Concessionaire Selection: Methods and Criteria

Xueqing Zhang, M.ASCE[1]

Abstract: Various innovative public private partnerships (PPPs) have been explored in worldwide infrastructure development in which BOT (build-operate-transfer) is the underlying concept. Selection of the right concessionaire, which is critical to the success of such BOT-type PPPs, depends on the quality of identifying and defining suitable project-specific criteria and the quality of formulating an efficient tender evaluation methodology. A systematic research approach (including literature review, case studies, interview/correspondence, and a structured questionnaire survey) has been adopted to draw experience and learn lessons from international PPP practices and to unearth and refine experiential and expert knowledge from worldwide experts and practitioners. Tender evaluation criteria and methods currently used in diverse types of PPP projects in both developed and developing countries are identified, compared, analyzed, and then generalized.

DOI: 10.1061/(ASCE)0733-9364(2004)130:2(235)

CE Database subject headings: Infrastructure; Build/operate/transfer; Financing; Private sector; Partnership; Construction industry.

Introduction

Many activities in project/construction management are often confined within national or cultural boundaries due to lack of knowledge, reluctance (inertia) to change, resource constraints, high pressure on growing project demands that require immediate results, and the complex nature of issues in this field such as sensitive and confidential data (Loosemore 1999). This is also the case in international public private partnerships (PPPs) in infrastructure development, in which many countries and regions still lack experience and expertise. For example, Ashley et al. (1998) draw attention to the limited history of PPP projects in the North American market—few North American PPP projects have reached completion, while fewer still have been operating long enough to produce definitive results. Furthermore, the evolving knowledge and expertise in infrastructure PPPs are widely dispersed, inadequately documented, and rarely analyzed or compared. Collecting, codifying, and consolidating this knowledge and expertise and benchmarking ''best'' practices that have evolved in more experienced countries and sectors will undoubtedly benefit international infrastructure development.

Significant realignment of risks among multiple project participants is a striking feature of a BOT (build-operate-transfer)-type PPP scheme, in which the concessionaire undertakes far more commitments and assumes much broader and deeper risks than a mere contractor. One critical step towards successful PPPs is to formulate a workable and efficient methodology to select the appropriate concessionaire that provides the best offer and has strong overall capabilities to deliver the required works and services. The use of a suitable tender evaluation method and the derivation of project-specific tender evaluation criteria are two important issues in this concessionaire selection process.

This paper identifies, compares, analyzes, and generalizes tender evaluation methods and criteria used in different types of PPP projects in worldwide infrastructure development. For this purpose, a knowledge-mining process has been carried out to draw experience and learn lessons from international PPP practices and to unearth and refine experiential and expert knowledge hidden deep beneath the subconscious decision-making processes and thumb-rules used by scarce experts in the field of project financing.

Research Methodology

This research has been done in a systematic approach, involving four phases: (1) literature review; (2) case studies; (3) interviewing and correspondence with experts and experienced practitioners; and (4) a structured questionnaire survey of worldwide expert opinions on improved PPP practices.

Table 1. Country Wide Respondent Breakup Details

Country	Number of respondents
Australia	1
Hong Kong, China	14
India	1
Japan	1
Peru	2
The Philippines	3
Mainland China	1
Malaysia	2
Singapore	1
South Africa	1
Thailand	2
U.K.	13
U.S.	4
Total	46

[1]Research Assistant, Dept. of Civil Engineering, The Univ. of Hong Kong, Pokfulam Rd., Hong Kong.

Note. Discussion open until September 1, 2004. Separate discussions must be submitted for individual papers. To extend the closing date by one month, a written request must be filed with the ASCE Managing Editor. The manuscript for this paper was submitted for review and possible publication on July 15, 2002; approved on February 3, 2003. This paper is part of the ***Journal of Construction Engineering and Management***, Vol. 130, No. 2, April 1, 2004. ©ASCE, ISSN 0733-9364/2004/2-235–244/$18.00.

Table 2. Respondent Breakup Details Based on Working Background and Organization Type

Category	Number of respondents
1. Based on working background	
(1) Academia	17
(2) Industry	29
2. Based on organization type	
(1) Public	12
(2) Quasi government	24
(3) Private	10

Literature Review

An extensive literature survey of relevant published and documented information has been carried out. Most of the reviewed literature is in printed hardcopy format. Various articles and useful knowledge in several online databases and World Wide Web pages have also been explored. This literature review is from the perspective of public/private partnerships and focuses on key issues in this domain. These include feasibility study, risk allocation, source selection methodology, prequalification and tender

Table 3. Summary of Responses on Tendering Methods

	Used by respondents' units or experienced by respondents		Recommended	
Tendering methods	Number of responses	Percentage of total responses (%)	Number of responses	Percentage of total responses (%)
Open competitive tendering	20	27.78	22	34.38
Invited tendering	15	20.83	13	20.31
Registered lists	4	5.56	5	7.81
Project-specific prequalification and shortlisting	19	26.39	24	33.33
Negotiated tendering	14	19.44	8	12.5
Total	72	100	64	100

