Build-Operate-Transfer-Type Procurement in Asian Megaprojects

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Abstract: Lessons are drawn from the recent resurgence in public-private partnerships for the procurement of large scale infrastructure, with a focus on Asian megaprojects. BOT (build-operate-transfer)-type win-win cooperation aligns well with the paradigm shift that has repeatedly been called for in addressing construction industry shortfalls. However, the many volatile variables involved and the limited experience in dealing with the special risks encountered highlights the need for decision support frameworks to evaluate and select the optimal from among: (1) potential BOT-type projects; (2) prospective franchisees; and (3) innovative project financing packages. Such frameworks should include appropriate success criteria and indicators for their evaluation. Benchmarking of good practices would establish reasonable ranges of values for such indicators. Identification of critical success factors, classifications of common risks, and comparisons of recent experiences on BOT-type projects lead to recommendations for the development of a ''BOT body of knowledge'' with related guidelines and toolkits. These would assist both public and private sector decision makers considering BOT-type modalities to attain multiple win-win-win targets that benefit their respective interests, as well as those of the general public end users.

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Background and Introduction

Private investment in public infrastructure can be traced back to 18th century examples of concession contracts to supply drinking water to Paris and 19th century examples such as the Suez Canal and Trans-Siberian Railway, as well as canals, turnpikes, and railroads in Europe followed by the Americas, China, and Japan (Walker et al. 1995; Levy 1996). This trend was largely reversed in many countries for the greater part of the 20th century. Two World Wars, the Great Depression, and other upheavals dampened private sector interest in such mega-investments during these turbulent times. Governments took on more responsibilities for, and thus played dominant roles in, infrastructure development in this period. However, a worldwide resurgence in the private financing, development, and operation of mega-infrastructure projects was evident from the 1980s. This was largely fueled by the fast growing needs of increasing populations and their even faster growing expectations, particularly in Asia. Dwindling governmental coffers, surplus private resources, and a search for efficiencies in providing infrastructure encouraged this shift.

The Cross Harbor Tunnel in Hong Kong was in fact privately financed in the late 1960s and could therefore be considered a precursor to the above resurgence. However, the term build-operate-transfer (BOT) was itself reputedly coined in Turkey in the early 1980s. It has since spawned an alphabet soup of acronyms (such as BOOT, BOO, BTO, BRT, BLT BOOM, and DBOM) that reflects variations of the concept and emphasis, as well as parallel approaches to public-private partnership (PPP) projects, for example, in the U.S. (Levy 1996) and the Private Finance Initiative (PFI) in the United Kingdom (Merna and Smith 1999). Infrastructure procured through such BOT-type protocols in various countries include roads, bridges, ports, airports, and railways in the transportation sector; power, telecommunication, water supply, and waste disposal systems in the utilities sector; and hotels, hospitals, and prisons in the buildings sector.

This paper examines such trends, assessing their sustainability and drawing lessons from strengths and weaknesses that emerged in recent BOT-type infrastructure projects. Experiences from the BOT-type procurement of tunnels in Hong Kong and power stations and roads in Mainland China need to be compared with projects and initiatives in other countries, such as India, Laos, Malaysia, the Philippines, Sri Lanka, and Thailand. While the focus on Asia is encouraged by the expected resurgence in growth following the recent regional economic downturn, brief comparisons with the West and Australia add to the overview of the way forward for PPP in infrastructure procurement.

For example, fundamental changes are needed in mindsets, regulations, and legislation to accommodate the divergences from traditional civil engineering procurement scenarios that separated the financing, design, construction, and operational functions. It is seen that lessons learnt from recent PPP projects should now be incorporated in formally redefining risk distribution and function allocation and in reengineering frameworks of roles and relationships in forthcoming BOT-type initiatives.

The paper also summarizes recent developments of appropriate criteria and tools by which to evaluate both the need for BOT-type approaches and the different proposals by prospective franchisees. The search for ''critical success factors'' that need to be pursued by project sponsors and addressed by such prospective

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J. Constr. Eng. Manage. 2002.128:93-102.

franchisees is also examined, based on the results from previous surveys, for example by Tiong (1996) on the latter, as well as from recent experiences on all fronts. An overall survey of the recent international literature and of basic project documentation in Hong Kong was supplemented by further experiential knowledge. The latter was derived from interviews and correspondence with practitioners and discussions with researchers mostly in Australia, the U.K., and Asia during the present study, which formed part of a research project at the Dept. of Civil Engineering of the Univ. of Hong Kong.

Concluding observations and recommendations call for the identification of key success factors for overall project success, as well as for the development of databases of criteria, indicators, and typical value ranges for ‘‘benchmarking’’ against best practices in BOT-type procurement. The provision of such information, along with a range of typical models, organizational frameworks, and guidelines, are proposed as both possible (based on the present stock of experiential knowledge) and necessary (in order to strengthen the strengths and weaken the weaknesses of BOT). Such consolidation would help to open up more opportunities for institutional, national, and international development within BOT and similar PPP procurement frameworks, by overcoming both threats and apprehensions associated with the potential abuses of less familiar procurement systems (Kumaraswamy 1995).

Growing Potential for Build-Operate-Transfer-Type Procurement

Disillusion with Traditional Procurement Paths

Failures to achieve substantial increases in productivity and to control burgeoning construction dispute levels have raised arguments against the adversarial scenarios perpetuated in most traditional procurement paths (Egan 1998). These often position the constructor against the architects/engineer/client, rather than encouraging teamwork toward common targets. Increasing awareness of these shortcomings has led to wide experimentation and a proliferation of procurement options, such as with various types of turnkey or project/construction management–based arrangements (Kumaraswamy 1998). Even such initiatives have failed to achieve significant breakthroughs, and the search for appropriate procurement systems thus continues (Kumaraswamy 1999). Furthermore, even previously welcomed industry reviews and recommendations such as by Latham (1994) in the U.K. fell short of expectations. Cox and Townsend (1997) attributed such shortcomings to a failure to deal with the ‘‘structure’’ of the construction industry (and the consequential procurement arrangements), which they saw as the root cause of its major problems.

