



## Reach on Infrastructure Innovative TOT Integrated Financing Mode Framework

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**Abstract :** Infrastructure projects are always in a changing environment and are full of risks. In view of the shortcomings of the current single TOT financing model and the failure of the project, this paper proposes an innovative TOT integrated financing model from the perspective of comprehensive integration, aiming to strengthen its ability to adapt to environmental changes and to cope with risks, Which will contribute to the success of the project. Through in-depth discussion on the theoretical basis and practical cases of the TOT model, the paper clarifies the necessity and feasibility of the research, and finally proposes the theoretical framework and operational mechanism of the innovative TOT integrated financing model.

**Keywords :** Infrastructure; Innovative TOT Integrated Financing Mode; framework ; operational mechanism

### 1. Introduction

The TOT project financing model comes from the evolution of the BOT project financing model. Many scholars at home and abroad have carried out various researches on TOT. Such as: Professor Akintola Akintoye conducted an in-depth study on the risk sharing model of the

TOT project financing model ; Wang Songjiang and Wang Minzheng comprehensively discussed the technical issues of TOT model transfer of management rights in public infrastructure in Yunnan Province ; Ding Jian gave a detailed introduction to the operation path and countermeasures of the TOT financing model. These studies have both theoretical and operational models, and have achieved fruitful results. However, these studies are mainly aimed at a certain aspect of the single TOT financing model, and there is less research on the TOT model from the perspective of integration.

At present, China is in the period of rapid development of economic construction, and a large number of infrastructure projects are put into construction. These projects are characterized by complexity and system. In the face of huge scale, long cycle, numerous participating organizations and large investment quotas, the single financing model has problems such as excessive risk and uneven risk sharing, which may lead to project failure. Therefore, this paper proposes an innovative TOT integrated financing model, in order to better adapt to the uncertainty of the environment and promote the smooth implementation of the project, thereby accelerating the process of urban infrastructure construction and improving people's living standards.

## **2. Analysis of the connotation and composition of the innovative TOT integrated financing model**

### **2.1 The connotation of innovative TOT integrated financing mode**

The concept of "comprehensive integration" was first proposed by the famous scientist Qian Xuesen and his collaborators, including the process of integrated integration methodology and system integration. Since infrastructure projects are characterized by open and complex giant systems, there is no fixed, ready-made theory to guide, and it is impossible to make rigorous theoretical descriptions and precise quantitative conclusions like simple systems, so new solutions must be sought.

Innovative TOT integrated financing mode is to introduce PPP mode in a single TOT mode. In the project implementation process, the two will be combined according to the specific situation to form the TOT-PPP-TOT mode, thereby, reducing financing risks and improving comprehensive benefits. It can be said that the innovative TOT integrated financing model is a comprehensive integration of knowledge or ideological fields, and new knowledge, new ideas

and new methods can be generated through integration.

**2.2 Comparative analysis of TOT and PPP financing models**

TOT is the abbreviation of transfer-operating-transfer. It is a new mode for private institutions, foreign investors and other social investors to participate in the construction and operation of public infrastructure. The government transfers the management rights of the completed public infrastructure project to the social investors (private institutions, foreign capital, etc.) during the franchise period, and after the franchise expiring, the social investors will transfer the public infrastructure project back to government without compensation.

PPP is the abbreviation of Public Private Partnerships. The connotation of PPP mode has broad and narrow meanings. From a broad perspective, the PPP model refers to various long-term cooperative relationships between government and social capital to provide public goods or services, including BOT, TOT, BOO, ROT, BTO, etc. From a narrow point of view, the PPP model emphasizes the whole process of government and social capital cooperation, starting from the stage of project confirmation and feasibility study, and throughout the entire implementation process of the project, the two parties are jointly responsible for the project throughout the project life cycle, and hand over to the government at the end of the period. The PPP model proposed in this paper uses a narrow concept.