Table 4. Competitive Tender Evaluation Methods

Tender evaluation method	Brief description
Simple scoring method	Maximum achievable score points are assigned to each predetermined selection criterion, against which alternative tenders are evaluated, and a score is then awarded to each tender for each criterion. The awarded score for each criterion may range from 0 to the predetermined maximum achievable score points for that criterion. The total score for a tender is the sum of all awarded score points for all evaluation criteria. The tender with the highest total score is chosen as the winning tender.
NPV method	This method is often used to assess the commercial and financial packages of a BOT tender. For conforming or equivalent designs, the tender with the lowest NPV of tolls/tariffs over the concession period is selected as the winning tender. This method is suitable for projects where there are relatively correct estimations of the quantities of products or services to be provided by the project (such as a power or water treatment plant) based on the offtake agreement. The client may also compare the NPV of the construction, operation and maintenance costs, and financial charges over the concession period (or even over the whole project life) for further evaluation.
Multiattribute analysis	Various criteria are classified into several criterion packages (e.g., financial, technical, managerial, legal, and environmental). Each of these packages may in turn include many subcriterion packages. According to their relative importance, varying weights are assigned to each main package and also to each subpackage within that main package; and maximum available score points are allocated to each criterion within a main or subpackage. Each tender proposal is then evaluated against every criterion and awarded a score for that criterion. The proposal with the highest total weighted score will be chosen for the BOT concession.
Kepner–Tregoe decision analysis technique	This technique includes the following decision stages: formulating a ''decision statement,'' identifying and weighting decision objectives (interms of ''MUST'' and ''WANT'' criteria), generating alternatives, evaluating alternatives against the MUST and WANT criteria, and selecting the most suitable alternative. The decision statement provides the focus for the following steps and sets limits in the selection. The MUST and WANT criteria identify specific requirements of the decision. The MUST criteria function as a screen to eliminate failure-prone alternatives by a ''Yes-or-No'' judgment. Then, the remaining alternatives will be judged on their relative performance against WANT criteria. The WANT criteria give the evaluator a comparative picture of the remaining alternatives.
Two-envelope method	Price is submitted in a separate envelope. Tenders are assessed on nonprice criteria first. Then, the price envelope of the highest scoring proposal based on nonprice criteria is opened. If its price is within government's budget (not known to tenderers) then the contract is awarded to the highest scorer.
NPV method+scoring method	Then NPV method is used for financial evaluation while the weighted point scoring method is used for qualitative evaluation.
Binary method+NPV method	Tenders are first evaluated against pre-established ''MUST'' criteria via the binary method. Any tender failing to satisfy any ''MUST'' criteria is rejected. Then, remaining tenders are evaluated against the NPV method.

J. Constr. Eng. Manage., 2004, 130(2): 235-244

Table 5. Summary of Responses on Competitive Tender Evaluation Methods

Tender evaluation methods	Used by respondents' units or experienced by respondents		Recommended	
	Number of responses	Percentage of total responses (%)	Number of responses	Percentage of total responses (%)
Net present value method	16	43.24	16	43.24
Simple scoring method	10	27.03	1	2.70
Multiattribute analysis	8	21.62	13	35.14
Kepner–Tregoe decision analysis technique	3	8.11	7	18.92
Total	37	100	37	100

Table 6. Evaluation Criteria and Maximum Score Points Used for Toll Roads in California (Levy 1996)

Evaluation criteria	Maximum achievable score (points)
Transportation service provided	20
Degree to which proposal encourages economic prosperity	10
Degree of local support for the project	15
Relative ease of proposal implementation	15
Experience/expertise of sponsors and support team	15
Supports for environmental quality and energy conservation	10
Degree to which nontoll revenues support proposal costs	5
Degree of technical innovation displayed in proposal	10
Supports for achieving the civil rights objectives	10
Highest achievable score	110

evaluation methods and criteria, critical project success factors, contract management, financial arrangements, relevant laws, regulations and guidelines, good practices and innovative procurement approaches, and relevant decision-making frameworks.

Case Studies

International PPP practices in infrastructure development have been studied. These include PFI (private finance initiative) projects in the U.K. (Blackwell 2000), BOT (build-own-operate)-type toll roads in the U.S. (Levy 1996), BOT tunnel projects in Hong Kong (Zhang and Kumaraswamy 2001a), BOT-type projects in Australia (Shepherd 1999), BOT power and transportation projects in many developing countries such as China (Zhang and Kumaraswamy 2001b), India (Malini 1999), the Laos PDR (Kumaraswamy and Zhang 2001), the Philippines (Alfelor and Ofori 1999), Sri Lanka (Ministry of Finance & Planning 1998), and Thailand (Charoenpornpatana and Minato 1997). These PPP projects include roads, bridges, ports, airports, and railways in the transportation sector; power, telecommunication, water supply, and waste disposal systems in the utilities sector; and schools, hotels, hospitals, military facilities, and prisons. In these diverse types of infrastructure projects, many have been successfully developed with significantly increased value to the outputs, for example, the first eight DBFO (design-build-finance-operation) roads in the U.K. and the BOT Laibin B power station in China. However, serious problems had been encountered in a number of PPP projects, including the Second Stage Expressway System and the Don Muang Tollway in Thailand due to political instability (Ogunlana 1997), some highway projects in Washington State and the State of Arizona due to strong public opposition (Levy 1996), and the Tha Ngone bridge project in the Laos PDR due to high toll levels and consequent strong public opposition (Kumaraswamy and Zhang 2001).

