

# Critical Issues for Investment Control of BT Project From the Perspective of Project Governance: the Case Study of a Metro Project

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**Abstract.** It is well known that the introduction of BT mode in construction of public infrastructure can reduce financial pressure of government public organization greatly, but it might make the public be exposed to the debt risks. The key of resolving this problem is to control the investment in BT project effectively. Based on a practical metro project example, the grounded theory was employed to recognize key points in the hierarchical structure for completeness and improvement of the investment control system. Furthermore, it studied the influence mechanism of key factors on the investment control system, some factors located in the level of contractual governance were discussed with emphasis. The research provides an important decision-making guideline for the project investment control of public sectors.

## Introduction

In order to relieve the construction investment problem for public projects, BT Mode is introduced by government to attract investment from private organization. The construction investment is supplied by private organization, and the construction work is also taken charge by private organization, finally the government organization buy-back the completed project under a limited price[1], more public project are built up and public funds are used more effectively because of BT Mode. However, government is facing more complex investment problem, the price for buy-back project is consist of the construction funds, and the financing funds[2]. If each consist of construction funds and financing funds is out of control, the buy-back price will be higher and give government heavier funds pressure[3]. So this problem faced by government about how to control the investment effectively need to be solved urgently.

Because of BT project involved several stakeholders, and the contract linked the stakeholders as a bond, so the governance structure is formed. Moreover, project control rights transfer and allocation between different stakeholders, and reform new control rights allocation, so the investment control structure is hierarchical and complex. It is noteworthy that there are many reveal key element to resolve the investment control problem, reference[4] research how risk influence buy-back price based on the risk allocation. At a later time references[5,6] future analyze different risk how influence buy-back price. Moreover, reference[7] discuss the problems in contract designing, the problems contain buy-back price, risk allocation, power and benefit allocation. However, the key point to achieve investment control goal is how to allocate power, responsibility and benefit based on dynamic state. In consideration of public organization as a center status in investment control structure, it is necessary to research the key element in the view of governance.

Based on this hierarchical structure and a practical metro project example, the grounded theory was employed to recognize key factors in the hierarchical structure for completeness and improvement of the investment control system. Furthermore, the theory studied the influence mechanism of key factors on the investment control system, some points located in the level of contractual governance were discussed with emphasis. The research provides an important decision-making guideline for the project investment control of public organization.

## **Recognizing of the Core Elements of Controlling Investment Based on Grounded Theory**

### **The Method of Recognition**

BT pattern recognition control core elements of governance layer only through quantitative methods is relatively difficult to directly measure the investment[8]. Qualitative research is to conduct in-depth and studied by researchers interact between objects, detailed studies on the nature of things and then get a more comprehensive interpretive understanding. Grounded Theory approach by the two sociologists - Glaser and Strauss suggested that qualitative research is considered to be the most scientific methodology.

### **Source of the Data**

According to information of the target projects focus on grounded theory richness rather than the number of samples the size of principle, this study Shenzhen Metro Line M BT project as a research object, using grounded theory methods to identify the core elements of its impact on investment in the project management control layer.

### **The Process of Decoding**

#### **Open coding**

Open coding is the first step in the decoding process, the aim is to find the generic concepts from the data, to determine the generic properties and dimensions, and then give it a name and scope of the study of phenomena[9]. In the process of open coding for Shenzhen Metro Line M BT project, a tag is attached to each relevant material. There are 194 different information in total, among which 140 are used to set up model, the remaining are used to theoretical saturation test. Through analyzing concepts to conclude several categories, this is the process of conceptualization and categorization, finally we abstract several kind of control power which contain propose power, execute power, examine and approve power, supervision power, and so on (see Table 1).

