highest yield but also to avoid

the risk effectively.

Firstly, we can categorize various risks we may encounter into two types, the systematic risk and the non-systematic risk. Then define them into subdivisions according to their cause of formation.

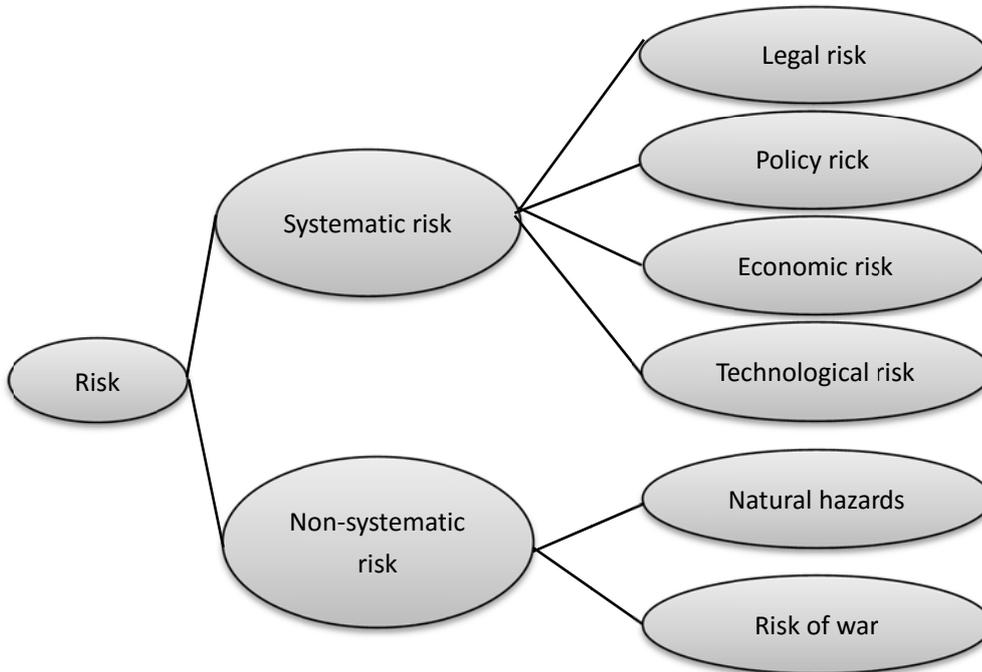


Figure 3: Risk categorization

Apparently, non-systematic risk is rare and cannot be dispersed, so we should care more about how to disperse the systematic risk. In our PPP-REITs model, for each aspect, we have different risk-sharing strategy.

(1) Risk-sharing strategy in the PPP aspect

In order to obtain the maximum utility for each party in the SPV, according to Nash Negotiation Model, we can find an optimal point which achieves the equilibrium for both public sector and private sector.

Assume the utility function for government and private sector is as below Eq. (5) Eq. (6),

$$U_G = \begin{cases} (Y_G - C_G) \times R_G^k, & \text{with risk} \\ 0, & \text{without risk} \end{cases} \quad (5)$$

$$U_P = \begin{cases} (Y_P - C_P) \times R_P^k, & \text{with risk} \\ 0, & \text{without risk} \end{cases} \quad (6)$$

Here,  $Y_G$  and  $Y_P$  represents the profit for Government and Private sector (including economic benefits, reputation benefits and so forth),  $C_G$  and  $C_P$  represents the cost for Government and Private sector (including economic cost, environmental cost and so forth),  $R_G^k$  and  $R_P^k$  represents the sharing of a certain risk K, for Government and Private sector. Then, we have the following Game Model,

		Government (Public Sector)	
		Strategy	
Private Sector	Take the risk	(-, -)	(0, $(Y_P - C_P) \times R_P^k$ )
	Refuse the risk	$((Y_G - C_G) \times R_G^k, 0)$	(0, 0)

Table 1: Game Model for public sector and private sector

For the risk is the same for both the government and the private sector, so  $R_G^k = R_P^k = R^k$ , and the results of Nash equilibrium is determined by the sign of  $(Y_G - C_G)$  and  $(Y_P - C_P)$ . If  $(Y_G - C_G)$  and  $(Y_P - C_P)$  are both positive, then there are two Nash equilibriums, and at this time it is reasonable to choose the bigger equilibrium. If  $(Y_G - C_G)$  and  $(Y_P - C_P)$  are both negative, then both parties' utility is zero so the only Nash equilibrium is to refuse the risk. If one of  $(Y_G - C_G)$  and  $(Y_P - C_P)$  is positive and the other is negative, there is only one Nash equilibrium, that is, to let the party with positive result to take the risk.

