

# PLANNING MODEL OF INFRASTRUCTURE PROJECT IN CHINA

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In China, public services have been delivered to citizens at low prices and subsidized by government to a great extent since 1949. Government directly invested, constructed and operated public infrastructure. However, the single source of government investment could not satisfy the increasing demand on infrastructure projects. Moreover, the direct government investment and management of public utilities resulted in poor construction performance. In addition, the monopolistic operation of state-owned companies caused low operation efficiency, striking resources waste, and heavy fiscal burden due to the lack of specific obligation division between government and state company.

From 1994, the Chinese government began to attract foreign companies to participate in the investment, construction and operation of infrastructure projects mainly through BOT method. Since the China's entry into the WTO, the domestic private companies have been encouraged to invest and operate infrastructure projects, too. However, many privately financed infrastructure projects still encountered difficulty originated from excessive or inadequate government obligation.

The proper obligation division between government and private company becomes the key issue in infrastructure project planning. The authors aim to propose a proper project planning model which shall fit all kinds of infrastructure projects with various fund origins. The proposed planning model shall include a comprehensive planning framework and a six-step planning process. In particular, the financial indicator, i.e. self-reimbursement ratio is introduced for correct appraisal of project feasibility and proper obligation division between government and project company.

*Key Words: China, Infrastructure, Implementation Scheme, Self-reimbursement rate, project planning*

## 1. History of Development and Operation of Infrastructure Projects in China

### (1) Disadvantages of government provision of public services

Infrastructure is defined as the basic facilities, services, and installations needed for the functioning of a community or society, such as transportation and communications systems, water and power lines, and public institutions including schools, post offices, and prisons (Akatsuka and Yoshida 1999). In China, infrastructure are mainly classified into several types: urban public utilities (such as urban

mass transit, tap water supply, wastewater disposal, pipeline gas supply, heat supply, garbage disposal and other items), electric power facilities, highways, railways, telecommunication system, and flood control works (SDPC 2000), which are respectively administered by construction authority, electric power supervision authority, transportation authority, railway authority, telecommunication authority and water resource conservancy authority.

Since 1949, infrastructure was regarded as public welfare undertaking in China. Public services produced by infrastructure projects were delivered to

citizens at low prices and subsidized by government to a great extent. Governments not only undertook the supervision function of infrastructure projects but directly invested in, constructed and operated public infrastructure. Although the construction market of infrastructure projects opened up to private companies from 1984 (SC 1984), government still directly invests in and operates infrastructure projects.

So far, the government fund and loan accounts for over 80% of the total investment of urban construction (RG 2006). However, the single source of government funds in the construction of new facilities and the operation and maintenance of existing facilities can not satisfy the increasing demand on the public service delivery caused by the accelerated progress of industrialization and urbanization.

From 1990, government begun to reduce or even cancel fiscal subsidy for public utilities, and confirmed the price of public services based on its cost. For example, the average price of tap water in 36 cities increased from 0.14 CNY/ton (approximately 2.1 JPY/ton) in 1998 to 1.32CNY/ton (approximately 19.8 JPY/ton) at the end of 2002 (RG 2006). The price of public service increased quickly; however, the service quality was still poor. Consumers of public services feel unsatisfied with this practice.

Due to the constraints of limited fiscal budget for public service and affordable public service price, the effective and efficient resources utilization in the construction and operation process of physical facilities shall become the only resort of government to improve public service delivery.

However, the direct government investment and management of public utilities resulted in poor construction performance (NAOC 2004). Another investigation manifests that the monopolistic operation of state-owned companies within their respective service areas caused low operation efficiency, striking resources waste, and heavy fiscal burden (RG 2006 and Xiang 2005).

## **(2) Introduction of private fund and management capability**

The effective and efficient implementation of private investment and management of

infrastructure projects in foreign countries, particularly in the UK and the USA, attracted the attention of the Chinese government and changed its attitude toward private delivery of public services from prohibition to encouragement.

With the purpose of meeting the demand of economic development and people's living improvement on public service and infrastructure projects, from 1994, the Chinese government opened up the investment market of certain scope of infrastructure projects (SPC, MEP, and MOT 1995) and began to attract foreign companies to participation in the investment, construction and operation of infrastructure projects. A certain number of laws, rules and administrative measures were correspondingly issued and enforced for government at all levels to administer the foreign investment in infrastructure projects.