BOT-type arrangements, while neither possible nor advisable on all civil engineering megaprojects, provide an excellent vehicle to reverse the overfragmentation of functions that has previously led to divergent (if not confrontational) agendas of the multiple participants. In essence, a private sector consortium finances, designs, constructs, and operates an asset for an agreed franchise period in the BOT mode. While superficially an extension of the design-build/turnkey mode, i.e., enhanced by the addition of two functions (of finance and operation), BOT in reality leaps ahead in terms of philosophy (and potential benefits), spelling out a significant shift in the procurement paradigm. Of course, like Turnkey, it is only suitable for certain types of projects.

Reengineered Risk Distribution and Creative Financing Fundamentals

An important facet of the new procurement paradigm of BOT is the radical realignment of risks between project participants. Construction project risks may be broadly classified into: ‘‘project risks,’’ comprising development, design, construction, operation, finance, and revenue generation risks; and ‘‘global risks,’’ comprising political, legal, commercial, and environmental risks (Garvey 1997). The shifting to the franchisee of many such risks previously borne by ‘‘owners’’ (clients) may accommodate enhanced rewards or, in the alternative, incorporate some minimal safeguards/guarantees of minimal returns. The paradigm shift in project financing for BOT-type projects was also crucial in that it envisaged ‘‘nonrecourse’’ funding, where lenders would treat the cashflows of the project as the only source from which loans would be repaid and the project assets as the only available collateral; i.e., lenders would not have recourse to any other cashflows or assets of participant organizations within the franchisee consortium.

This reconceptualization of project finance through imaginative financial engineering (Merna and Smith 1999) enabled the mobilization of vast resources of private capital for public projects. This in turn facilitated creative financing packages for megaprojects that would hardly have attracted traditional financing. Furthermore, this mechanism also effectively mobilized a ‘‘user pays’’ scenario, whereas, on the other hand, more pressing socio-economic and/or political priorities of cash-strapped governments may have directed their scarce resources to less capital intensive projects or to those with quicker economic and/or political returns.

Fig. 1 illustrates the basic relationships in a typical BOT-type project.

Growing Globalization and Infrastructure Needs

Enhanced mobilities and instantaneous communications have enabled rapid movements of both physical and financial resources to areas where they are needed, or could reap more benefits. For example, excess construction capacities or surplus funds from one region could easily flow into another to redress shortages and meet sudden needs. The phenomenal demands to upgrade basic infrastructure in most developing countries can thus be fed by BOT-type arrangements that facilitate mutually beneficial flows. The megascale of such demands is boosted by tremendous pressures for both new infrastructure and infrastructure renewal in developed countries themselves.

Private financing of public infrastructure was thus welcomed by cash-starved governments. The efficient maintenance and operation of assets such as power stations and roads by the private sector provided an added advantage, while also allowing for the recovery of the investment over a longer period. The transfer of the asset back to the government (or the sponsor) at the end of a specified period in the BOT concept accommodated a variety of perceived needs, such as for the state to retain ultimate ownership of sensitive or strategic national assets and/or to impose a ceiling on otherwise unlimited revenue recovery rights conferred on a private party.

Various Versions of Build-Operate-Transfer

While BOT in Turkey has been legitimized by a specific law (Law 3465) based on the original BOT concept, diverse variations

J. Constr. Eng. Manage. 2002.128:93-102.

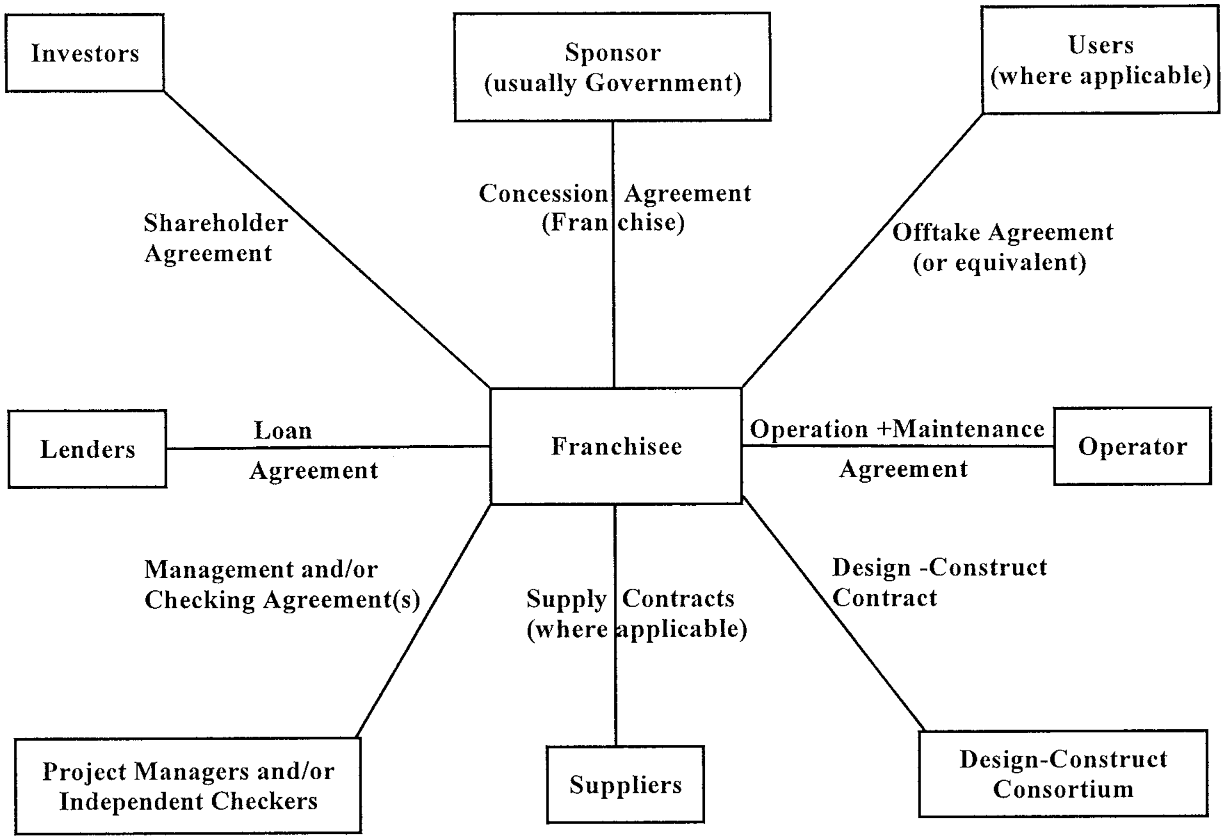

Fig. 1. Typical relationships between principal participants in build-operate-transfer-type procurement