Table1 Category formed by open coding

Original statement	Conceptualization	Categorization
Design company is S,prospect and disign contract is signed between S and shenzhen Metro company Shenzhen Metro Company has books for tendering,require design company to establish estimate cost as it .....	a01 Propose power for bidding a02 Propose power for establish estimate .....	A01 sponsor's propose power (a01,a02,a03,a04,a05) .....
The risk of accuracy date supplied by BT owner is assumed by BT sponsor BT sponsor is responsible for the management of overall design and preliminary design .....	a78 Inaccuracy and omission of primary design document a79 Poor management of primary designing .....	A15 sponsor's design risk(a78,a79) .....
The risk of delay for removing is assumed by BT organizer In construction period, all the change on geological conditions should be assumed by BT organizer, BT organizer should coordinate with government. .....	a98 The delay of removing a99 Project site geological defects .....	A27 organizer's conctruction preparation risk (a98,a99,a100) .....
The risk of extra free caused by prospect,the risk of claim and penalty caused by poor management are assumed by contractor. .....	a126 The risk of breaking the contract .....	A40 Both parties' breaking contract risk (a126) .....
	(140 concepts in total)	(43 categories in total)

### Spindle decoding

Spindle decode its core mission is to build a variety of conceptual categories between interrelated, the performance of the various categories through open coding process and the extracted organic strung together in the specific operation.through carefully analyzing the 140concepts and 43 categorizations from open coding date, 8 spindle decoding are summaried(see Table 2).

Table 2 Eight kinds of relationship based on spindle decoding

Num	Main category	Relevant category
B01	sponsor's control power	A01 sponsor's propose power, A02 sponsor's execute power, A03 sponsor's examine and approve power, A04 sponsor's supervision power
B02	organizer's control power	A05 organizer's propose power, A06 organizer's execute power, A07 organizer's examine and approve power, A08 organizer's supervision power
B03	both parties' sharing control power	A09 Both parties' propose power A10 Both parties' execute power, A11 Both parties' examine and approve power, A12 Both parties' supervision power,
B04	the risk undertaken by sponsor	A13 sponsor's investment risk, A14sponsor's prospect risk,A15 sponsor's design risk, A16 sponsor's purchase risk,A17 sponsor's delay risk, A18 sponsor's suspend risk,A19 sponsor's cost risk,A20 sponsor's change risk,A21 sponsor's supervise risk,A22 sponsor's coordination risk,A23 sponsor's transfer risk
B05	the risk undertaken by organizer	A24 organizer's investment risk,A25 organizer's design risk, A26organizer's purchase risk, A27 organizer's conctruction preparation risk,A28 organizer's delay risk,A29 organizer's suspend risk,A30 organizer's cost risk,A31 organizer's change risk,A32 organizer's quality risk,A33 organizer's subpackage risk, A34 organizer's coordination risk,A35 organizer's force majeure risk,A36 organizer's transfer risk,
B06	the risk undertaken by both parties	A37 Both parties' purchase risk,A38 Both parties' cost risk,A39 Both parties' change risk, A40 Both parties' breaking contract risk,
B07	contract price	A41 contract free, A42 cost time valuation
B08	contract adjustment	A43 contract adjustment

### Selective decoding

Selective decoding means around the core areas, and other areas of the system to be connected, verify the relationship between the conceptualization and development of a comprehensive yet complementary areas of complete process[10]. sponsor's control power(B01), organizer's control power(B02), both parties' sharing control power(B03) are BT sponsor's and organizer's control power; the risk undertaken by sponsor(B04), the risk undertaken by organizer(B05), the risk undertaken by both parties(B06) are sponsor's and organizer's risk; contract price(B07), contract adjustment(B08) are BT project payment of the price. So the key points influenced BT project investment could be concluded in the allocation of control power, the allocation of risk, and the controlling of buy-back price.

### Theoretical Saturation Test

Stop sampling as a standard theoretical saturation test is when the data is no longer collect fresh produce new theoretical insights when, no longer able to reveal new property category theory is saturated.

## **The Analysis of Key Points in Governance Level About Investment Control Power**

This paper get the core points of the investment controlling in project governance level about BT project after investigation, interview, statistics and other research process. The three core points will be detailed analysis as follows.

