PFI Risk Management Research

Wei Huang[1]; Junyan Jin[2]; and Shoujian Zhang[3]

[1]Undergraduate, Department of Construction and Real Estate, Harbin Institute of Technology, Harbin 150001, China. E-mail: arsl22222@126.com
[2]Postgraduate, Department of Construction and Real Estate, Harbin Institute of Technology, Harbin 150001, China. E-mail: jjyyuyue@126.com
[3]Professor, Department of Construction and Real Estate, Harbin Institute of Technology, Harbin 150001, China. E-mail: zhangsj@hit.edu.cn

Abstract

Being different from traditional means for the finance in public projects, PFI cooperates with the government procuring from private finance to provide resources to the project in the public sectors. In the United Kingdom, PFI is widely used in many governments' public projects. This article describes the current situation of PFI in China and the necessity of introducing PFI to China. It also includes the connotation of PFI and the different types of PFI. Then it describes eight kinds of risks that PFI will go through in China. Depend on PFI projects' risk sharing principles and mechanisms, The PFI project risk management measures are proposed to promote PFI develop in China.

INTRODUCTION

Currently PFI are introduced to China' public construction project. These models in the country are just beginning in China, especially PFI, studied by Xie and Hu (2003). PFI has been well developed in the UK as an important mean of infrastructure financing. Engineering Project Risk Management is researched by Wang (2003a). PFI mode project develops rapidly in China, effectively promoting the development of public construction projects. But generally PFI projects have many participators, long construction period and a large number of uncertainties. There is a huge investment and high sunk costs in the PFI project, making the project very risky. Therefore, the study of PFI financing model risk management has important practical significance for the promotion and application to PFI financing model.

IMPLICATION OF PFI

Private Finance Initiative (PFI) means government gives the opportunity to private sector to participate in production of infrastructure and public goods rather

than that the government is responsible for providing the output of public projects in a traditional way, which is a new way of public project outputs. In this way government cooperates with the private sector. Private sector undertakes the production of public goods or provides public services while government purchases products or services from the private sector or gives concession to private sector in public projects, or operates project with the private sector in a co-operating mode. PFI helps government achieve the optimization in allocation of government public goods resources output (Kwak 2002).

PFI is currently a advanced way to output public product used by developed countries. This method is currently used in the Hong Kong's first undersea tunnel, Japan's Kansai International Airport, American California PFI project, Australian Sydney M4 western Expressway and French the Orret airport light railway and so on.

THE CURRENT SITUATION OF PFI IN CHINA

Infrastructure projects play an important role in the process of national economic construction and social development. A large number of scholars and practitioners have done fruitful researches in the commonalities of infrastructure projects' construction. There are few researches in applying PFI in infrastructure. The direct cause is that PFI is still in its infancy, people cannot accept the concept of infrastructure privatization. China also has a small number of public service infrastructure projects tried PFI mode and achieved good economic and social benefits, for example in construction of Amoy city real estate information management platform government used PFI building mode (Yang and Huang 2007).

THE CONNOTATION OF PFI

The private sector makes the government become services buyers from the owner of the property under the PFI (Ren and Li 2004). PFI includes the following four elements: Design - The private sector is responsible for the design of public facilities and engineering. Construction - Facilities are built by private sector. Finance – the rent to infrastructure are used as the repayment to Private sector 'loan. Operations - in general case, many public services are operated by the administrator of public institutions, most of who are experienced and know how to effectively serve the public. In order to enable investors and governments are benefit from PFI project, they should take reasonable risk control, risk analysis.

PROJECT RISK ANALYSIS OF PFI

United States' project management institute defines project risk as unfavorable results to project objectives generated from uncertain events on the process of project implementation. As there PFI projects have a long life cycle with multiple participants and relationship between the parties is complex, risk exists in Figure 1. Uncertainty and Cash Flow of the Various Stages of PFI Project the whole process of the project (Wideman 1992). In the entire process of project implementation, the uncertainty of project showed a decreasing trend as the project

proceeds and the demand of capital investment and the outflow of profit are very uneven. We can see uncertainty and cash flow of the various stages of PFI project from the Diagram (see Figure 1). According to the development status quo of the PFI in China's development, we can divide the risks faced by PFI project for eight areas: political risk, legal risk, financial risk, natural risk, environmental risk, construction risk, operational risk and force majeure risks (Sun 2004).