have evolved in many countries. These mainly differ in the precise mechanisms of ownership, usage rights, and obligations. These variations include the following, with the terms indicating basic arrangements and/or essential emphasis:

- BOO=build-own-operate,
- BLT=build-lease-transfer,
- BOOM=build-own-operate-maintain,
- BOOT=build-own-operate-transfer,
- BOOTT=build-own-operate-train-transfer,
- BTO=build-transfer-operate,
- DBFO=design-build-finance-operate,
- DBO=design-build-operate,
- DBOM=design-build-operate-maintain,
- DOB=design-operate-transfer,
- ROO=rehabilitate-own-operate, and
- ROT=rehabilitate-operate-transfer.

In the Philippines, for example, the "BOT law" embodied in Republic Act 7718 of 1993 recognizes a range of procurement protocols from BLT, BOO, BOT, BT, and BTO to DOT, along with any other approved variants. BTO was preferred in the Caltrans project in California (Levy 1996) primarily to reduce tort liabilities that may have overburdened private entities. Meanwhile, it has been observed that maintenance and life cycle costs may be optimized through DBO. This mechanism has therefore also been used in procuring utilities, for example, in the 120 mgd Tolt water treatment facility in Seattle. This also enables continued public ownership of the facility. DBOM has been used in North American transportation projects, whereas BOO has been employed for power production under the Public Utility Regulatory Policies Act in the U.S. and also for power projects in India and Sri Lanka and buildings such as prisons in Australia.

New airports such as Terminal 3 at Toronto have been procured on a finance, design, build, and operate basis, while airport redevelopment and expansion such as at Terminals 1 and 2 at Toronto have been approached in the same way (Walker et al. 1995). Further variations are introducable when risk sharing formulas do not yield viable scenarios for either party. For example, a franchisee may be offered the rights to use, operate, and recover revenue from an existing facility to supplement low cashflows from the new asset. This was provided, for example, in the Dartford River crossing project in the U.K. and the North-South highway in Malaysia. Merna and Smith (1999) documented an alternative mechanism at the new Athens Airport at Sparta, where a tax on airline tickets had to be imposed to raise the bridging equity needed before the new project could even commence.

Another variation is the use of a "shadow toll" mechanism, as in the U.K. on DBFO road projects, where the franchisee receives revenue from the government/sponsor rather than directly from the motorists. This of course negates the user-pays principle in that version. While DBFO has been used on many trunk road projects in the U.K., it may soon be superseded by (or absorbed in) the PFI (Private Finance Initiative) program, which has spanned a series of sectors, particularly health, energy, telecommunications, and government buildings, including prisons (Merna and Smith 1999). The PFI was launched in the U.K. in 1992, following the privatization of a large number of public utilities in the 1980s, as well as after the commencement of the Channel Tunnel and the Dartford River Crossing on BOT-type terms.

BOT has been successfully used on five tunnels, including three harbor crossings in Hong Kong, one of which (the Eastern

J. Constr. Eng. Manage. 2002.128:93-102.

Harbor Crossing) incorporates a virtual shadow toll mechanism for the rail component only—since it is paid an agreed fixed revenue stream by the relevant railway corporation. BOT has also been used in road and power projects in Mainland China, in the Philippines, and in Thailand. A form of BRT was used on an office building in Hong Kong, while BOOT has been used in the new Olympic Stadium in Sydney and the new Docklands sports stadium in Melbourne.

The main difference between BOT and BOOT is that the additional ''O'' (for ownership) in the latter would imply that property development rights were also conferred on the franchisee. Walker et al. (1995) illustrated this with an example of a BOT franchisee who may only build and collect tolls from a motorway, whereas a BOOT franchise may confer additional rights to construct and derive rents/revenue from buildings at specific locations along the route. This may compensate for less certain traffic levels or lower toll rates that may be socio-economically desirable. BOO, on the other hand, eliminates the transfer element and the corresponding uncertainty of the state of the facility at transfer, while providing an incentive for a longer life cycle focus by the franchisee and enabling longer term investment recovery.

More examples from Asia will be examined in the following section with a view to deriving lessons from recent experiences and initiating the development of BOT body of knowledge that can be beneficially drawn upon in the future.

Some Lessons Derived from Examples of Build-Operate-Transfer Projects in Asia

This section sets out to scan a small sample of recent BOT projects and developments in Asia, since it has provided a fertile testing ground for such initiatives, given the greater gaps between higher infrastructure demands and lower supplies of public funds. However, the transition of governments from funders to facilitators has involved uncertainties and some virtual (although unintended) trial-and-error exercises, for example, on the extent of government guarantees and/or support required. This suggests the usefulness of learning from the successful ''trials'' so as to minimize any further ''errors'' in framing future BOT-type scenarios.