After China's entry into the WTO in 2001, the Chinese government began to open the investment market of infrastructure projects for both foreign and domestic private companies to invest, construction, and operate infrastructure projects. The Chinese legal framework including laws, rules and administrative measures has been modified pursuant to the principle of transparency and non-discrimination (including national treatment) prescribed in the Protocol on the Accession of the People's Republic of China (WTO 2001).

Under such favorable situation infrastructure projects financed by private companies are increasing quickly. From 1990 to 2000, private investments in infrastructure projects in China totaled \$44 billion, accounting for less than 10% of the total annual infrastructure investment (ADB 2003), which implies that there is still a wide space for private sector to invest in infrastructure.

## **(3) Transitional government administration on public service delivery**

During the privatization of infrastructure projects the government regulation shifts gradually from direct investment and administration of infrastructure projects to indirect supervision of the investment, construction, operation project companies through fiscal, financial, legal and administrative means.

In order for governmental organizations to

accommodate themselves to the new regulation requirement, a series of legal instruments (shown in Table 1) have been issued and enforced by different government departments including the Ministry of Foreign Trade and Economic Cooperation (the predecessor of the Ministry of Commerce), the State Planning Commission (the predecessor of the National Development and Reform Commission), the Ministry of Electric Power (the predecessor of the State Electricity Regulatory Commission), the Ministry of Transportation, the Ministry of Construction, the State Council (i.e. the Chinese

central government) and local governments.

However, because there is certain difference of project planning and approval procedure, method, and content requirement in these legal documents, it is inconvenient and troublesome for relevant government departments to adopt various project planning and approval methods and procedure for foreigner-invested infrastructure projects (including electric power projects), privately invested public utility projects and privately invested fixed asset projects (which include infrastructure projects), respectively.

Table 1 List of Legal Documents Governing Private Provision of Infrastructure Projects

<b>PFI related law, rule, or policy</b>	<b>Enacting time</b>	<b>Enacting organ</b>
Notice on questions of attracting foreign investment via BOT method	1994	Ministry of Foreign Trade and Economic Cooperation
Provisional regulations on foreign invested build-operate-transfer projects	1995	State Planning Commission
Notice on questions concerning the administration of examination and approvals for foreign invested concession projects established on trial basis	1995	State Planning Commission, Ministry of Electric Power and Ministry of Transportation
Interim provision and approval procedure on electric power project invested directly by foreigners	1996	Ministry of Power Industry
Interim administrative measures for project financed by foreign investors	1997	State Planning Commission and State Administration of Foreign Exchange
Construction law of the People's Republic of China	1997	National People's Congress
Bidding law of the People's Republic of China	1999	National People's Congress
Interim provisions on utilizing foreign capital in urban public utilities	2000	Ministry of Construction
Protocol on the accession of the People's Republic of China	2001	WTO
Opinion on expediting the marketization process of public undertaking	2002	Ministry of Construction
Provisions on guiding the orientation of foreign investment	2002	State Council
The guide to feasibility study of investment projects	2002	National Development and Reform Commission
Notice on proper disposal of problems concerning guarantee of fixed rate of return for foreign investment	2002	State Council
Administrative measures on concessionary operation of Beijing urban infrastructure	2003	Beijing Municipal Government
Opinion on the implementation of further reform of investment and financing regime in urban infrastructure sector	2003	Beijing Municipal Government
Provincial regulation on administration of government investment. Beijing, China	2004	Beijing Development and Reform Commission
Administrative measures on concessionary operation of public utilities	2004	Ministry of Construction
Interim measure on verification and approval of enterprise-invested projects	2004	National Development and Reform Commission
Interim administrative measure on verification and approval of foreigner-invested projects	2004	National Development and Reform Commission
The decision of the State Council on reforming the investment system	2004	State Council

For the promotion of smooth implementation of all kinds of privately financed infrastructure projects, Du and Watanabe (2005a) proposed a uniform planning and approval procedure together with the required contents of relevant project documents, which shall be submitted to relevant authorities for review and approval.