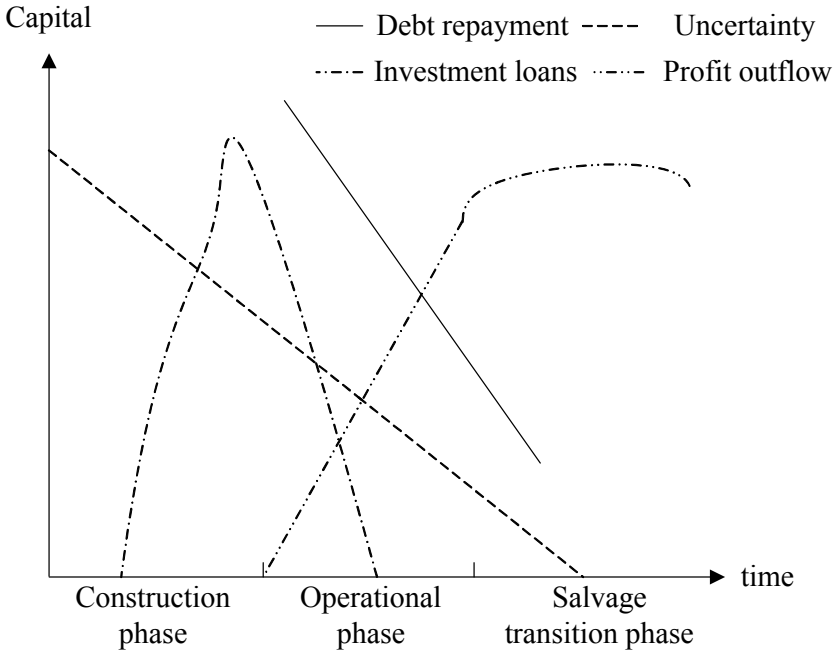

Figure 1.Uncertainty and cash flow of the various stages of PFI project.

Political risk. Political risk is a type of risk that the country has adopted an unfavorable policy to PFI normal operation due to the war, and mandatory or discriminatory policies and measures results in different degrees risks to PFI program in assets and interests .For our country's PFI projects, changes in national economic policy or system, and breach of contract all will affect the returns to investors. And political risks are often comprehensive with related effect. So once the political risk appears, PFI projects will face the risk of failure.

Legal risk. Legal risk is the risk raised by changes in terms of the sensitivity of the legal system, the tax system, labor relations. PFI projects rely heavily on government franchises, specific tax policy and so on. Government franchises and related policy play as an important credit support for project financing. China's current law is not very completed, so for our PFI projects, legal risk is particularly important.

Financial risk. Financial risks of PFI project model include mainly the following three kinds of risk.

(1) Interest rate risk. Interest rate risk is the risk of the value of the project reducing or benefits eliminating caused from changes in interest rates. It is mainly

manifested in the process of raising capital and operations. For example, investors will have loss of opportunity because of falling interest rates if investor got a long-term financing loan when interest rates are higher (Zhang 1998).

(2) Exchange Risk. Fluctuations in exchange rates will affect the cost of production in PFI projects. For example, when our interest rates fall, the price of imported raw materials will rise, which may affect the cost of the entire project? Because the analysis of PFI project' payback period, internal rate of return, return on equity and net present value after tax are based on the exchange rate and the discount rate, exchange rate risk would adversely affect the project in financial base and SPC (Special Purpose Company) debt structure .

(3) Inflation Risk. Inflation may make wage and price levels rose sharply, leading operating costs rising, which have a tremendous impact on the financial feasibility of PFI projects.