Examples from Hong Kong

Hong Kong has a commendable track record of procuring tolled tunnels on a BOT basis. This has evolved over more than 30 years, starting with the decision to BOT the first cross-harbor tunnel in the late 1960s. The latter was transferred at the designated end of the franchise period in 1999, providing a good example of the completed BOT cycle and an opportune time for review of the Hong Kong experience. Detailed observations from such a study will be presented separately by Zhang and Kumaraswamy (2001). Each of the five BOT tunnels was procured under an enabling ordinance (specific legislative enactment) that provided the required legal framework. Meanwhile, the body of knowledge in project managing these BOT projects has developed notably in both the public and private sectors. Experienced companies have returned to bid for new projects whether as franchisees or parts of franchisee consortia, e.g., in construction or operation. High performance levels have been recorded in the construction components (i.e., the ''B'' in BOT), for example, in terms of quality, early completion, and few (if any) disputes in general. Sharply defined common goals, with early completion enabling earlier and longer revenue flows, for example, no doubt contributed to better teamwork, hence minimizing some of the problems of traditional procurement systems discussed in the second section of this paper. For example, adversarial posturing between different functions/organizations was reduced, despite the addition of new players in the Hong Kong BOT scenario, such as the independent checking engineer organization that is charged with checking designs.

Ingenious engineering solutions were developed by such integrated teams in tunneling and immersed tube construction. For example, considerably reduced construction periods on the Tate's Cairn Tunnel project were achieved by the introduction of two sloping adit tunnels initially used for construction traffic (and replacing the originally planned single vertical shaft adit). This enabled the opening up of more tunnel excavation faces, facilitating simultaneous operations.

While the operational revenue levels in the first cross-harbor tunnel were considered to justify further BOT road tunnels, concerns arose on the adequacy of returns in the Tate's Cairn Tunnel and the Eastern Harbor Crossing. In the latter, a toll increase was agreed after arbitration (Tam and Leung 1999). This led to the incorporation of ''toll adjustment mechanisms'' in the recent projects. These would, of course, also safeguard public interest in providing for reasonable but not excessive returns. Having agreed on maximum and minimum levels of estimated net revenue (ENR) and a defined number and level of anticipated toll increases (ATI), the franchisee may implement an ATI on a designated date provided the actual net revenue (ANR) is below the maximum ENR. The franchisee may also advance an ATI should the ANR fall below the minimum ENR. If the ANR exceeds the maximum ENR, excess revenues are siphoned into a toll stability fund that the government may choose to use to defer specified ATIs by subsidizing the toll if deemed useful.

However, it has been suggested that the inability to attract enough potential franchisees to bid for the Western Harbor Tunnel project (eventually leaving only one bidder in the field to negotiate with) may reflect some possible shortfalls in the governmental guarantees and safeguards. This aspect may need to be revisited in future projects, for example, to provide greater comfort to prospective franchisees that anticipated revenue streams will not diminish due to low usage or parallel infrastructure development.

Comparisons from South East Asia

Rates of return on the Western Harbor Crossing were banded between 15 and 16.5% for the first three years and between 15 and 18.5% for the next seven years, while projected returns on Pakistani power projects, the Malaysian Labuan Water Supply project, and the Bangkok Second Stage Expressway were 16, 18–20, and 21% (with 3% over the first 10 years but 21% over the whole 31 year period), respectively (Walker et al. 1995). A proposal to cap BOT returns at 15% in Mainland China (PRC) for BOT projects was soon abandoned when investors were seen to be looking elsewhere, such as the Philippines and Malaysia, where BOT projects in the power and road sectors were already in operation, and South Asia, which was then coming ''on stream.'' These may also be compared with allowable rates of return of 17, 18, 20.25, and 21.25% as planned in the mid-1990s on four toll road projects in California (Levy 1996), where the third project was considered particularly risky in terms of design and construction, whereas the last of the four projects incorporated other business, local, and environmental mitigation risks.

However, the need for comprehensive feasibility studies to identify projects that are suitable (or not) for BOT can never be

J. Constr. Eng. Manage. 2002.128:93-102.

underestimated, given the many variables and risks involved. An example of overestimated traffic in an inadequate feasibility assessment doomed a BOT arrangement for a bridge crossing over the Nam Ngum River in the Lao PDR. The government bought out the Australian franchisee's 50% share at a preagreed price (Kumaraswamy and Zhang 2001). A worse scenario unfolded in the breakdown of the BOT agreement with a Japanese franchisee for the Second Stage Expressway in Bangkok following subsequent disagreements on toll levels. Details of this and another problem BOT scenario—on the Don Muang Tollway project linking Bangkok to its airport—have been described by Ogunlana (1997), while Tam and Leung (1999) also comment on problems in the Bangkok Elevated Transport System initially envisaged as a 60 km rail system and road through the capital. Proposed midstream changes from elevated to underground are listed amongst other changes that followed several changes by the government. The Hong Kong franchisee also blamed problems with land acquisition along the route that was expected to support property development. Tam and Leung (1999) concluded that political risks were the most difficult to handle, in comparison with the relatively easy technical risks and the harder but often manageable financial risks in such BOT projects.

Emerging Examples from South Asia

While outcomes have not been so widely documented, BOT opportunities in ports, power, and roads in India, Pakistan, and Sri Lanka, among others, have attracted the increasing attention of investors. For example, Faruqi and Smith (1997) described a case study of the BOT concession for the Karachi Light Rail Transit system, also providing brief comparisons with similar rail systems elsewhere. Independent power projects in Pakistan were encouraged by the relevant policy framework and incentive package promulgated by the Pakistani government in 1993 for private participation in power generation.

Although Sri Lanka has invited investments in BOT ventures for many years, relatively few have actually been launched up to date, in comparison to initial expectations. ''Guidelines for BOO-BOT Projects'' (issued by the former Secretariat for Infrastructure Development and Investment) in 1992 have been upgraded to comprehensive ''Guidelines and Incentives for Private Sector Participation in Economic Infrastructure Development'' by the Bureau of Infrastructure Investment. Examples of ongoing BOT projects include power generation projects as well as the main port (in Colombo), which was handed to a consortium on a BOT [perhaps more accurately on a DOT (develop-operate-transfer)] basis for 30 years from 1999.