Interview and Correspondences with Experts and Experienced Practitioners

Face-to-face and telephone interviews with experts and experienced practitioners have been conducted. To ensure fruitful interviews, lists of questions and discussion issues stressing different aspects of PPPs according to the types of interviewees are sent ahead of the targeted dates of interview so that they have time to prepare and collect relevant information. In addition, postal, fax, and e-mail correspondences with a number of public clients, consultants, concessionaires, contractors, financiers, lawyers, and academic experts in a number of countries yield a wealth of experiential information and expert opinions.

Questionnaire Survey

Questionnaire survey is an effective, convenient, and economical investigative tool for obtaining data and sampling the opinions of individuals in spatially diverse locations in a relatively short time. The writer conducted a questionnaire survey [entitled ''Procurement of build-operate-transfer (BOT) type projects''] from December 2000 to May 2001. This survey aims to solicit and consolidate worldwide knowledge and expertise that would contribute to (1) identifying the strengths and weaknesses of current PPP practices and to (2) the formulation of a workable and efficient procurement framework for PPP projects. Two sections of the questionnaire are related to tender evaluation methods and evaluation criteria, respectively.

Forty-six respondents have returned complete questionnaires. They are from 42 different organizations/institutions in a number of countries and regions, such as Australia, Hong Kong Special Administrative Region of China (Hong Kong), India, Japan, Peru, the Philippines, Mainland China, Malaysia, Singapore, South Africa, Thailand, U.K., and U.S. Twenty-nine respondents are from industry and 17 are from academia. Tables 1 and 2 provide some details on respondents' background information. All these respondents have been involved in PPP projects or have done some research in this field. Many of the respondents are from organizations that have rich PPP experience, knowledge, and expertise, for example, the Asian Development Bank, Essex County Council (U.K.), Department for International Development (U.K.), Gammon Construction Ltd. (Hong Kong), Highways Department (Hong Kong), International Finance Corporation, Manchester City Council (U.K.), Nishimatsu Construction Co. Ltd. Hong Kong Branch, Partnerships U.K., the Philippine BOT Center, Public Private Partnership Unit of the Ministry of Defense (U.K.), Schools Private Finance Team of the Department for Education and Employment (U.K.), Southern Energy Asia-Pacific Ltd. (Hong Kong), Transport Department (Hong Kong), and the World Bank.

J. Constr. Eng. Manage., 2004, 130(2): 235-244

Table 7. Award Criteria for Winning Tender in PFI Projects (Based on Treasury Taskforce 1999)

Criteria	Description
Meeting output specifications	Winning tender offers a deliverable solution that provides services at the specified standards and represents good value for money. The deal should be assessed over whole contract life, innovation encouraged, and related risks fully assessed.
Whole life value for money	Tender evaluation should focus on the overall cost of services (overall NPV of tenderers' unitary charges) over the contract life rather than on the phasing of expenditure or individual cost components within it. Residual value should also be assessed if the asset reverts to the client at the end of the contract. The winning tender should offer best value for money in terms of whole life cycle costs and quality of service provided that the price over the contract period is affordable and acceptable financing terms have been secured.
Accepting key contract terms and required transfer of risks	Winning tenderer should accept key contract terms (particularly those regarding service charges and transfer of risks). These include: (1) The allocation of general and specific legislative risks and the boundary between them; (2) compensation schemes for termination and the trigger events for default; (3) payment mechanism; (4) indexation relating both to the base costs and the appropriate indices; (5) ''step-in'' rights; and (6) changes in client requirements.
Confirmation of access to finance	Winning tender should provide satisfactory assurances of adequate funding. These include: (1) The quality of the financial institutions (including their credit ratings), experience of PPP projects and views from advisers on their ability to deliver; (2) the financing plan, the proposed method of funding, and an outline of the financial facilities to deliver that plan; (3) security guarantees or other support the financiers will require from the concessionaire; (4) the tenderers' and their financiers' due diligence requirements; (5) winning tender's financiers are content with the commercial terms and have reviewed the results of financial models that reflect these terms and are satisfied and willing to fund the proposed venture; (6) results of the financial model should be capable of supporting the debt facilities envisaged by the project's financing plan; and (7) the financiers should also confirm that all key aspects of their due diligence study that may affect their willingness to enter into the financing have been completed to their satisfaction.
Affordable unitary charges	Unitary charge of the winning tender must be affordable to the public sector, i.e., the client still has sufficient funding to meet other priority needs after meeting payments for PFI deals. The accounting treatment of the PFI project needs to be considered as part of the affordability assessment.
Cohesive consortium	The concessionaire consortium should be a fully cohesive entity. The winning consortium should have a single point of contact representing all parties to the consortium. The winning tender should contain tangible evidence that various participants are working together through a cohesive approach. Where a consortium seeks the client's approval for a change in a consortium member or debt provider after concessionaire selection, the new party should be required to sign up to the terms and principles previously agreed by the consortium and its constituent members.

Tender Evaluation Methods

Fair and Competitive Selection Process

Five tendering methods have been identified through literature review and case studies. They are (1) open competitive tendering; (2) invited tendering; (3) registered lists; (4) project-specific prequalification and shortlisting; and (5) negotiated tendering. In the questionnaire survey respondents are asked to indicate which of these tendering methods their organizations have used or the respondents have experienced, and which they would like to recommend use in future PPP projects. Table 3 provides a summary of the responses. It can be seen that open competitive tendering is most commonly used and also the most recommended by the respondents. It should be noted that each respondent may identify more than one method in each case, which explains the totals (72 and 64) being larger than the number of respondents. Furthermore, one respondent to the survey also recommends a tendering method that accepts alternative proposals that are submitted in conjunction with a conforming tender for any of the five tendering methods listed in the questionnaire.