## **2. Research Background, Methodology and Objective**

### **(1) Problems of Infrastructure Project Planning**

The National Development and Reform Commission (NDRC) (2002) promulgated *the Guide to Feasibility Study of Investment Projects (tentative edition)* to govern the preparation of feasibility study report of any government-invested fixed asset projects (including infrastructure projects), which shall be sponsored by a state company. However, the guide does not consider the appropriate financial obligation division between government and state company.

In practice, the Beijing Municipal Government, which undertook the excessive obligation, i.e. the guarantee of debt repayment, take over the 5th Beijing Ring Highway Project only after three months of its operation (Significant 2004). In another case, due to the lack of specific obligation division, the Guangxi Province Government had to raise approximate CNY 200 million every year to disburse annual loan interest which should be paid by the state highway companies affiliated to the Guangxi Province Government (Five 2005).

Pursuant to *the Decision of the State Council on Reforming the Investment System* issued by the State Council (2004), social fund, i.e. non-government fund shall be used as much as possible for profitable infrastructure projects, thus any infrastructure projects shall be well planned. The specific evaluation criteria are necessary for government to judge whether the proposed project scheme is profitable, partly profitable, or unprofitable, in other words, whether it deserves complete private investment or needs government subsidy based on the current practice. However, all legal documents issued by various government departments do not stipulate or propose the judgment criteria of financial obligation division between government

and the private sector.

Most of the infrastructure projects, which are financed and operated by foreign companies encountered difficulty, a certain number of which originated from excessive government commitment such as overmuch risk obligation (Du and Watanabe 2005b, Wang 2005). In addition, private companies participating in infrastructure projects did not gain the same treatment as those provided for state-owned companies, i.e. inadequate government obligation (Zhao 2003).

Therefore, the proper project planning, particularly the due division of financial obligation between government and project company, becomes the key issues of relevant project authorities in infrastructure project planning whether the project company is a private company, a state company, a consortium of mere private companies, a consortium of mere state companies, or a consortium of both private and state companies.

### **(2) Research Methodology and Objective**

Based on thorough analysis and careful comparison of relevant legal rules and government policies on infrastructure project planning, the authors shall propose a project planning model which may be applied by project authorities to all kinds of infrastructure projects involving new construction of physical facilities in China.

The planning model shall not only include the contents of former project proposal and project feasibility study report, which are prepared by state or private companies, but also contain obligation division between government and project company, particularly the risk and financial obligation division based on the total lifecycle of the proposed infrastructure project. The analysis of cost and benefit in the total lifecycle of proposed project shall be conducted.

The proposed planning model shall include a comprehensive planning framework and a six-step planning process. In particular, the financial indicator, i.e. self-reimbursement ratio is introduced for correct appraisal of project feasibility and proper obligation division between government and project company.

### 3. Planning Framework for Infrastructure Projects

In order to integrate the formerly used project documents into the proposed project planning framework, the authors list the contents of preliminary feasibility study (i.e. project proposal) stated in the Notice (SPC, MEP, and MOT 1995) and feasibility study report stated in the Provisional regulations (SPC 1995) in Table 2, the contents of project proposal (i.e. preliminary feasibility study) and feasibility study report for foreigner-invested electric power project stipulated by the former Ministry of Power Industry in Table 3 (MOPI 1996; SPC and SAFE 1997), the contents of project proposal and feasibility study report for urban infrastructure projects invested by government in Table 4 (BMG 1999 and BDRC 2004).

The authors classify the contents of this project document into four types: demand analysis, technical scheme, financial scheme and business scheme including contract scheme.

Based on the previous analysis the authors clarify the intrinsic logic between various parts of contents in the project planning document and propose the comprehensive planning framework of infrastructure projects, which includes four parts of contents: service scheme (shown in Table 5), technical scheme (shown in Table 5) and business

scheme (shown in Table 6) and financial scheme (shown in Table 7).

Service scheme is the base of the project planning framework. Technical scheme contains three parts of contents: engineering design, construction scheme, operation and maintenance scheme. Business scheme is the key part of the project planning framework.