While examples of a progressive transfer of toll revenue to the public purse have been encountered in some BOT schemes, an innovative approach to phased ownership itself was proposed by the Southern Development Authority (SDA) of Sri Lanka for a portfolio of megaprojects that have, however, yet to be launched. Commercially exploitable land would be provided by the SDA on a 99 year lease, the extent being proportional to the investment. The land would be vested in a Joint Venture Real Estate Company where the SDA and the investor would hold equal shares. A parallel Joint Venture Services company would be set up for manufacturing/processing on this land, where the equity of the franchisee would be scaled down from 80% in the first 15 years, 70% in the next ten, and 55% in the last ten, to complete transfer at year 35.

While power generation in India has long been targeted for BOT/BOO-type participation by independent power producers (as also in Malaysia) the two-phase 2,015 MW natural gas combined cycle Dabhol power station project in Maharashtra State encountered problems at the very outset. These have been mostly attributed to a change of state government that led to a complete project review (not unlike some Thai transportation project scenarios), thereby providing a further example of the need to adequately manage the increased political risks in such long term projects that also impact directly on public users (unlike short term construction projects for a specific client). While a large U.S. corporation is involved in this Dabhol mega project, another U.S. company reportedly considered exit strategies on a U.S. $1.3 billion 1,000 MW coal fired power plant in Karnataka State. Government delays, a slow moving judiciary system (investigating alleged corruption charges that were subsequently quashed at the Supreme Court), and apparent conflicts between assurances at state and federal governmental levels were cited (Karp 1999). However, an overall governmental resolve persists, with eight fast-track projects designated to attract foreign investors. Gupta and Sravat (1998) provide a detailed description of the developmental project financing of such private power projects.

People's Republic of China

Apart from Hong Kong, which is now a Special Administrative Region within the People's Republic of China (PRC) and which started its BOT adventures while still a British colony, Mainland China has itself initiated many BOT projects and set up systems to facilitate BOT-based infrastructure development. It has been jokingly said that Hong Kong itself was one of the largest DOT (develop-operate-transfer) projects, given on a 99 year lease that ended with a smooth transfer in 1997!

BOT is just one of the emerging vehicles for foreign investment in the PRC, particularly in the power and transportation sectors. In February 1998, the PRC government itself announced the funding of a U.S. $750 billion infrastructure development program over the next three years. For example, 81 new power plants of at least 2,000 MW capacity were envisaged by 2010, while 35,000 km of expressways and Class 1 highways and 112,000 km of new provincial and country roads were envisaged over a 30 year period. Of course, the proportion of such projects that would be procured on a BOT basis depends on many variables.

Recognizing the needs for adequate legal frameworks and operational support, the Chinese government has, in the past decade or so, been engaged in developing the BOT infrastructure and initiating pilot project to test and refine concession protocols. For example, the BOT circular entitled ''Circular on Several Issues Concerning the Examination Approval and Administration of Foreign Funded Projects'' was issued by the former State Planning Commission jointly with the then Ministry of Power and the Ministry of Construction in 1995. This BOT circular provided a framework for selection, approval, and tender processes for wholly foreign-invested BOT projects.

Meanwhile, projects such as the Shajiao B (second phase) power plant in Guangdong province, the Yan'an Donglu second Tunnel in Shanghai, and a series of road projects may be said to have been at the forefront of innovative BOT vehicles used at local/provincial levels, with joint venture franchisees often involving Hong Kong companies in partnership with local organizations.

The Shajiao B power plant, with two 360 MW coal fired plants, was in full operation after 33 months of the 1984 agreement and had a designated 10 year operation period thereafter

J. Constr. Eng. Manage. 2002.128:93-102.

(Vickridge et al. 2000). The 2.2 km Yan'an Donglu second Tunnel project with a 30 year concession period from 1994 was described by Zhang et al. (1998), who also examined the governmental guarantees, risk distribution, advantages, and disadvantages of the project. The guaranteed return (of 15%) to the franchisee was cited as a disadvantage of this (joint venture investment) model to the PRC government, in that the government retained the major risks. Shen et al. (1996) examined the application of BOT to other PRC infrastructure development as well, and to governmental incentives such as tax holidays.

A more recent and coordinated initiative at national level identified five pilot projects to serve as models for expanded programs in power, water treatment, and transport. Of these, the 2×350 MW Laibin B power plant in the Guangxi Autonomous region, the Changsu thermal power plant in Hunan Province, and the water treatment plant in Chengdu, Sichuan Province, were issued for competitive international tender with the first two agreements concluded earlier. The Laibin B concession agreement for 18 years, including 33 months of construction, was signed in September 1997. This was the first wholly foreign-owned BOT venture, with two French organizations holding 25% equity, having raised 75% debt from limited recourse project finance. The only financial guarantee from the Chinese government was in the form of a take-or-pay contract to purchase a minimum of 3.5 GWh per year (Vickridge et al. 2000). The importance of this first national BOT-based project in setting standards and formulating model documentation and procedures is described by Wang and Tiong (1999).

In addition to these pilot projects, a review (funded by UNDP) of the PRC BOT regulatory environment and initiatives led to the BOT circular of 1995, which is a precursor to the expected general BOT regulations and legislation. Meanwhile, the Asian Development Bank funded the examination of issues involved in a BOT model for road development in particular, with consultancies awarded for the development of standard prequalification, tender, and concession contract documents (Tam 1998).

Revisiting Risks, Roles, and Relationships

While the primary function of contracts has been said to be a clear allocation of risks, and whereas the appropriateness of risk distribution in traditional construction contracts has been questioned, BOT scenarios provide both opportunities and challenges for a reappraisal of risk management. Challenges arise from the markedly increased project variables, much longer time horizons, greater vulnerability to external risks, and multiple project participants (including specialist financiers and operators), with multiattribute success criteria. While it has been said that risk allocation in such BOT-type scenarios is an art (Renton 1997), it is now necessary to introduce some science into this art, in order to minimize the problems mentioned in the previous section on road, bridge, and power projects in Thailand, Laos, and India, respectively, and indeed on other road projects—for example, in China and Mexico and an airport project in Toronto, Canada. Levy (1996) documented PPP projects that went awry in the U.S. due to problems such as changing political tides and a growing public mood of NTFIMBY (no toll facility in my backyard) in Washington state, and strong public opposition to the Metro Road project in Arizona. Lam (1999) tabulated risk mitigation measures adopted on a long list of such projects in many countries, along with the residual risks that nevertheless surfaced and the consequences suffered in these scenarios.