**table 1: comparison of operational characteristics of PPP and TOT financing modes**

Financing modes index	PPP	TOT
project ownership	the private sector and the government each have certain ownership	government has ownership
project management rights	the private sector and the government each have certain management rights	the project company has full management rights during the concession period.
investor range	large	large
number of stakeholders	many	many
the difficulty of obtaining funds in the short term	medium	easy
upfront cost	medium	low

time required for financing	short	short
degree of government involvement	project full life cycle	transition phase
government risk	medium	low
sustainable development capability	strong	strong
applicable conditions	completed and under construction projects with long-term, stable cash flow	completed projects with long-term, stable cash flow

From the comparison of the characteristics of the two financing modes of PPP and TOT above, it can be found that each financing mode has different operating modes, scope of application, and risk factors, and there are certain deficiencies. Since each project is in a complex and dynamic environment at all stages of its life cycle, it is difficult for a single financing model to fully meet the complex practical needs of the project. Therefore, it is necessary to introduce the idea of integrated integration in the implementation process of the project. Several financing modes will be integrated as needed to form a flexible integrated financing model.

In the innovative TOT integrated financing model, the TOT model is integrated with the PPP model to increase the risk resistance capability. The reason why the PPP model is chosen is that the degree of government participation in the PPP model is relatively high. Government participation can share risks and conduct more stringent supervision. Therefore, the PPP mode mainly plays a role in solving the problem.

## **2.3 The necessity and feasibility analysis of innovating TOT integrated financing Model**

### **2.3.1 Necessity analysis**

(1) Meeting the government's urgent need for infrastructure development

World Bank experts G. Ingram research shows that infrastructure capacity and economic output are growing at the same time. For every 1% increase in infrastructure, GDP will increase by 1% or more. China is currently in a period of rapid economic development, and urban infrastructure investment needs an average of 175 billion to 250 billion yuan per year. Relying on government fiscal expenditure alone will not be able to meet such huge funding needs.

Innovative TOT integrated financing model is of great significance for improving the

operational status of traditional infrastructure that has drawbacks in financing methods, technology levels and management models. In this way, the government can not only revitalize the existing stock assets, but also obtain a large amount of funds for the construction of other infrastructure projects to meet the government's urgent requirements for infrastructure development.

## (2) Intrinsic requirements for infrastructure projects

An infrastructure project is a one-time process of interrelated tasks or activities for the completion of a unique product or service. It is a heterogeneous, hierarchical and open complex system with one-time, uniqueness, the clarity of the objectives, the temporary and open nature of the organization, and the irreparable nature of the consequences. It can be seen that the project itself has a greater risk than the general business activities. A functional relationship can be expressed between the objectives of the infrastructure project and the elements that achieve the goal:  $O^{(t)} = E^{(t)} R^{(t)} \sum P^{(t)}$ ,

where  $O^{(t)}$  represents the state of the project system at a certain time 't' and its overall function,  $E^{(t)}$  represents the environment of the project system at a certain time 't' and its effect on the system,  $R^{(t)}$  indicates the contact status of the project system and the overall 'organizational effect' at a certain time.  $\sum P^{(t)}$  represents a set of input elements and their collection of functions at a certain time 't'. It can be seen that the various elements of achieving the project objectives will change over time, and not all project system elements can be identified. During the project implementation process, new elements will appear constantly, or the likelihood that a identified element will appear will also change over time, and the impact of system elements on the project's objectives will also change as the internal connections between them change. In order to improve the probability of project success, it is necessary to monitor the various system elements of the project from time to time, dynamically evaluate the project objective function, and adjust the project operation mechanism in a timely manner. Therefore, the innovative TO integrated financing model is a requirement of the intrinsic characteristics of infrastructure projects.