### The allocation of Project Control Power

Contractors will have right to manage the project implementation in the process of construction Control in the BT project after the contract signing by the organizers and contractors, but the organizers always have the important supervision, decision-making and change control. In Shenzhen metro line M, organizers not only manage the early stage of the project and design, but involved in construction management of project construction. There is little power to the contractor in this BT-Mode.

Considering the characteristics of the BT project such as the operation is not yet mature, the investment is big and the professional construction technology, there are some principles of BT project control as following: (1) Exclusive control, which means the control rights is owned completely by government; (2) The importance of investment, which means government distributes a part of control rights to BT organizer if the investment control requestment is high; (3) Properties of BT project, which means government distributes a part of control rights to BT organizer if BT organizer's ability is high.

### Risk allocation in Contract

The risk of investment control in BT project comes from the uncertainty dynamic factors which influenced the total repurchase. And the risk sharing in investment control of BT project is divided the risk treatment responsibility and the risks brought about by the loss or risk and return between the sponsors and investors.

The risk sharing in investment control of BT project is the gaming result of the sponsors and investors(see Table 3). A common myth is that governmental sponsors should transfer risk as much as possible to investors. Actually, reciprocity and mutual benefit is more likely be achieved through a reasonable risk sharing to achieve the "win-win" goal.

Table3 The key risk sharing in Shenzhen Metro Line M

Risk level	Risk element group	Risk element	Risk assume party
Macro risks	Macro economic risks	Inflation	Both parties
		Changes in interest rates	Both parties
	Nature factors risk	Adverse geological conditions	BT organizer
Medium risk	project financing	Project financing ftructure	BT organizer
	Project prospect and design	Design resources	BT sponsor
		Inaccurate, not in time	BT sponsor
		Changes in planning programs	BT sponsor
	Project construction	Prepare the construction site	BT sponsor
		Demolition pipeline risk	BT organizer
		Security Risk	BT organizer
		Schedule delays	Both parties
		Substandard quality	BT organizer
	Design changes	Both parties	

### Controlling of Total Repurchase Price

The total repurchase price of BT project including the repurchase price and the return on investment based on repurchase price. Both of the two parts formed the payment mechanism the total repurchase. The repurchase price of Shenzhen metro line M consist with the project cost and the risk in lieu. For the Shenzhen metro line M with the method of repurchase in advance, the cost of investment and financing should be considered in the return on investment.

For the government, understanding the key influence factor and the influence mechanism of repurchase value before the BT contract negotiations with investors will facilitate the government chooses their own repurchase plan. Analyze the total repurchase in order to analysis the mechanism and the key factors how to influence the total repurchase in BT project, thus, lay the foundation of the risk sharing and power allocation in investment control.

### Conclusion

Through identifying the core element for BT-Mode urban rail investment management, and analyzing project control allocation, risk allocation and the repurchase price control, the conclusion is gained to popularize BT mode in a certain significance.

Project control allocation, risk allocation and the repurchase price control has become obviously the three key problems which need to be paid attention about BT-Mode urban rail transit in governance management level. The construction of total cost is decided by d the repurchase plan. By the way, the effectiveness risk sharing of project is determined by the optimization of the configuration in project control. Therefore, the new BT-Mode project should study the control power, the risk and the payment control as a whole system. Helping the government at a dominant position in the investment control, promoting the BT-Mode project smoothly implemented.

The payment ability should be considered in order to avoid debt risk for government public section, systemly research project control rights, reasonable risk sharing and buy-back based on governance theory, then establish BT project investment control framework. Specifically, government should make sure whether BT sponsor or BT organizer is the leading party in BT project investment control. Then formulate main contract terms in order to ensure project goal and system arrangement. Based on the main contract terms and system arrangement, clear and definite the risk allocation between BT sponsor and organizer, and formulate risk contract terms to give some compensate based on when risk is appearing. The government should consider the key element to design buy-back contract terms, which is the basic guarantee for realizing investment control goal.

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