### 4. Establishment of Proper Project Planning Process

Based on the analysis of previous section, the author suggests that infrastructure project planning shall include six steps: service planning, selection of technical scheme (including engineering design, construction scheme, operation and maintenance scheme), establishment of business scheme, financial analysis, proposal of obligation division scheme and project implementation scheme. The proposed public service and infrastructure project shall be procured according the principles of objectivity, transparency, impartiality, competition and efficiency. Not only state companies may bid for the proposed project, so do private companies. Private companies shall be treated the same as state-owned companies, so the tax cost imposed on private companies shall be included in the proposed financial scheme.

Table 2 Requirement of Preliminary Feasibility Study and Feasibility Study for Foreigner-Invested Infrastructure Projects

Type of content	Preliminary feasibility study	Feasibility study report
Demand analysis	The analysis of market demand on public service	Survey of the project and target Market demand for the project
Technical scheme	Engineering and technique Environment protection	Description of project engineering and technical index, including the technology to be adopted Assessment of the effects of the project on the environment Engineering and construction plan
Financial scheme	Total investment amount Economic and financial analysis	Project costs Financial analysis, including total investment, cost of labor and materials, financing scheme and cost, cash flow, internal rate of return, inflation rate, supposed foreign exchange rate and interest rate, analysis of risks and sensitivity and other items
Business scheme	Service pricing standard and price adjustment principle Concession duration Principle of Risk allocation Government obligation	Project charge Description of the project company Operation plans

Table 3 Requirement of Project Proposal and Feasibility Study Report for Foreigner-Invested Electric Power Projects

<b>Type of content</b>	<b>Project proposal</b>	<b>Feasibility study report</b>
Demand analysis	Demand on electric power	The demand on electric power or the necessity of the project
Technical scheme	Technical, environmental standard and equipment type Construction method	Conceptual design documents (project capacity, project siting, technical standard, environmental standard and type of equipment)
Financial scheme	The necessity of utilizing foreign investment Total investment Economic evaluation and financial analysis	The necessity of utilizing foreign investment Total investment Financial analysis
Business scheme	Investment source Capital structure (investment amount, financing amount, equity/debt ratio), Certificate of foreign parties' credit Formation of company Operation management	Financing method and requirement (draft of loan agreement) agreed by the Ministry of Power Industry and verified by the State Administration of Foreign Exchange Investigation in qualification and achievement of engineering and equipment corporations. Province price authority's commitment and approval of electric price Bid documents for procurement of equipment and for civil works (equipment parameters, capability and price)
Contract aspect	Arrangement of connection with water source, fuel source, transportation, and electric grid	Contract of purchase and sale of electric power endorsed by Ministry of Power Industry Agreement on link with electric grid ratified by Ministry of Power Industry Agreement on land usage, fuel supply, water supply ratified by Ministry of Power Industry Agreement on the operation management of power plant ratified by Ministry of Power Industry.

Table 4 Requirement of project proposal and feasibility study report for government-invested urban infrastructure projects

<b>Type of content</b>	<b>Project proposal</b>	<b>Feasibility study report</b>
Demand analysis	Project outline and necessity	Project outline and necessity
Technical scheme	Project capacity Project siting and site area Construction scheme and component works Preliminary construction schedule Preliminary analysis of environment impact, transportation, culture relic protection, labor protection, safety, sanitary, consumption of water and energy source	Project capacity Function requirement Quality standard Project siting and plot plan Consumption of fuel and resource Environment protection Labor protection and health care Construction scheme and component works Construction duration and schedule Access to water source, electric power, road and communication for purpose of construction
Financial scheme	Approximate total investment estimate Prediction of economic and social benefit including financial appraisal and economic appraisal	Total investment estimate Analysis of economic and social benefit
Business scheme	Preliminary scheme of fund raising and loan repayment	Investment source and capital structure The constitution of the company including the memorandum of association and articles of association

Table 5 Service and technical scheme of infrastructures projects

Category		Detail
Service Scheme		Present condition and forecast of service demand quantity, service price, and service standard.
Technical Scheme	Engineering Design	Facility performance and capacity Facility quality Facility life Design schedule Facility component: Architecture/aesthetics Ground and foundation Civil, electrical and mechanical systems
		Pollution prevention technology and facilities Byproduct disposal technology and facilities
	Construction scheme	Construction technologies and installation method Construction and installation schedule Material and equipment supply schedule
		Construction/demolition waste disposal Safety planning for handling hazardous materials Noise mitigation and handling of dangerous/emergency Situations Protection of flora and fauna Protection of cultural/archeological relics
Operation & Maintenance scheme	Service quality standard Service supply planning Facility maintenance planning	