Based on the analysis above, we can conclude that when a certain risk K is shared only with the party who prefer it, the utility of the whole project is maximized. So, in the PPP aspect, we should allot a task to the party whose risk-sharing capability is higher.

From the perspective of government, it is better for the government to take the legal risk and the policy risk for it has the advantage to ensure the consistency of the policy and is more proficient in interpreting the law and various regulations. From the perspective of private sector, the third party in the SPV who is responsible for the construction and management is more suitable to take the technological risk because they are professional in their field and can cooperate to effectively eliminate technological hazards. REITs institution, for its advantage in financing and managing the investment, is the best taker for the economic risk and we are going to furtherly analyzing how the REITs institution can disperse the economic risk.

## (2) Risk-sharing strategy in the REITs aspect

At present, urban regeneration is an unstoppable trend in China, which provides a large basis for the REITs institutions to effectively lower down the economic risk. Because usually, an urban regeneration project is not just a composition of one or two simple projects, but a complex composition with many integrated projects or sub-projects, which may involve many cities, districts and various construction field. The key point on disperse the systematic risk lies in the diversity of the investment portfolio and the urban regeneration project is just the ideal investment portfolio we want. Moreover, when REITs institution has formed a solid cooperation relationship with the government, there will be more projects to come. The more projects we have, the less risky of the REITs institution and its investors and the yield from the project investment is more stable. This mechanism can be illustrated as below,

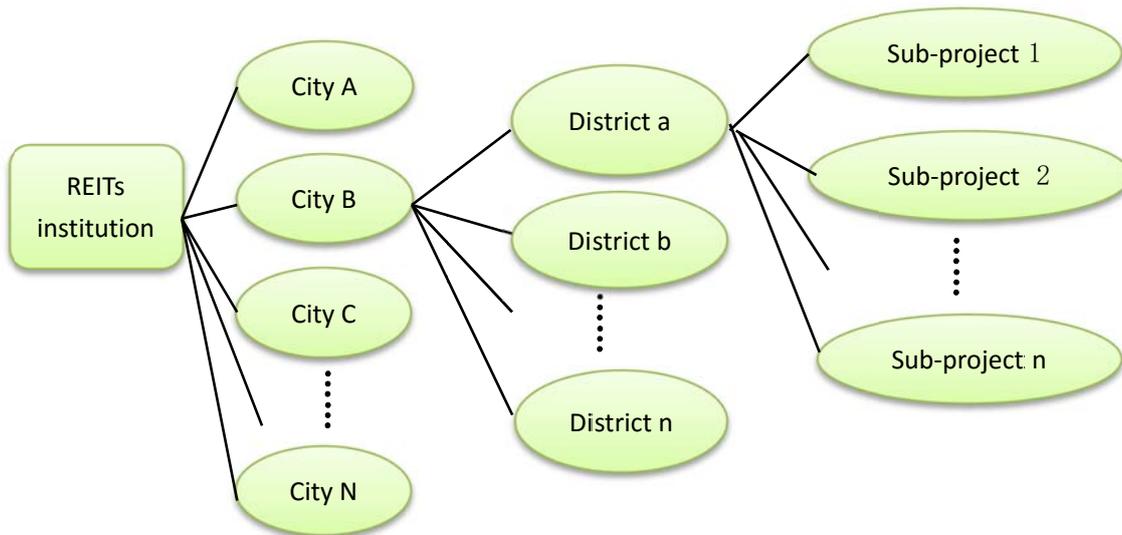


Figure 4: Risk-sharing strategy for REITs institutions

When the number and the scale of the urban regeneration project reach a certain level, the economic risk of the systematic risk can be effectively dispersed, or the risk may even be close to zero. This theory is realistically practical and adoptable according to China's heavy demand on urban regeneration and it may even promote the emerging of professional REITs institution that only serves for urban regeneration.