## (3) Increase management flexibility and increase the success rate of TOT projects

Infrastructure projects are always in a dynamic environment, and the various variables that make up the project's goals are also dynamic. When the environment changes dramatically, that is, the  $E^{(t)}$  in function  $O^{(t)} = E^{(t)} R^{(t)} \sum P^{(t)}$  will change, which will affect the realization of the

project objectives, If the project adopts a single TOT financing model, once the model cannot cope with the impact of such changes, the project will be forced to terminate, and the losses caused are enormous. Adopting the innovative TOT integrated financing model, in the face of the current TOT financing model can not continue, by analyzing the problem, the project stakeholders can change the financing mode to adapt to the current situation of the project, based on the existing problems and the current internal and external environment. So that the project can continue to run, and ultimately achieve the project objectives. The innovative TOT integrated financing model has greater flexibility and success rate in management than a single TOT model.

### ***2.3.2 Feasibility analysis***

#### **(1) Policy and legal feasibility**

Infrastructure usually includes public facilities, public works, and other transportation sectors, such as urban transportation, ports, and waterways, involving the interests of the general public, government responsibilities, and national policy orientations. Infrastructure usually includes public facilities, public works, and other transportation sectors, such as urban transportation, ports, and waterways. It involves the interests of the general public, the government's responsibilities, and the orientation of national policies. Therefore, It is generally stated that infrastructure is owned or dominated by state-owned assets. In the innovative TOT integrated financing model, the TOT model does not involve the ownership of infrastructure projects, and the PPP model government participates in the whole process, which guarantees the government's control over infrastructure projects, which is in line with the special requirements of relevant policies and laws and regulations in China. Thus, it is easy to be accepted and promoted.

In order to promote the rapid development of infrastructure, since the 1990s, China has issued a series of important policies and regulations on the investment and financing system of infrastructure projects, such as <Measures for the Administration of the Transfer of Highway Management Rights>, <Notice of the State Planning Commission on Printing and Distributing Several Opinions on Promoting and Guiding Private Investment>, <Guidance on the development of government and social capital cooperation> etc. The risk-constraining mechanism and management system for investment under market economy conditions have been basically established, which has laid a good policy and legal basis for the development of public-private partnerships.

## (2)Economic feasibility

In a general sense, the return on investment in infrastructure projects is relatively low. However, infrastructure is an engineering facility that provides public services for social production and residents' lives, it is a general material condition for the survival and development of society, which makes it almost unaffected by economic cyclical changes, and China's infrastructure projects are strongly supported by the government. Therefore, investment returns are relatively stable and market risks are relatively small.

On the other hand, the innovative TOT integrated financing model is to conduct life cycle risk management and dynamically manage stakeholders, which reduces investment risks and enhances investors' enthusiasm for participating in infrastructure construction. The wide participation of these investors has provided sufficient funds for project construction and laid a good economic foundation for the construction of infrastructure projects.