Natural risks. Natural risk is the harsh natural conditions objectively existed in PFI project site such as harsh climatic conditions and poor site conditions, which will constitute a potential threat to investors. It includes impact of weather conditions, geographical environment of construction site, ecological environment and impact of construction site conditions.

Environmental risks. With the rapid development of China's economy and the implementation of sustainable development policy, environmental pollution and ecological protection get more and more attention from government and the public. For PFI project of our country, to meet the requirements of environmental protection legislation, we need to increase the project cost of production or increase investment to improve Production environment. Moreover, in the case of lenders making the project site and project assets as collateral, if the lender uses the right to take over the project, he will bear the pressure and responsibility for environmental protection. In addition to the fines for pollution, environmental costs may include environmental audit program costs, environmental impact assessment fees and so on.

Construction risk. Construction risk mainly refers to a number of risks associated with construction projects including the risk from failed projects, delayed completion project, construction project which cannot achieve the expected operating standards after construction is completed, construction project whose Supporting infrastructure is imperfect .For investors, construction risk means increasing in interest expense and extending the loan repayment period. Technical requirements of the project design, contractors' build capacity, ability to use funds rationally, the ability of contractor to provide a security contractor and the ability to fulfill commitments are the main factors to influence construction risk. If the project is not in accordance to go into operation, basis for the survival of project finance will be fundamentally damaged, causing construction delays, cost overruns and quality issues.

Operational risk. Operational risk is the core of PFI projects risks in China. It refers to the risk that due to the negligence of the operator or significant operational problems, which ultimately affect the profitability of the project. The operation period after the

completion of the construction period is a critical stage of cash flow recovery. It has Market Risk, Technical risk and Energy and raw material risk (Zhou 2007).

(1) Market Risk. Market risk is the risk of losses in positions arising from movements in market price. The risk will come from oscillation in the price of goods or services, Competition between competitors and Changes in market demand.

(2) Technical risk. The development of technology make completed PFI projects lose advantage, resulting in relatively high cost and relatively poor service, which is technical risk. The risk is affect by technology innovation and technical improvements.

(3) Energy and raw material risk. For PFI projects which rely on certain energy and material, if there is not supplement guarantee of enough energy and material in operational period, these projects will face pretty large risk. The fluctuation of energy and material's price and reliability both can affect the whole project operation.

Force majeure risk. Force majeure risk is the risk that the PFI projects' participants cannot forecast and get over the events which can damage and disaster the whole project. Generally, Natural phenomena about force majeure include volcano eruption, earthquake, flood and lightning etc. Force majeure risk cannot be bored and controlled by any participant and the result is unforeseen. Though force majeure risk is rare, its danger is great.

PFI PROJECTS' RISK SHARING PRINCIPLES AND MECHANISMS

PFI projects' risk sharing principles. Specificity of PFI financial mode is its risk diversion and sharing. The participant shall bear risk that can influence and control risk most effectively and produce most overall effectiveness. If any participant cannot bear the risk, insurance will do it. If insurance cannot diverse risk, all participants shall share the risk. In the ideal situation of PFI financial mode, all participants and government can achieve "win-win", All mentioned above decide the succeed of PFI projects (Wang 2003a). According to theories mentioned above, PFI risk sharing principles are: Risk commensurate with the affordability; Control force should symmetrical to control force; Risk coordinates with participation of investors; Risk management commensurate with impact of projects economy; Income corresponds to the risk; No treatment for risk corresponds to caused damage.

PFI projects' risk sharing mechanisms. For PFI projects' risk sharing mechanisms, Political risk and Legal risk is mainly borne by the government, and construction risk and operation risk is mainly beard by SPC on behalf of participant. Moreover, financial risk, natural risk, environmental risk and force majeure risk are avoided and transferred mainly through risk management technology of SPC. Establishing a fair and reasonable clear risk sharing mechanism is crucial for the success of the project. It can make SPC to improve the production means and its efficient management to reduce the risk, rather than rely on transferring risk to the government, which can ensure the smooth implementation of the project and Prevent inefficient management caused by Risk constraint. And this way The government take the risk Actively will bring great confidence for private capital investment in public goods production, making the operation of PFI develop rapidly and healthy in China (Hu et al. 2004).