Table 6 Business scheme of infrastructures projects

Category	Detail
Investment	Capital structure (equity/debt) Government investment
Financing	Loan sources and structure
Revenue	Tariff/toll level and adjustment mechanism Government subsidy Annual operation income
Expenditure	Tax, duty and royalty Annual design, construction, maintenance, operation and asset replacing outlay Allocation of risk obligation
Project duration	Design, construction and operation duration

### (1) Service planning

In order to overcome premature project development mentioned and inaccurate prediction of demand on public service (Du and Watanabe 2005b), demand analysis (shown in the top part of Table 5) shall be based on the accurate demand analysis of public service, the five-year (or ten-year) national economic social development program, national industry policies and urban infrastructure development programs. The Project administration department shall provide reliable historical data of public service to consultants to increase the accurate level of demand forecast of public service including service quantity, quality standard. Regarding public service price, the public opinion shall be considered through questionnaire investigation or public hearing. It is advisable for project administration department to reduce fiscal subsidy for service and increase service price in a gradual and smooth way based on the past service price and analysis of public opinion. The demand analysis is the focus of project proposal and shall be conducted and appraised by experts.

### (2) Identification of technical scheme

Technical scheme shall be carefully planned and the following contents are included:

- Confirmation of project capacity
- Confirmation of quality standard of public service
- Selection of technical standard and life of equipment
- Selection of quality standard and life of civil works
- Project siting and layout
- Preparation of construction and maintenance scheme,
- Assessment and precaution of ecological and environment impact,
- Analysis of resource consumption, equipment utilization and labor demand
- Labor protection and safety

### (3) Establishment of business scheme

Following the demand analysis and identification of technical scheme, pursuant to the present regulations on privately financed infrastructure projects in China, the business scheme of infrastructure project (shown in Table 6) shall be planned carefully, which mainly concerns the identification of project environment, the design of capital structure of a project company and the obligation division between government and the project company. The risk allocation and fiscal obligation shall be proposed in these stage.

Table 7 Financial scheme of infrastructures projects

Financial Variables	Financial Parameters	
Annual construction cost Annual operating/maintenance cost Annual assets purchasing cost Annual assets replacing cost Annual operating income	Time Parameter	Concession period Design and construction period Operation period Grace period Payback period Debt payment period
<b>Capital Structure</b> Equity Loan and bond Debt/equity ratio	Economic Parameter	Interest rate Exchange rate of currency Inflation rate Insurance fee rate Rate of return on equity
<b>Financial Indicators</b> Net present cost (NPC) Net present revenue (NPR) Self-reimbursing ratio (SRR)	Accounting parameter	Depreciation rate of fixed asset
	Tax Parameter	Business income tax rate Value-added tax Royalty Earning reserve
	Currency Parameter	Currencies of loans and equity Currencies of revenues and payments
	Market Parameter	Price of material, power and equipment Price of project product or service Tariff

The business scheme shall include the following contents:

- Calculation of annual project cost without tax burden and exposure to risk, including construction, maintenance, operation and replacing cost based on the technical scheme proposed. This sum of annual project cost shall constitute raw project cost. The present value of raw project cost shall be expressed as Raw NPC in later calculation formula.
- Establishment of service price scheme acceptable to the public.
- Identification of current taxes and accounting criteria of the depreciation of fixed assets and the amortization of intangible assets
- Establishment of interest rate, inflation rate, foreign exchange rate (if foreign investment is involved) and insurance rate
- Planning of capital structure (e.g., ratio of equity to debt shall be more than 1/3) and financing scheme based on private investment and operation.
- All risk shall be identified and evaluated based on the likelihood and financial influence of risk. Risk shall be categorized into two types: retained risk to government and transferred

risk to the project company (ACT 2003)

- Selection of concession duration based on the designed life of key equipment and civil works and subject to government limit (30 years of operation period is permissible in China). It is suggested that the initial value of concession duration shall be decided based on part experience or directly awarded the permissible duration if there is no experience.