#### D. Merits of the PPP-REITs model

On the basis of the above analysis, we can see that the PPP model based on REITs has the following advantages:

##### (1) A widely raised channel and adequate fund

In the PPP-REITs model, the source of funds is very wide. Not only from the government, the third party of the cooperative venture company funds and by the institutions of REITs can absorb funds in the primary market and secondary market investors., which make full use of the advantages of REITs in the financing capacity, but also to create universal participation of urban renewal in the good investment environment, and to share the urban renewal and development achievements. At the same time, because REITs is able to meet the investment needs of medium and small investors, especially the introduction of the secondary market, and greatly reduce the investment threshold, so it can accumulate social wealth, and solve the problems encountered in the process of urban renewal funding breach problem and insufficient financial resources of government.

##### (2) High security of funds and stable value increase

Based on PPP mode supported by REITs, the urban renewal investment project, the systemic risk can be decomposed from the perspective of PPP and REITs, which can greatly enhance the security of the funds, and protect the investors and the project in company earnings stability. As the urban renewal project has significant economic benefits, urban renewal is often able to drive a region industrial upgrading and transforming. At the same time, even if it is public welfare projects, such as "village in city" renewal for park, for it has strong positive external effect, commercial areas, residential areas around will increase significantly in terms of value.

### (3) High liquidity

Problems encountered in the previous discussion, a significant problem is that urban renewal project construction period is long, easy to appear liquidity risk of investment especially in economic indexes, such as interest rate, exchange rate and inflation rate instability from time to time. But based on PPP mode supported by REITs, due to the advantages of REITs, the introduction of the secondary market, in the secondary market, REITs vouchers can be realized at any time and publicly traded, so it is good for investors who has high desire of liquidity, which also makes investors more willing to choose REITs investment, so as to REITs sources to provide security.

### (4) High efficiency in decision-making process

Cities in the process of updating encountered another difficulty is that urban renewal lack intrinsic motivation. If only let the single party play a role, such as government or real estate developers lead urban renewal, decision-making efficiency is not high. Based on PPP mode supported by REITs, the government can avoid the problem of shortage of fund. At the same time, and multi professional company cooperation, can complement each other in some professional problems. In particular, the establishment of a special item company, to be able to fully display the advantages of modern corporate decision-making, while also increasing the transparency and credibility of decision-making.

### (5) High degree of specialized management

In the past urban renewal projects in China, government set up temporary departments responsible for construction, or undertaken by an independent real estate developers, whose operation often lead to management process not professional. At the same time, because the urban renewal is a systematic project, involving the demolition of old urban areas, public transport, construction of the park, network communication, water and electricity facilities, landscaping and other a series of problems. If only dominated by the power of the government or developers, it is inevitable that it could be exhausted. However, based on PPP mode, special project company set up the urban renewal project of all professional institutions. Companies are gathered together, safeguarding their respective rights and profession. The parties have done their best to learn from each other, such as government planning and supervision, financial supervision mechanism. In this way, the professional management of urban renewal projects has been greatly improved, and the sustainability and continuity of urban renewal projects have been guaranteed.

### (6) Strong positive externalities

Urban renewal project features is its strong positive external effect, because urban renewal will drive a region and an urban industrial structure transformation and upgrading, but also play a significant role in the improvement of the appearance of the city, urban ecological environment, living environment, social security and other, so it has good economic benefit, social benefit and ecological benefit. Based on PPP mode supported by REITs, the benefit from private funds collection, return and benefit as well as urban residents of their own, and this benefit also is not limited to the economic benefits.

## Summary

Urban renewal is in accordance with China's "Thirteenth Five Year Plan" in terms of promoting urban healthy development and upgrading of the industries structure, and is also in line with the

"national model town of planning (2014-2020 years)," which pointed out to optimize the layout of urbanization and improve the capacity for sustainable development of the city's planning ideology. Now, the urban renewal in China has just started, and the prospect has a bright future. In this paper, the PPP model based on REITs is proposed, which is based on the background of the China's current urban renewal practice, hoping to provide a new idea for the development of China's urban renewal and urbanization.

At present, China's urban regeneration is in a critical deepening stage of development, although China's urban renewal started late and there are still some difficulties and challenges remained to be solved properly, but in the booming trend, facing the good development opportunity. Based on the above analysis and discussion, PPP model can be widely used for urban renewal, with obvious economic benefit, social benefit, ecological benefit, effective organization of social resources, improving the sustainability of China's urban renewal.

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