## (3)Theoretical feasibility

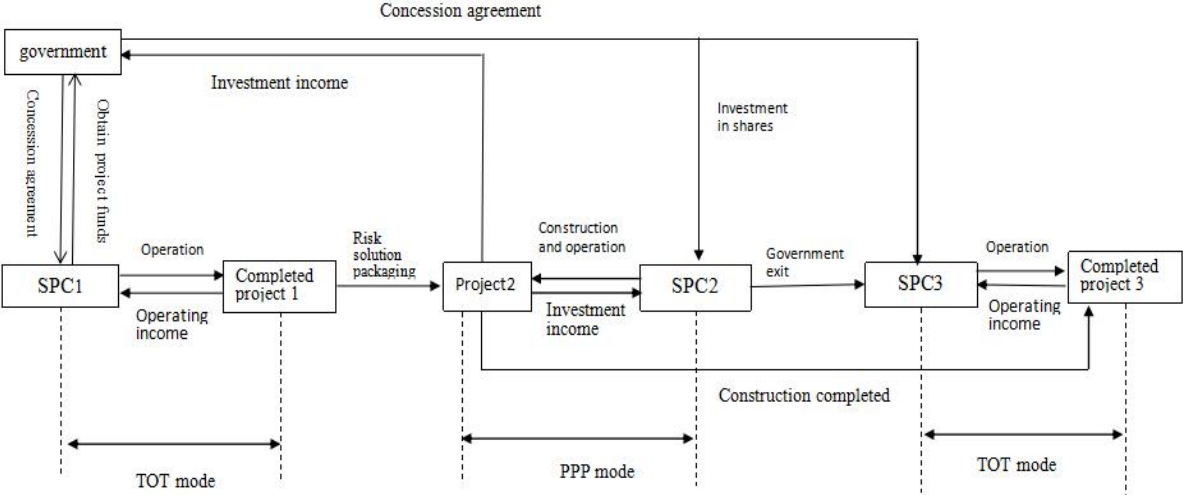
The Work Breakdown Structure (WBS) in project management can break down infrastructure projects into different sub-projects; The project division theory can divide each sub-project into operational sub-projects and non-operating sub-projects; Project life cycle theory emphasizes that projects have different operational characteristics in different life cycles and face different project risks; The comprehensive integration theory can realize the organic combination of experts, information and computer, realize the combination of theoretical knowledge and subjective experience, combine qualitative and quantitative, and form these factors into an organic system, resulting in the overall effect of  $1+1>2$ . These theories have laid a good theoretical foundation for the research of the innovative TOT integrated financing model, and provided a good theoretical guidance for its practice, which makes it operationally feasible.

## **3.Theoretical framework and operational mechanism of innovative TOT integrated financing model**

### **3.1 Theoretical framework**

In a single TOT model, the relationships, rights and obligations of the various stakeholders of the infrastructure project are basically the same, but in the project implementation process, the project risks are constantly changing. The risk-sharing principle refers to the fact that the most

controlled party usually controls the corresponding risk and the degree of risk assumed matches the return. It can be seen that as the risk changes, the rights and obligations of various stakeholders will also change. In this case, changing the financing model will help to rebalance the rights and obligations of all stakeholders and achieve a new balance of interests, which will allow the project to continue to operate. According to the characteristics of TOT and PPP modes, using the idea of integrated integration, this paper constructs the following theoretical framework of innovative TOT integrated financing model, As shown in Figure 1.



**Figure1: Innovative TOT Integrated Financing Model Theory Framework**

Seen from left to right in Figure 1, in the first phase, the government and SPC1(Special Purpose Company) reached a cooperation agreement on the operation of the completed infrastructure project in TOT mode; in the second stage, the solution can be packaged for major risk events that occur in the project, the government will then reach a cooperation agreement with the SPC2 in PPP mode for the new project content (project 2 in the figure); in the third stage, when the problem is solved and the project meets the scope of application of the TOT mode, the government will once again reach a cooperation agreement with the appropriate project company (SPC3 in the picture) to operate the infrastructure project in TOT mode. In each phase of the mode transition, the stakeholders of the project may change, the partners of the project company also change, and the rights and obligations of stakeholders are naturally adjusted, which avoids the breakdown of the relationship between the partnerships and reduces project losses.