RISK MANAGEMENT STRATEGIES AND COUNTERMEASURES OF PFI FINANCING MODEL PROJECT

Risks diversion, risk retention, risk aversion, risk mitigation and risk use are main risk management strategies and countermeasures of PFI (Wang 2003b). Now risk management strategies and countermeasures of PTI projects are listed in table (see Table 1).

Table 1.Measures to Risk.

Risk types	Risk management strategies	Measures to risk
Political Risk	Risks diversion or risk retention	Buying insurance to reduce political risks; Written agreement with government or concession contract to formulate specific work they should do; Multilateral institutions in the project financing process, and try to let the government involved; Establish pipeline to communicate and coordinate with government departments; Regulate countermeasures and compensation measures in concession contract; Write imposed conditions, imposed price, compensation measures clearly in the concession contract.
Legal Risk	Risks diversion or risk retention	Signed a security agreement with the government; For the special case, lose legislative restrictions and develop applicable approaches for it.
Financial risk (1) Interest rate risk. (2) Exchange risk (3) Inflation risk	Risk aversion, risks diversion or risk retention	Check the feasibility of bidders' financing plan and bank financing commitment, required bidders to submit a performance bond; Use fixed-rate financing, reducing the proportion of foreign currency financing and use derivative to avoid the risk; Seek subsidized mechanism of interest rate and currency fluctuations; Consider inflation rate in Rate adjustment mechanism and use fixed-price contracts as far as possible; Have a loan guarantee of fixed rate; Use multiple currencies; Work closely with the banks and other financial institutions; Use hedging techniques such as interest rate cap, interest rate range, minimum-guarantee to reduce the impact of changes in interest rates.

Table 1.(Continued).

Risk types	Risk management strategies	Measures to risk
Natural risks	Risks diversion or risk retention	Purchase insurance to reduce nature risk; Sign related compensation agreement with the government, and claims in accordance with the relevant regulations; Take precautions to guard against natural risks;
Environmental risks	Risks diversion or risk retention	Take rigorous environmental impact assessment, and gain review and approval of the EIA; Adopt clean technologies and establish pollution prevention fund; Standardize contingency provisions of changes in environmental standards in concession contract;
Construction risk	Risks diversion, risk prevention or risk retention	Plan the pre-operation of bidding, develop accreditation standards prudently, choose successful bidder carefully and establish project risk reserve; Do good project feasibility study, use a relatively mature technology and The project sponsor provides completion guarantees; Government avoids completion delay risk through taxes and financial tilt; Sign completed construction contract to minimize the risk that contractors will mistakes, in particular building strict penalty clause and provide an final award to minimize the risk of delay completion; Use sophisticated technique, award in EPC contract. Demand the contractor provide performance bond issued by a bank or insurance company. Demand parent company of contractors to provide security. Require the contractor to provide the compensation of delay completion, which is sufficient to cover the interest to increased for delayed completion; Adopt a fixed completion date and a fixed price for contract work.
Operational risk (1) Market Risk (2) Technical risk	Risk aversion, risks diversion or risk retention	Commission a professional consultants predict operational capacity, and make clear guaranteed the operation amount in concession contracts; Set up clause to prevent competition, and ask the government to provide security; Signed a contracts of periodic and quantitative payment and direct purchase; Standardize reward and punishment for operations in contract. require operators to provide performance guarantee;

Table 1.(Continued).