In the open competitive tendering process, all interested parties should be treated on equal footing without discrimination. Otherwise, some tenderers may drop out of the competition or submit noncompliant tender proposals. This benefits neither the public nor the private sector.

Competitive Tender Evaluation Methods

A number of competitive tender evaluation methods are currently used. These include the simple scoring method, NPV (net present value) method, multiattribute analysis, and Kepner–Tregoe decision analysis technique (Kepner and Tregoe 1981; Zhang et al. 2002). A brief description of these methods appears in Table 4.

In the questionnaire survey, respondents are asked to indicate which of the above tender evaluation methods their organizations have used or the respondents have experienced in a BOT-type tender evaluation, and to indicate which method they would recommend using. Table 5 provides a summary of responses on tender evaluation methods. It can be seen that the NPV method and multiattribute analysis are the two most commonly used tender evaluation methods. They are also the most recommended.

J. Constr. Eng. Manage., 2004, 130(2): 235-244

Table 8. MUST and WANT Criteria in Tender Evaluation of Western Harbor Crossing

MUST criteria	WANT criteria
1. Project scope must include the WHC to be developed through a BOT scheme and a section of Route 7 that the tenderer shall design, construct, and transfer at no cost following construction to the government that shall control and maintain.	1. The level and stability of the proposed toll regime.
2. The WHC must be a dual three-lane immersed tube road tunnel together with the associated approaches, toll plaza, interchange, electrical, and mechanical installations, buildings, and all related operational facilities. All these facilities should be contained within the tunnel area.	2. The proposed methodology for toll adjustments.
3. The proposed tender must meet the transport, engineering, and operational requirements of the government.	3. The robustness of the proposed works program in meeting the government's target date of completion.
4. The proposed tender must contain a toll adjustment mechanism based broadly on the principles specified by the government.	4. The financial strength of the tenderer and its shareholders, the resources that they will be able to devote to the project, and their ability to formulate and support an appropriate financing package for the project development.
5. Importation of labor from outside Hong Kong is not allowed except under certain special deserving circumstances. Illegal immigrants should be prevented from being employed.	5. The structure of the proposed financing package including the levels of debt and equity, hedging arrangements for any interest rate and/or currency risks, and the level of shareholders' support.
6. The government will have the right to use passage tax to meet traffic management objectives.	6. The proposed corporate and financial structures of the concessionaire company.
7. Tenderers must demonstrate that they have sound financial backing, capable of bearing the financial risks of significant variation in the costs of construction and operation, and in the revenues over the concession period.	7. The quality of the engineering design, environmental considerations, and construction methods, including traffic control, surveillance, tunnel electrical, mechanical, ventilation, and lighting systems.
8. The government does not take equity in the project.	8. The proposed tunnel operation, maintenance, and inspection requirements.
9. The proposed financing must be without recourse to the government.	9. The ability to manage, maintain, and operate effectively and efficiently.
10. The tunnel area will not carry land title. There is no property development associated with the concession.	10. The benefits to the government and the community.
11. The tenderer must take measures to ameliorate the air, noise, water quality, and visual impacts associated with the project.	
12. The concessionaire company shall be a limited liability company.	

Some respondents also provide the following evaluation methods: (1) two envelope method; (2) NPV method+scoring method; and (3) binary method+NPV method. These methods are also explained in Table 4.

Comments on Tender Evaluation Methods

For small and simple PPP projects the binary method, simple scoring method, and two-envelope method may be appropriate methods for tender evaluation. For projects in which technical issues are not a problem and there exists proven construction technology, the NPV method (possibly supported by sensitivity analysis) may be more appropriate. One shortcoming of the NPV method is that it does not consider the relative technical advantages and disadvantages of different tenders. For complex projects, the multiattribute analysis and the Kepner–Tregoe decision analysis technique may be more suitable.

Financial aspects are the most important issue that needs to be considered in concessionaire selection for PPP projects. Hence the financial package is usually assigned a much higher weight than other evaluation packages. The NPV method is often used in conjunction with other evaluation methods, for example, the two-envelope method, NPV+scoring method, binary method+NPV method, and tender price+multiattribute analysis.

Estimation errors of various variables may combine to have an overall effect on the financial feasibility of a project. Therefore more diligence efforts should be exercised in analyzing the financial aspects of tenders through sensitivity analysis. This can identify variables that contribute most to overall investment riskiness and project returns and thus point the decision maker to where efforts should be directed to effectively control risks and maximize profits. It can also direct attention to critical variables which require further forecasting efforts because of their potentially significant impacts on the final decision, for example, where it is identified that a small error in estimating such variables may make the NPV negative or depress the internal rate of return below the desired rate (Woodward 1995).