Renton (1997) rightly pointed out that high risk/high reward projects are unsuitable for BOT procurement, listing reasons such as difficulties in raising nonrecourse finance, which by definition depends on project cashflows and assets. After excluding such high risk projects at the outset, a detailed risk analysis is recommended with probability and sensitivity analyses, apart from traditional economic and financial analyses, before proceeding to formulating BOT documentation, which would allocate the risks.

While the growing literature on identifying and analyzing construction project risks provides useful background, it is worth focusing on risk classifications, identifications, and/or analyses specific to the BOT or PPP scenario, such as the following:

1. Tam and Leung (1999), who found that political risks were the most difficult to handle in comparison with financial risks, while technical risks were the easiest to handle, even on projects incorporating innovative technologies, in Southeast Asia.
2. Songer et al. (1997), who demonstrated a Monte Carlo risk assessment methodology for revenue dependent (privatized) infrastructure projects, yielding graphic best-case/worst-case scenario problem refinement techniques and flexible decision-making tools for assessing feasibilities and encouraging risk modification, mitigation, and eventual appropriate distribution.
3. Akintoye et al. (1998), who, noting the conscious transfer of risk to the private sector in the U.K.'s PFI (Private Finance Initiative), conducted a survey on perceptions of the relative importance of 26 postulated risk factors, such as design risk, construction cost risk, environmental risk, and legal risk. They presented rankings of the importance of such risks by the different groups surveyed, i.e., contractors, clients, and lenders, as well as a consolidated all respondents ranking. They also surveyed and commented on risk analysis and assessment techniques used in PFI schemes.
4. Merna and Smith (1996), who classified risks first into two broad categories of global and elemental—the first being those deemed to be generally outside the control of the project parties (including political, legal, commercial, and environmental factors), and the second including project risks (such as construction, design, technology, operation, finance, and revenue risks). However, it may be argued that some of the above global risks may be even to some degree within the control of the project sponsor, particularly if it is the government; hence, the following classifications are preferred, also because of their greater detail in breaking down risks.
5. Charoenpornpattana and Minato (1999), who presented a detailed identification of privatization-induced risks in transportation projects in Thailand. Their analyses extended to characterizing risks as static/dynamic, fundamental/particular, government/private/other source, speculative/pure, financial/nonfinancial, and measurable/immeasurable. Their risk classification itself grouped risks under five broad headings of political, economic, legal, transaction, and operation with specific risks of 6, 6, 3, 9, and 8 listed under these respective parent headings. After checking and analyzing each risk against each of the above sets of characteristics, they recommend whether it should be allocated to the private party or to the government or shared. In this latter context of shared risks, a model proposed by Kumaraswamy (1997) for risk distribution between parties on construction megaprojects in general may be conveniently coupled to graphically convey the specific and overall risk distribution profiles.

J. Constr. Eng. Manage. 2002.128:93-102.

6. Salzmann and Mohamed (1999), who identified families of risks (containing factors and subfactors) found to need addressing in BOOT projects. They presented these in two separate frameworks corresponding to the development phase and the operations phase, respectively. Their identification of 12 risk factors (such as project characteristics) together with 58 risk subfactors in the development phase and 11 risk factors with 39 risk subfactors in the operations phase was based on a detailed survey of available literature. While the framework may be expanded and/or amended in different scenarios, it provides a useful template to commence a risk identification, analysis, and distribution exercise as outlined in the previous references in item 5 above.

Having mitigated identified risks and redistributed residual risks appropriately, ideally to those project participants who are best equipped to deal with them, contractual documents and organizational arrangements will necessarily have to be reengineered to reflect these realities. Traditional relationships between various construction project functions such as client/promoter, designer, and constructor would also need reexamining and realignment. Changing long established mind sets may pose the greatest challenge, while providing opportunities to overcome problems from adversarial attitudes in traditional arrangements. Only then can meaningful win-win-win team-oriented BOT scenarios be properly generated.

Assessing Build-Operate-Transfer-Type Procurement Needs and Evaluating Proposals

Project Feasibility Assessments

Detailed risk assessment, as discussed in the previous section, should form an integral part of thorough feasibility studies of infrastructure megaprojects that are proposed for BOT-type procurement. It is useful to first clarify the core objectives of the proposals—whether they are the potential sponsors (e.g., government) or prospective franchisees forwarding unsolicited proposals. Although the latter is not uncommon in Asia, competitive proposals are usually invited thereafter. However, private sector consortia could submit unsolicited proposals, for example, even before the Private Finance Initiative in the U.K., under the New Roads and Street Works Act of 1990, and the government may exercise an option either to solicit further bids to introduce some competitive element, or to directly enter into an exclusive agreement (Levy 1996).

Many basic questions arise in the case of a project that is thought to be potentially appropriate for BOT-type procurement. For example: (1) Is the proposed project most suited for BOT-type (versus another form of) procurement? (2) If so, which is the most appropriate vehicle from the many versions, such as BOT, BOOT, and BOO, that are possible? (3) How should the franchisee be selected; i.e., against which criteria should proposals be evaluated? (4) What guidelines/conditions should be applied to ensure a satisfactory service to the public, e.g., with regard to toll/tariff levels, quality of construction, and operation? and (5) What guarantees/assurances/comfort letters should be given to potential franchisees to attract private investors?

Other questions that arise include those related to expected operational life, maintenance and environmental issues, ownership and land usage rights, strategic issues, technology transfers, and socio-economic and political concerns.