#### Tax cost

State companies are exempted from certain types of taxes, which shall be paid by private companies. In order to set up a uniform standard and objectively calculate the total project cost within the designated project lifecycle the total project cost analysis in business case shall include relevant tax cost based on the private investment and operation of infrastructure projects. The type and rate of taxes shall be identified.

In the bidding process, if state companies also bid for the proposed projects, its total project cost shall be adjusted to include the tax cost with the purpose of treating all bidder with the same evaluation criteria.



### **Risk cost**

Except that the State Planning Commission (1995) required that preliminary feasibility study should include the principle of risk allocation, all other preliminary feasibility study and feasibility study prescribed by other government organs did not consider risk as an inevitable factor for the objective evaluation of project feasibility and optimal selection of concessionaire. Because of the multiple stage and long duration of infrastructure projects the project risk must be specifically considered and objectively evaluated in project planning. Moreover, the risk obligation shall be reasonably allocated between government and the project company.

In normal case, project authority shall undertake the risk of change in law, foreign currency fluctuation, and partial demand change. At the same time project companies shall assume the risk of force majeure, design and construction, maintenance and operation, and partial demand change.

Up to now, there is no specific government rule on the allocation of demand risk, which is still at the discretion of contracting authority.

The feasible method for private concessionaires in electric power or water sector to reduce demand risk is to obtain the guarantee of government that a certain quantity of public service shall be procured through signing concession contract. For example, the government guarantee of electric power purchase in Laibin B power project is approximate 55% of installed capacity (Ye and Tiong 2003). The guarantee of 50% of annual procurement quantity of public service by government may be appropriate for electric power, clean water, incineration or accommodation or supplier of wastewater

Regarding transportation projects, because toll is directed paid to private concessionaires, in general cases, the government does not guarantee the traffic volume for private concessionaires. However, the specific protection clauses that government guarantees access right of private companies to similar free transportation network shall be provided in concession contracts as a incentive measure for private participation in transportation projects.

### **Price control and government subsidy**

From 1990, government begun to reduce or even

cancel fiscal subsidy for public utilities, and confirmed the price of public services based on its cost, which inevitably cause the increase of public service price. However, the quick increase in public service price has caused public dissatisfaction (RG 2006).

Price authority shall control the price of public service within an affordable level. One feasible way is to reduce fiscal subsidy for service and increase service price in a gradual and smooth way based on the past service price and analysis of public opinion. Therefore, a certain level of financial obligation of government shall be undertaken by government for partly self-reimbursed infrastructure projects such as subway, daily garbage treatment facility, and wastewater disposal facility since the service price of these projects is still controlled by government. In deciding the initial business scheme the type and amount of government investment or subsidy shall be confirmed based on current practice.

In addition, the price control and subsidy for services shall be conducted according to the Schedule of Specific Commitments on Services of Protocol on the Accession of the people's republic of china (WTO 2001)

### **(4) Financial analysis**

During the planning of business scheme, all financial parameters, financial variables have been decided. The capital structure, debt percentage, equity percentage has been decided, too. The financial indicator including NPC, NPR, and SRR, shall be calculated according to the following procedure:

#### Calculation of discount rate

$$\text{Discount Rate} = \text{Interest Rate of Loan} \times \text{Debt Percentage} \\ + \text{Rate of Return on Equity} \times \text{equity percentage}$$

Calculation of risk-adjusted Net Present Cost (NPC) discounted to the beginning of project construction based on the designed technical scheme, current taxes and predicted risk probability and impact

$$\text{NPC} = \text{Raw NPC} + \text{Risk NPC} + \text{Tax NPC}$$

$$\text{Raw NPC} = \text{Operating Costs} + \text{Capital Costs}$$

Risk NPC=Consequence x Probability of risk Occurrence

Calculation of risk-adjusted Net Present Revenue (NPR) discounted to the beginning of project construction based on the service price and expected service demand.

Calculation of Self-Reimbursement Ratio (SRR), i.e. NPR/NPC

$$SRR = NPR/NPC$$

The term of self-financing ability, which is similar to SRR, has been used by Chang and Chen (2001) and Zhang (2005), respectively, however, they did not use the SRR to establish the financial obligation division and project implementation scheme specifically.

The financial analysis in this section aims for the reasonable obligation division between government and project company. Therefore, in the calculation of project cost, the actual market price of various inputs shall be adopted; however, in the computation of project revenue, the government controlled price of public service shall be applied, which is lower than the real cost price of public service in most cases.