Evaluation Methods and Criteria Used in Different Projects

BOT-Type Toll Roads in the U.S. under the ISTEA

The Intermodal Surface Transportation Efficiency Act (ISTEA) implemented in 1991 created a framework for PPPs in toll roads. The ISTEA allows the combination of federal, state, and private sector funds in highway PPPs and expands project eligibility for

J. Constr. Eng. Manage., 2004, 130(2): 235-244

Table 9. Commonly Used Decision Statements, MUST and WANT Criteria in BOT Tender Evaluation (Based on Tiong and Alum 1997a)

Commonly used statement	1. Select the tender that offers the best overall value for money 2. Select the tender that offers the most attractive financial package and most effective technical solution 3. Select the tender that is best researched overall in the technical and financial aspects of the project
Commonly used MUST criteria	1. Tenders must be complete and must comply with the tender guidelines 2. The proposed concessionaire must have proven capacity (financial and technical) and experience in construction and operation of similar projects 3. The proposed concessionaire must have a local company in its team
Commonly used WANT criteria	1. Degree of attractiveness of financial package 2. Financial returns to government and benefits to community 3. Relative soundness of technical solution for project implementation 4. Relative experience and expertise of the promoter in similar projects 5. Degree of environmental impact

such schemes and the use of various procurement models including BOT, BOO (build-own-operate), BBO (buy-build-operate), BTO (build-transfer-operate), and LDO (lease-develop-operate).

Scoring Method Used in California

A scoring system was used in four BOT-type toll roads in California: Santa Ana Viaduct Express, Mid-State Tollway, San Miguel Mountain Parkway, and SR 91 Median Improvement. Evaluation criteria and corresponding maximum achievable score points are shown in Table 6.

Multiattribute Analysis Used in SCDOT

The South Carolina Department of Transportation (SCDOT) initiated a unique multiattribute tender evaluation technique. To ensure confidentiality, each tenderer's name is replaced by a letter designation upon receipt of its proposal. The results of tender evaluation are represented by four charts. A value chart displays each tender's scope of work, total project costs, right-of-way acquisition process, maintenance, law enforcement provisions, and toll collection policies. A second chart lists each tender's source of revenue, funding required from revenue bonds, toll collections, state obligation bonds, and investment earnings. A third chart compares cash outlays of each tender. A fourth chart addresses financial risks by rating each tender's financial plan dependency in one of four categories: high, medium, medium-high, and very high. An overview tabulation would then be prepared, based on which the SCDOT finally determines and then begins negotiations with the preferred tenderer (Levy 1996).

PFI Projects in the U.K.

The U.K. has practiced innovative PPPs within its PFI program that was launched in late 1992 as a policy framework to enable public works and subsequent services to be carried out using private sector inputs. The PFI switches away from asset-based projects to service-orientated activities by transforming government units from being owners and operators of assets into purchasers of long-term services from the private sector. There are two drivers for PFI projects: (1) reducing the public sector borrowing requirement by making off-balance sheet transactions and (2) cost savings and efficiency gains introduced by the private sector.

Multiattribute Analysis Approach

In PFI projects, tenders are evaluated against various criteria in different assessment areas (Blackwell 2000). General evaluation criteria may include: (1) innovation; (2) compatibility with operational approach; (3) deliverability; (4) flexibility; and (5) risk transfer. The assessment areas depend on the nature of the project, which may include: (1) risk transfer; (2) planning/site considerations; (3) design; (4) redundant premises; (5) consequential risk; (6) occupancy risk; (7) development risk; (8) program; (9) accommodation requirements; (10) facilities management; (11) alternative revenue streams; (12) contract framework; and (13) consortium structure. Each assessment area in turn includes a number of items to be assessed against the evaluation criteria. For example, within the assessment area of contract framework there are five items:

1. Demonstration of an understanding of the contractual issues;
2. Position on liquidated damages;
3. Position on performance-related deductions against the unitary charge;
4. Acceptance of change of law risk; and
5. Position on collateral warranties.

For each assessment area a matrix box is constructed, with all assessment items under that assessment area positioned against the evaluation criteria. Criteria that are inappropriate to an assessment item would be blanked out. For example, the item of ''position on liquidated damages'' is unlikely to be assessed against the criterion of ''innovation,'' which is much more important in the assessment of alternative revenue streams. After the assessment of every item under an assessment area a subscore is calculated for that area. The total score of a tender is the sum of the subscores for all assessment areas.

NPV Method

The NPV method is used in the examination of relevant financial aspects of PFI projects. Tender evaluation is focused on the overall cost of services (i.e., the overall NPV of a tender's unitary charges) over the contract life or the whole life cycle of a PFI project. The NPV of the residual value of the asset of a PFI project is also assessed if the asset reverts to the client at the end of the contract period. The NPV method is also used in the analysis of whether a PFI project can achieve better value for money than a traditional public procurement approach. For example, in the DBFO (design-build-finance-operate) roads, the Highways Agency compares the NPV of the projected payment under the DBFO contract over the long period of the contract life (typically 30 years) with the NPV of the costs of a traditionally procured public sector comparator over the same length as the DBFO con-

Table 10. Distinctive Winning Elements for BOT Contracts (Tiong and Alum 1997b)

Financial package differentiation	Technical solution advantage	Differentiation in guarantees
1. Lowest tolls or tariff	1. Proven technology	1. Winner seeks the least government guarantees and incentives
2. Strongest financial commitments	2. Shortest construction period	2. Guarantee of minimum and stable toll increases
3. Lowest construction cost	3. Most cost-effective solution	3. Guarantee of standby credit in case of cost overruns
4. Highest ratio of equity to debt	4. Most sound solution	4. Winner guarantees to share revenues and profits with governments
5. Largest revenue or profit sharing with government	5. Most innovative solution	5. Fixed interest rates for bank loans
6. Shortest concession period	6. Least environmental impact	
	7. Safest for construction	

tract life. The calculation of costs of the public sector comparator also takes into consideration the risks borne by the Agency under the conventional procurement.