Having analyzed recent BOT project failures, Ogunlana (1997) warned that all infrastructure projects are not amenable to privatization, identifying nine characteristics that indicate suitability for BOT-type procurement: a stable political system, a predictable and proven legal system, government support for a project that is also clearly in the public interest, long term demand, limited competition, reasonable profits, good cash flows, and predictable risk scenarios. In addition, he cautioned against BOT-type projects that do not take off, for example, due to either a shortfall in the foregoing factors, wide gaps between government and private sector expectations, lack of clarity and transparency in government objectives, regulatory policies and decision making, inability to unbundle and manage risks, or inadequate capital markets and mechanisms for efficient long-term financing.

Ashley et al. (1998) developed a project scoring table (PST) tool based on nine high level evaluation criteria to assess the suitability of a project for PPP (public-private partnerships), from the viewpoint of transportation projects in the U.S. Decisions corresponding to these criteria are grouped into nine clusters: (1) political clearance; (2) partnership structure; (3) project scope; (4) environmental clearance; (5) construction risk allocation; (6) operational risk allocation; (7) financing package; (8) economic viability; and (9) developer financial involvement. Components within each of these clusters were also identified; e.g., the construction risk cluster "characterizes the technical and contractual risk allocation for the project," while the political clearance cluster "establishes the organizational structure, legislative status, and political standing of the project." Evaluation of each of these components is done first from the viewpoint of the government/sponsor and next from that of the potential franchisee. Win-win scenarios are distinguished from win-lose or lose-lose scenarios according to a proposed simple scoring system. This may be modified for Asian scenarios and for other infrastructure types, i.e., other than on transportation projects in the U.S., for which this was originally developed.

Evaluating Build-Operate-Transfer-Type Proposals

Methodologies for evaluating BOT-type proposals must necessarily compare expected (potential) performance levels against the main envisaged project success criteria. This draws in added dimensions related to financial packages and projected operational performance, in addition to mere cost considerations in traditional tenders, or cost and quality levels in design-construct tenders. Assessment of technical proposals involves evaluating designs and potential constructed facilities in a life cycle scenario including environmental impacts, while the financial proposal evaluation includes assessing financial strengths, financing arrangements, and toll stabilization/control measures. "Three envelope" systems have been used, on transportation projects, for example, where up to 70% weighting may be assigned for the financial proposal, around 20% for the engineering, and about 10% for traffic flow/transportation arrangements. More detailed breakdowns, including weightings between criteria, have been developed before inviting proposals, for example, as in Hong Kong and Sri Lanka.

If toll levels and/or franchise periods were not specified at the outset, these may also enter into the evaluation. Suitable sets of such evaluation criteria need to be decided upon within each package. The weighting between these individual criteria (and subcriteria) needs to be decided as well. Next, appropriate indicators must be derived for evaluating competing proposals against these criteria. For example, criteria such as financial viability and financial stability may be evaluated using indicators that include internal and economic rates of return, debt:equity ratios, and debt

J. Constr. Eng. Manage. 2002.128:93-102.

Table 1. Distinctive Winning Elements in Build-Operate-Transfer-Type Proposals

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

Note: CSF = critical success factor.

composition ratios (between long-medium-short-term debt). A benchmarking exercise is recommended to establish databanks of realistic ranges of values for such indicators in each sector (e.g., power) and region/country, in order to benefit from previous experiences.

Meanwhile, a survey of current approaches to evaluating BOT-type bids identified tools such as those described in the following:

1. Birgonul and Dikmen (1996), who proposed an approach using a ‘‘synthetic index’’ to accommodate all parameters that could affect the selection of the most feasible alternative. This is based on the BOT model that was formulated in Turkey in the 1980s and focuses more on the net present value (NPV) type indicators of cash flow to derive modified NPVs, i.e., weighted according to other parameters that in turn lead to the synthetic indices and the ranking of competing bids.
2. Tiong and Alum (1997a), who presented an overview of current practices and techniques based on the aforementioned NPV methods, other scoring systems, and the Kepner-Tregoe decision-making technique. The latter is a simple but well structured general decision-support strategy that first separates ‘‘musts’’ from ‘‘wants’’ criteria, next rejects proposals that do not comply with the (essential) musts criteria, and then scores (rates) each of the other proposals in turn against the wants criteria, which are themselves first weighted according to their relative importance. The overall weighted totals of each proposal can then be conveniently compared.
3. Lloyd (1996), who confirmed that the aforesaid Kepner-Tregoe decision-making analyses were indeed used in practice, in this case by Hong Kong BOT tender assessment panels on the basis of criteria developed exclusively for each project prior to the receipt of tenders, with weightings being assigned to each criterion. He went on to describe the sequence of evaluation steps involving three panels from relevant policy branches (bureaus) and departments, the watchdog role of the ICAC (Independent Commission Against Corruption), as well as the clarification and negotiation stages that are needed on these types of (multiattribute, multiple stakeholder, multidimensional and multidisciplinary) projects.
4. The Sri Lankan Guidelines on Government Tender Procedure Part II (Ministry of Finance and Planning 1998), which identifies the key factors of evaluation as (1) the price offered, e.g., price/KWh, toll, or rent; (2) the duration; and (3) the tariff structure, while listing five main criteria for evaluating the technical aspects and three main criteria for evaluating the financing plan.
5. Merna and Smith (1996), who proposed a BOOT bid evaluation model based on a matrix point system centered on criteria such as: (1) meeting the terms of the concession; (2) the residual value of the facility; (3) the selling price of the product or off-take; and (4) other project-specific factors. They also proposed structuring bids into four packages: construction, operation, financing (including loans), and revenue (including toll/tariff levels and other assorted revenue schemes).

While the foregoing survey observations are framed from the perspective of the BOT sponsor, prospective franchisees would doubtless benefit from an appreciation of the systems, criteria, and indicators employed to evaluate their proposals in improving both their competitiveness and their eventual performance. Furthermore, the following section specifically shifts the perspective to that of the franchisee.