#### **(5) Feasibility study of proposed business scheme and obligation division between government and project company**

After SRR has been decided, the feasibility of proposed business scheme shall be analyzed. The various value of SRR represent three types of project conditions:

$$SRR = 1$$

IF the SRR is just equal to 1, it means that the total operation revenue can reimburse the total project cost and the model company may obtain expected rate of return on investment thus the project is feasible thereby government may continue to prepare implementation scheme.

$$SRR \geq 1$$

IF SRR is more 1, it means the total operation revenue not only can reimburse the total project cost at the expected rate of return on investment but also

provide more profit for the project company. In order to restrict the project profit to the reasonable scope, government may take several measures to reduce the SSR until is equal to 1. The measures including the reduction of public service price, concession duration, government investment or government subsidy, or the increase of concession tax. The reduction of government investment and subsidy shall be preferable.

$$SRR \leq 1$$

IF SRR is less than 1, it means the total operation revenue cannot reimburse the total project cost at the expected rate of return on investment. The proposed business scheme of project is infeasible and shall be adjusted. Government may take the following measures to adjust the formerly proposed business scheme.

- Government may extend concession duration; however, the concession duration is limited to 30 years pursuant to government regulation. Government may reduce taxes subject to the current regulation. The concession tax may be reduced to zero. Government may increase public service price subject to the ceiling price made by the price authority. the three methods may be used independently or jointly.
- If all the above three measures i.e. the extension of concession duration, reduction of taxes and increase of service price have been taken subject to government regulation, SRR is still less than 1, the government may also subsidize the project in the form of government investment or service subsidy. However, the government subsidy shall be within the reasonable extent. The due government subsidy may be obtained by the cost and benefit analysis of past similar projects on the whole project cycle. The current government subsidy for unit price of public service may also be used as the indicator of due government after the proper adjustment based on the price forecast of public service. The author suggests that government subsidy shall be selected first to reduce the front-end concentrated government payment.

- If all the above four measures i.e. the extension of concession duration, reduction of taxes, increase of service price and due government subsidy have been taken subject to the government regulation, SRR is still less than 1, which manifests that the proposed project is infeasible. Therefore, government shall stop the implementation of the proposed project.

By the above analysis process, not only project feasibility may be calculated the due obligation allocation between government and project concessionaire may also be decided.

### (6) Project implementation scheme

According to the result of financial analysis, if the proposed project is feasible, one business scheme is selected.

- If the project does not need the government investment or subsidy, the project implementation method may choose pure private investment plus BOT or BOO method
- If project is subsidized by the form of government investment the project implementation method may choose cooperative investment plus BOT or IOT.
- If project is subsidized by annual government subsidy, the project implementations scheme may choose pure privately investment, annual government subsidy and BOT.

The various project implementation schemes, including BOT, BOO, and IOT, are clarified in the following paragraphs:

**Build-Operate-Transfer (BOT)** denotes a infrastructure project that is built, operated, maintained and transferred to the relevant authority at the expiration of the concession period by a project company, which is authorized the concession right by a project authority to operate lawfully and independently, and obtain revenue to recover its investment and gain reasonable profit through

payments received from the users of the facilities. Most PFI projects adopted BOT scheme.

**Build-Operate-Own (BOO)** is similar to BOT except that the physical facilities of infrastructure project are owned by the project company and the transfer of the physical facilities is unnecessary. This implementation scheme is seldom adopted under current political situation.

**Installation-Operation-Transfer (IOT)** denotes government invests mainly in civil works of the franchised project and becomes the owner of such property, while the project company is encouraged to invest in mechanical and electrical equipment and to operate the project facilities during concession term. At the expiration of the concession term, the project facilities owned by private entity should be transferred to government. The 9<sup>th</sup> Beijing Subway Project adopted this implementation scheme.

## 5. Conclusion

The paper proposes a comprehensive project planning framework and proper project planning process, which includes six steps: analysis of project demand, selection of technical scheme, establishment of business scheme, financial analysis, financial obligation division between government and project company, and project implementation scheme. The financial analysis indicator, i.e. SRR is introduced to analyze project feasibility and divide risk and financial obligation between government and project company.

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