Award Criteria for Winning Tender of PFI Project

The relevant European Community procurement law requires transparency of the award criteria for the appointment of the preferred tenderer (winning tenderer) and the award of the contract. The following are common criteria (descriptions of which are provided in Table 7) that a tenderer should satisfy to be selected as the preferred tenderer and subsequently awarded the contract (Treasury Taskforce 1999):

1. Meeting output specifications;
2. Whole life value for money;
3. Acceptance of key contract terms and required transfer of risks;
4. Confirmation of access to finance;
5. Affordable unitary charge; and
6. Cohesive consortium.

BOT Tunnel Projects in Hong Kong

Kepner–Tregoe Decision Analysis Technique

Five large tunnel projects have been successfully developed in Hong Kong through the BOT approach since the late 1960s with the first one, the Cross Harbor Tunnel, transferred to the government in 1999 after 30 years of concession period. Based on past BOT experiences, the Hong Kong government has formulated a structured concessionaire selection framework, which incorporates the Kepner–Tregoe decision analysis technique. This framework has been used in the selection of concessionaires for two new BOT projects, the Western Harbor Crossing (WHC) and Route 3 Country Park Section. Taking the WHC as an example, the decision statement as well as MUST and WANT criteria used in tender evaluation are discussed in the following sections (Zhang et al. 2002).

Decision Statement, MUST and WANT Criteria

Decision statement: selecting a financially and technically strong consortium that will successfully deliver the required tunnel works and services through a BOT arrangement and in turn obtain a ''reasonable but not excessive'' return on its investments.

MUST and WANT criteria in general terms for the conforming proposal are derived from the project brief and shown in Table 8.

Alternative and Hybrid Proposals

The Hong Kong government welcomes alternative proposals that differ in whole or in part from the conforming proposal. WANT criteria in general terms are the same as those for the conforming proposal. The MUST criteria for alternative proposals are listed in the following:

1. The proposed tender must demonstrate with full supporting evidence that the alternative proposal is technically feasible, that the construction program is reliable, and that there are

Table 11. Additional Critical Success Factors (Based on Gupta and Narasimham 1998)

Success factors	Remarks
Ability to provide a suitable transfer package	Innovative transfer package ensures continuation of the quality services beyond the concession period. This includes: (1) training of the client's personnel; and (2) optional provisions allowing the client either to sell the facility to the promoter at a predetermined cost or to extend the concession period to the promoter with a minimum guaranteed return to the government.
Built-in flexibility for future growth and changes	The design of a large-scale infrastructure project should be dynamic and capable of achieving both flexibility and adaptability to change to meet future needs. Lack of a living system perspective will constrain future development and cause rapid degeneration and decay of the existing system.
Supportive and understanding community	BOT projects need support and understanding from the community directly affected by the project. The promoter should make an adequate and sustained marketing campaign so that the public can understand the long-term implications and benefits of the project.
Short construction period	This factor is particularly important for BOT projects in a country with high inflation and interest rates. Infrastructure projects require great amounts of construction capital. Early generation of revenues shortens the payback period and thus reduces the tolls/tariff charges.

Table 12. Tender Evaluation Criteria Packages for PPP Projects in General

Financial	Technical	Health, safety, and environmental	Managerial
1. Sound financial analysis	1. Qualifications and experiences of key design and construction personnel	1. Qualifications/experience of safety, health and environmental personnel	1. Location of home office registration/main place of business
2. Total investment schedule	2. Competencies of designer/ subdesigners, contractor/subcontractors	2. Management safety accountability	2. Constitution of the management, their qualification and experience
3. Payment and drawdown schedules	3. Quantities, conditions and ownership of plants and equipment	3. Past health and safety performance	3. Leadership and allocation of responsibilities in the consortium
4. Equity/debt ratio	4. Design standard	4. Past environmental performance	4. Organizational culture and structure
5. Sources and structure of main loans	5. Design life	5. Safety and health record/accident rate	5. Contractual relationships among participants
6. Sources and structure of standby financing facilities	6. Conforming to design requirements	6. Safety and health policy and management system	6. Working relationships among participants
7. Attractiveness of main loan agreement	7. Conforming to client's requirements	7. Noise mitigation and handling of dangerous/emergency situations	7. Coordination system within the consortium
8. Attractiveness of standby loan agreement	8. Additional facilities/services beyond client's requirements	8. Safety planning for handling hazardous materials	8. Dispute resolution system within the consortium
9. Attractiveness of shareholder agreement	9. Structural aspects	9. Environmental policy and management plan	9. Ability to address counterparty risk (default by other parties)
10. Low financial charges	10. Geotechnical and foundation aspects	10. ISO 14000 certification	10. Communication and documentation systems
11. Fixed and low interest rate financing	11. Electrical and mechanical systems	11. Conformance to laws and regulations	11. Partnering and negotiation skills
12. Long-term loan financing and minimizing refinancing risk	12. Architectural/aesthetics aspects	12. Protection of flora and fauna	12. Trade union record
13. Abilities to deal with fluctuations in interest/ exchange rates	13. Quality management and assurance systems	13. Protection of items of cultural/ archeological values	13. Project management skills
14. Creative financial packages	14. Design and construction quality control schemes	14. Construction/demolition waste disposal	14. Staff training regime
15. Local financing	15. Construction technologies and methods	15. Control of air and water pollution	15. Risk management system
16. Concessionaire's ability to get supplementary external finance	16. Constructability		16. Procedures for transferring the project to the client
17. Currencies of loans and equity finance	17. Maintainability		
18. Currency of revenues and payments	18. Value engineering potential		
19. Financiers' abilities (especially the leading bank's)	19. Construction programs and abilities to meet them		
20. Minimal financial risks to the client	20. Material schedule		
21. Internal rate of return	21. Use of local equipment and materials		
22. Net present value	22. Construction cost schedule		
23. Tariff/toll setting up and adjustment mechanism	23. Insurance package for construction and operation		
24. Low toll/tariff levels	24. Tariff/toll collection technology		
25. Government's control on tolls/tariffs	25. Operation and maintenance policy		
26. Schedule of revenues	26. Operation and maintenance cost schedule		
27. Financial strength of the participants in the project company			
28. Strong financial commitments from shareholders			
29. Construction period			
30. Concession period			
31. Financial institution guarantees			
32. Insurance cover			
33. Sharing of profits with the client			
34. Less financial guarantee required from the client			
35. Ability to address commercial risk (e.g., supply and demand risk)			