Success Factors and Winning Elements in Build-Operate-Transfer-Type Bids

Tiong (1996) studied a set of recent projects and surveyed their participants in order to identify critical success factors (CSFs) that need to be focused upon by bidders in pursuit of BOT-type franchises. He identified six such factors: (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. Analyses of these CSFs and the formulation of corresponding critical success subfactors led to the identification of a proposed tendering and negotiation model as a process model for developing superior proposals for BOT tender and negotiation.

Tiong and Alum (1997a) followed this with further surveys and analyses to identify the distinctive winning elements (DWEs) at the final selection phase. For example, the DWEs for the following three CSFs were identified as listed in Table 1.

The DWEs of successful proposals were compared with those of the unsuccessful bids in three case studies of the Eastern Harbor Crossing and Tate’s Cairn Tunnel in Hong Kong and the Labuan Water Supply project in Malaysia. It was found, for example, that the DWEs targeted by the sponsor and the winning proposal (franchisee) were very similar in the Tate’s Cairn Tunnel project, within the CSF of technical solution advantage. In general, it was found that a competitive edge is achievable through a cost-effective solution and a financial package that surpasses others in meeting government priorities such as construction costs and concession periods.

Meanwhile, additional CSFs have been proposed by others—for example, ability to provide a suitable transfer package, built-in flexibility for future growth and changes, and supportive community (based on a ‘‘smart’’ marketing of expected benefits from the project).

J. Constr. Eng. Manage. 2002.128:93-102.

Specifically, the importance of the financial component in the proposals is particularly evident in that this could contribute to around 70% of the evaluated score, as indicated in recent Hong Kong toll tunnel projects. Tiong and Alum (1997b) analyzed the detailed requirements for winning financial proposals in greater depth.

Concluding Observations and Recommendations

It is useful to conclude by integrating the perspectives on success factors considered separately in previous sections, in order to derive an overview on the overall success of BOT-type projects for the multiple participants. This would broadly aim at a win-win-win scenario for the various project participants from the public and private sectors as well as the ultimate public users. Many lessons have been learned from recent megaproject experiences, including the following:

1. Careful evaluation of the suitability of a project for BOT-type procurement appears critical at the outset, for example, with stable political and legal regimes and suitable socio-economic conditions with the project being clearly in the public interest, capable of sustaining steady cash flows, and being provided with adequate safeguards against the various risk factors;
2. A reasonable but not excessive rate of return is needed, again with any useful safeguards such as sensible toll adjustment mechanisms to achieve the desired balance;
3. A proactive, stable, and reasonable (including noncorrupt) sponsor (e.g., government/public sector body) is needed; and
4. A financially strong, technically competent, and managerially outstanding consortium is required as a franchisee, who should hopefully be attracted by the foregoing conditions.

Even on infrastructure projects deemed suitable for BOT-type procurement, deep SWOT (strengths, weaknesses, opportunities, and threats) analyses may be needed from time to time in advance of critical decisions such as the precise type of BOT (or PPP) to be adopted and the franchisee selection. Arriving at an appropriate BOT-type formula and a ''winning team'' for a given project scenario is complicated by the many unknowns and ''unlikes'' that cloud projections and comparisons. Nevertheless, the rapidly growing, but hitherto scattered, body of experience in BOT-type exercises is well worth consolidating into a BOT body of knowledge. Codifying this knowledge and benchmarking good practices that have evolved in more experienced countries and/or sectors with a record of relative success would help to establish basic guidelines and minimal requirements. These would help, for example, in striking a balance between too much and too little governmental guarantees/support, the former making it too easy for the franchisee at the expense of the public, while the latter may not attract any competent franchisees. Comprehensive risk identification and analysis, also drawing on recent BOT-type experiences, would contribute to achieving this balance.

Guidelines based on benchmarks and toolkits derived from tried and tested techniques would assist in the formulation and management of such BOT-type projects. The envisaged BOT body of knowledge should also include databanks of criteria, subcriteria, corresponding indicators for evaluation, and reasonable ranges of values for these indicators such as rates of financial and economic return. The databanks would ideally be classified according to both sectors and regions in order to facilitate meaningful comparisons. An in-depth and wide-ranging study appears useful for assembling this BOT body of knowledge, which would necessarily incorporate knowledge assimilated from various PPP (public-private partnership) procurement scenarios throughout the world.

The truism that each civil engineering project is unique is accentuated with the introduction of additional (and often volatile) variables in BOT scenarios. However, national regulations and laws are being formulated to provide minimal safeguards and basic frameworks. Model agreements and documentation formats are also being developed. Such developments are essential to provide viable frameworks and to inject the required consistency and certainty into these scenarios, so as to reduce the dangers of less than reasonable agreements being imposed on less experienced parties or those with lower bargaining power, or indeed being extracted through corrupt practices.

Morris and Kumaraswamy (1997) projected at least a fivefold increase in private investment in public infrastructure between 1995 and 2010. This was based on World Bank projections of: (1) increases in expenditure on new infrastructure in developing countries as a percentage of their GDPs; (2) increases in the private sector share in such expenditure; and (3) increases in the GDPs themselves, given the projected growth rates. Furthermore, the trends traced in this paper indicate an acceleration in private sector interest and governmental solicitations. These enhanced push-pull factors are likely to lead to private investment levels that even exceed previous projections, thereby promoting new openings for all concerned.

Furthermore, the paradigm shift in procurement has brought on stream infrastructure megaprojects that would have otherwise not been feasible. Common objectives encourage partnering type mind sets eliciting the synergistic teamwork that has evidently eluded most traditional construction procurement systems in recent decades. However, not all megaprojects are suitable for BOT-type procurement, and a detailed feasibility study is essential to avoid breakdowns as have been seen already. On the other hand, other forms of public-private partnerships (PPP) have been successfully applied to even smaller projects such as smaller roads, hospitals, and prisons, suggesting that appropriate modalities of PPP may achieve desired synergies on other projects as well, although still not constituting a panacea. Innovative procurement and creative financial engineering strategies have thus opened up more opportunities, while providing fresh challenges to project managers.

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J. Constr. Eng. Manage. 2002.128:93-102.