Risk types	Risk management strategies	Measures to risk
(3) Energy force majeure risk		Buy insurance to transfer the risk of force majeure; Seek government's funding and guarantees; Encourage sophisticated and advanced technology, and introduce of key technologies; Signed long-term supply contracts with suppliers, and establish a perfect supply and storage systems; Develop subsidies for update and strict penalty clauses in fixed-price contracts; Carefully select channels and modes of transportation for raw materials and machinery; Sign take-or-pay contract; Develop contingency plans for alternative raw materials as well as other alternative arrangements.
Force majeure risk	risks diversion and risk retention	Buy insurance to transfer the risk of force majeure; Seek government's funding and guarantees;

CONCLUSION

Due to most of PFI projects are public projects, which is related to people's livelihood, have a overall planning and careful research for PFI project is very important. Only in this way, can investors and contractor avoid, reduce, transform, or even eliminate project risk. Taking advantage of PFI financing mode can safeguard the interests of the State, users and investors, as well as promote the development of public construction projects, which will advance and support the development of China's economy.

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REFERENCE

Hu, Z., Zhang, J.R. and Jin, W.X. (2004). "The core issue to implement PFI system." *Construction Economy*, 3, 12-14.

Kwak, Y.H. (2002). "Analyzing Asian infrast ructure development privatization market." *J. Constr. Engrg. and Mgmt.*, ASCE, 128(2), 110.

Ren, P.L. and Li, Y.Y. (2004). "PFI model and infrastructure supply." *Journal of Shijiazhuang University of Economics*, 4, 421-423

Sun, T. (2004). "Risk management research under the bot model." *Business Studies*, 18, 100-103.

Wang, J. (2003). "Applying PFI in public products production to control risk." *Optimization of Capital Construction*, 5, 36-38.

Wang, Z.P. (2003). *Theory, method and application of engineering project risk management*, China Water Power Press, Beijing, China.

Wideman, R. (1992). *Max project and program risk management*, Project Management Institute, New York.

Xie, X.H. and Hu, Y.J. (2003). "Research on new model of project management now." *Fujian Jianzhu*, 2, 1-10.

Yang, Y. and Huang, P. (2007). "Research on applications of Private Finance Initiative (PFI) in China." *Construction Management Modernization*, 5, 44-46.

Zhang, J.J. (1998). *Project financing*, CITIC Publishing House, Beijing, China.

Zhou, P.Y. (2007). "Comparison and reference of international financing operational procedures." *Accounting and Finance*, 6, 20-22.

Strategy of Bidding under the Engineering Bill Pricing Mode

Baizhou He[1] and Chen Liu[2]

[1]Professor, Department of Economics and Management Engineering, Beijing University of Architecture, Beijing 100044, China. E-mail: hebaizhou777@163.cn
[2]Master, Department of Economics and Management Engineering, Beijing University of Architecture, Beijing 100044, China. E-mail: 1004798780@qq.com

Abstract

Now the competition of construction market is becoming more and more fiercely and China adopted engineering quantity list valuation for the construction market traction. Our country lastly introduces the 2013 edition of "code of valuation with bill quantity of Construction Engineering"(GB50500-2013) as the basis of list valuation. The owner issues tenders and the construction unit bidding for the project. This article aims to study how to choice fitful engineering by the construction unit and how to bidding effectively to increase the rate of win the bid maximally in the range of qualifications, then enterprises can made healthy and orderly progress.

INTRODUCTION

We usually say the market, broad sense refers to the commodity exchange places, and the construction market as part of the market, occupies a pivotal position in the national economy. The Architectural Engineering market is also called the construction market, the construction process is the sum of the relations of production and the elements, the whole process of the transaction market of engineering construction in construction production. China's Construction will be included in the category of market economy, not only includes the engineering contracting, but also includes the design, survey, material supply and supervision. With the acceleration of economic globalization, market competition is based on the construction market which showed the following characteristics: the transactions of construction market throughout the whole process of production; construction engineering trading activities in the market is fierce, it relates to the price, quality, reputation and time limit for a project, construction project bidding activity is the main way to do the transactions of construction market; constraints and supervision of construction engineering market transactions is by the construction method, the tendering and bidding law, real estate management law and other related laws and regulations. Construction units want to be an invincible position in the market economy system, we must make trading activities of the construction market, make the bidding activities as the main way, it is the construction unit to contract project in the