engineering, financial, programming and/or operational advantages over the conforming scheme;
2. The WHC must be a tunnel developed on the basis of a BOT arrangement;
3. The tunnel must be of a dual-3 lane configuration; and
4. The project must adopt the same corridor as used in the conforming scheme, i.e., the tunnel must connect Sai Ying Pun on Hong Kong Island and the proposed West Kowloon Reclamation on the Kowloon side.

In addition, the government may consider a hybrid scheme incorporating features from any conforming proposals and any alternative proposals submitted, subject to agreement with the tenderers involved.

Commonly Used Decision Statements and MUST and WANT Criteria

Tiong and Alum (1997a) have modified the Kepner–Tregoe technique for BOT tender evaluation. Through a questionnaire survey they have obtained the opinions of 30 government officials and their advisors on the validity of this technique for BOT tender evaluation and derived the commonly used decision statements, MUST and WANT criteria (as listed in Table 9) for BOT projects in general.

Critical Success Factors for PPP Projects

It is useful to identify factors that commonly lead to success of PPP projects in order to incorporate them in criteria for predicting success in future projects of a similar nature. Research into, and discussions about critical success factors (CSFs) in BOT-type infrastructure projects have been previously conducted, for example, by Berry (1991) and Morledge and Owen (1997).

Tiong (1996) has identified six CSFs of a winning tender for BOT projects: (1) entrepreneurship and leadership; (2) right project identification; (3) strength of the consortium; (4) technical solution advantage; (5) financial package differentiation; and (6) differentiation in guarantees. Tiong and Alum (1997b) have further identified those elements that give the winning proposal the distinctive advantage over other competing proposals during the final selection of a competitive BOT tender from the subfactors of the CSFs of technical solution advantage, financial package differentiation, and differentiation in guarantees (Table 10). Gupta and Narasimham (1998) provide four additional success factors for promoters to win BOT contracts, as shown in Table 11.

Generalization of Evaluation Criteria

In the previous sections multiple tender evaluation criteria used in different types of PPP projects in some countries have been compared. The writer has also explored tender evaluation criteria used in PPP projects in a number of other countries through literature review and case studies. Opinions on suitable evaluation criteria for PPP projects in general have been sought from experts and practitioners worldwide through interviews and correspondences. These criteria together with the above-mentioned CSFs and distinctive elements in a winning BOT tender are further examined, compared, distilled, coded, and consolidated. These initiatives help to generate four tender evaluation criteria packages for PPP projects in general. They are (1) financial; (2) technical; (3) managerial; and (4) safety, health, and environmental as presented in Table 12.

In the questionnaire survey, respondents are asked to indicate whether the classification of the four evaluation criteria packages are appropriate and to indicate the perceived relative overall significance levels of each criterion under each of the four packages on a scale of 0–5. Survey results confirm that the classification of the four evaluation criteria packages is suitable. For example, one expert from the World Bank commented: ''Your questionnaire aims at weighing a series of criteria that, for the most part, we consider as relevant and that we use to include in draft concession agreements whenever we are requested to advise.''

In tailoring these criterion packages for a specific PPP project, appropriate adjustments should be made to reflect (1) the revised risk allocations in a particular PPP project, (2) the uniqueness of each specific concession, and (3) the composition of the concessionaire, the resources and capabilities of, and the role played by, each constituent company. As the World Bank expert said ''... what counts is the relevance of a given set of criteria put together to build an agreement tailored to fit in a given corporate, commercial, social, etc. environment. Also, the final set of criteria may result from a negotiation since some criteria might not be weighed the same way by supervisory authorities, corporatized port authorities and private operators.''

Conclusions

The selection of the right concessionaire is critical to the success of a PPP infrastructure project. Competitive concessionaire selection is a trend in international PPPs for infrastructure development. A number of tender evaluation methods and their applications in some countries have been discussed. These include the simple scoring method, NPV method, two-envelope method, multiattribute analysis, and Kepner–Tregoe decision analysis technique. These methods can be modified and combined to suit a particular project. Respondents of the questionnaire survey recommend the use of the NPV method and multiattribute analysis in tender evaluation.