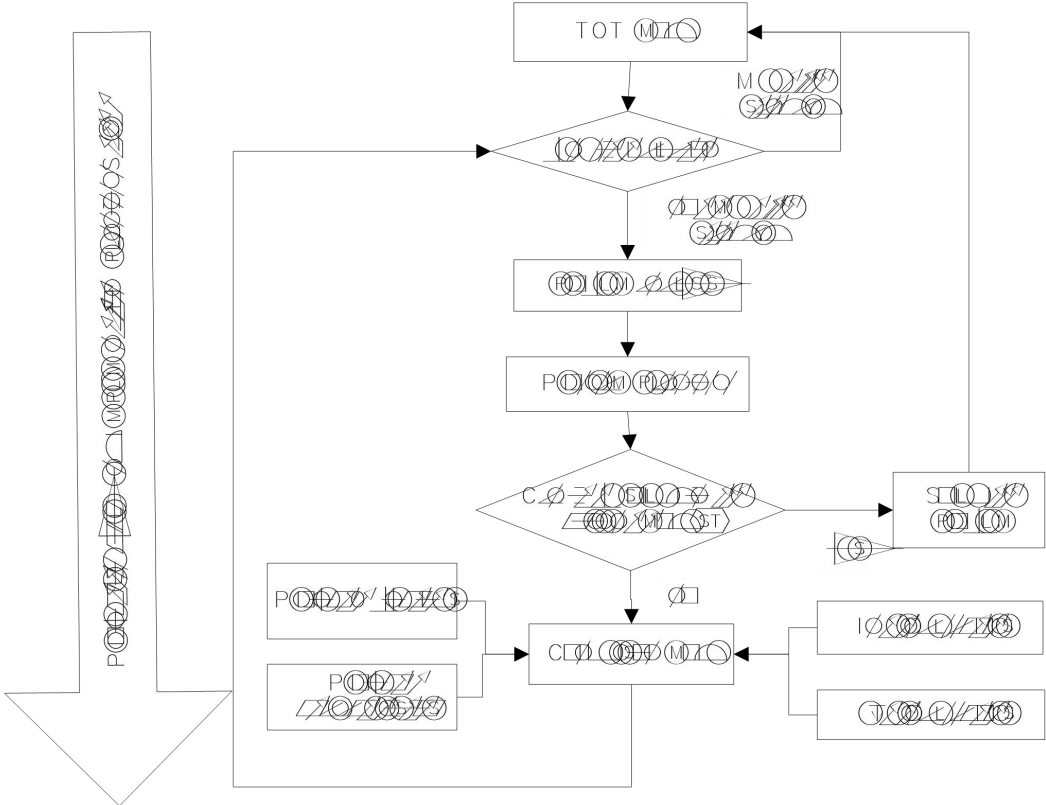
**3.2 Operating mechanism**

The so-called operational mechanism is to clarify the function of each element under the model, the relationship between the elements, and the interaction. It is the basic guideline for



guiding and restricting project activities. It can realize the self-regulation of the elements throughout the project life cycle, so that the project activities can be operated in an orderly and efficient manner, which can enhance the project's internal vitality and external resilience, and ultimately achieve the project objectives.

The innovative TOT integrated financing model is built around the project life cycle, as shown in picture 2. Monitor the operation of the project from time to time throughout the project life cycle. When there is a problem that prevents the project from proceeding, the project stakeholders analyze the problem and find out why. If the current financing model cannot overcome the problems, stakeholders will aim to solve the problems of the project, establish new projects, and introduce another more suitable financing model according to the internal and external environment of the project and the characteristics of the project itself. The innovative TOT integrated financing model is transformed between the TOT mode and the PPP mode by such an operational mechanism, thereby dynamically coordinating the relationship between the various stakeholders of the project and achieving the objectives of the project.



**Figure2: Innovative TOT integrated financing model operating mechanism**

## 4. Conclusion

Public-private partnerships play a vital role in the construction and development of infrastructure in China. Public-private partnership can achieve a win-win situation for the public sector and social investors. It not only promotes the rapid development of the infrastructure of the project site, but also opens up new investment channels for social capital, which helps to promote the coordinated development of the entire social economy. However, projects using the TOT, BOT, and PPP models alone often result in project termination due to misplaced targets, lack of cooperation among stakeholders, and neglect of public interest. Based on the theory of project differentiation, project life cycle theory and comprehensive integration theory, this paper combines the development characteristics of modern engineering projects, integrates a single TOT model and PPP model, and proposes an innovative TOT integrated financing model, which will effectively continue the existing Cooperation, expand the scope of cooperation, cooperation areas, and promote the construction and development of public-private partnership-related systems.

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