Multiple tender evaluation criteria used in different types of PPP projects worldwide have been explored through literature review and case studies, supplemented by interviews and correspondences with international experts and practitioners on suitable evaluation criteria for PPP projects in general. These criteria together with the CSFs and other important factors for successful PPPs that are identified by other researchers are further examined, compared, distilled, coded, and consolidated. These initiatives enable the generation of four evaluation criteria packages for PPP projects in general. They are (1) financial, (2) technical, (3) managerial, and (4) safety, health and environmental.

Analysis of the results of the questionnaire survey of worldwide expert opinions on improved PPP practices confirms that the classification of various criteria into the above-mentioned four general evaluation packages is appropriate. However, in tailoring these criteria packages for a specific PPP project, adjustments should be made to reflect the revised risk allocations in that particular PPP project, the uniqueness of the specific concession and the composition of the concessionaire, the resources and capabilities of, and the role played by, each constituent company.

References

Alfelor, W. M., and Ofori, G. (1999). ''Facilitating build-operate-transfer projects in the Philippines amid Asian financial turmoil.'' *Proc., Joint*

Triennial Symposium (CIB Commissions W65 and W55, with the Participation of W92, W99, TG31 & TG35), Cape Town, South Africa, Vol. 1, 316–324.
Ashley, D., Bauman, R., Carroll, J., Diekmann, J., and Finlayson, F. (1998). ''Evaluation viability of privatized transportation projects.'' *J. Infrastruct. Syst.*, 4(3), 102–110.
Berry, C. (1991). ''Criteria for successful project financing.'' *Project finance yearbook 1991/1992*, Bedfordshire, U.K., 15–20.
Blackwell, M. (2000). *The PFI/PPP and property*, Chandos, Oxford, England.
Charoenpornpatana, S., and Minato, T. (1997). ''Privatization-induced risks: stated-owned transportation enterprises in Thailand.'' *Proc., CIB W92 (Procurement Systems) and CIB TG 23 (Culture in Construction) Joint Symp.: Profitable Partnering in Construction Procurement*, 429–439.
Gupta, M. C., and Narasimham, S. V. (1998). ''Discussion of 'CSFs in competitive tendering and negotiation model for BOT projects' by Robert L. K. Tiong.'' *J. Constr. Eng. Manage.*, 124(5), 430.
Kepner, C. H., and Tregoe, B. B. (1981). *The new rational manager*, Princeton Research Press, Princeton, N.J.
Kumaraswamy, M. M., and Zhang, X. Q. (2001). ''Governmental role in BOT-led infrastructure development.'' *Int. J. Proj. Manage.*, 19, 195–205.
Levy, S. M. (1996). *Build, operate, transfer*, Wiley, New York.
Loosemore, M. (1999). ''International construction management research: cultural sensitivity in methodological design.'' *Constr. Manage. Econom.*, 17, 553–561.
Malini, E. (1999). ''Build operate transfer municipal bridge projects in India.'' *J. Manage. Eng.*, 15(4), 51–58.
Ministry of Finance & Planning. (1998). *Guidelines on government tender procedure*, Part II (private sector infrastructure projects), Sri Lanka.
Morledge, R., and Owen, K. (1997). ''Developing a methodological approach to the identification of factors critical to success in privatized infrastructure projects in the U.K.'' *Proc., CIB W92 and CIB TG 23 Joint Symposium: Profitable Partnering in Construction Procurement*, 487–498.
Ogunlana, S. O. (1997). ''Build operate transfer procurement traps: Examples from transportation projects in Thailand.'' *Proc., CIB W92 Symp. on Procurement—A Key to Innovation*, Montreal, Canada, 585–594.
Shepherd, F. (1999). ''Developing the Melbourne City Link.'' *Privatization Int.*, 134, 7–12.
Tiong, R. L. K. (1996). ''CSFs in competitive tendering and negotiation model for BOT projects.'' *J. Constr. Eng. Manage.*, 122(3), 205–211.
Tiong, R. L. K., and Alum, J. (1997a). ''Evaluation of proposals for BOT projects.'' *Int. J. Proj. Manage.*, 15(2), 67–72.
Tiong, R. L. K., and Alum, J. (1997b). ''Distinctive winning elements in BOT tender.'' *Eng., Constr., Archit. Manage.*, 4/2, 83–94.
Treasury Taskforce. (1999). *Technical note no. 4: How to appoint and work with a preferred bidder*, Treasury Taskforce, London, U.K.
Woodward, D. G. (1995). ''Use of sensitivity analysis in build-own-operate-transfer project evaluation.'' *Int. J. Proj. Manage.*, 13(4), 239–246.
Zhang, X. Q., and Kumaraswamy, M. M. (2001a). ''Hong Kong Experience in managing BOT projects.'' *J. Constr. Eng. Manage.*, 127(2), 154–162.
Zhang, X. Q., and Kumaraswamy, M. M. (2001b). ''BOT-based approaches to infrastructure development in China.'' *J. Infrastruct. Syst.*, 7(1), 18–25.
Zhang, X. Q., Kumaraswamy, M. M., Zheng, W., and Palaneeswaran, E. (2002). ''Concessionaire selection for build-operate-transfer tunnel projects in Hong Kong.'' *J. Constr. Eng. Manage.*, 128(2), 155–163.