Public-Private Partnerships

Case Study #1

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Traffic Demand Risk: The case of Bangkok's Skytrain (BTS)

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The following case study examines the issue of traffic demand risk and sheds light on how the problem of inaccurate ridership forecasts can impact a PPP project by using the example of the Bangkok SkyTrain.

TRAFFIC DEMAND RISK

Even though literature is rich about theory and practice of traffic forecasting, insufficient attention has been paid to the predicted accuracy of traffic forecasting models and the consequences of occurring errors.

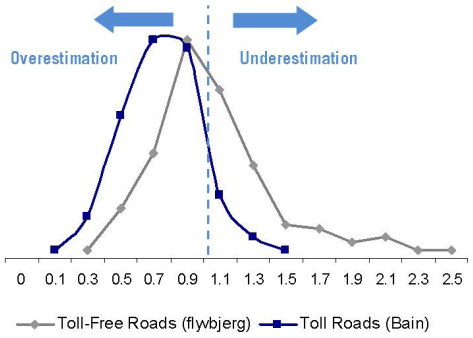
Emperical studies suggest however that traffic forecasts in the transport sector are characterized by large errors and considerable optimism bias.[1] This statement goes in line with the review conducted on PPP projects financed by the European Investment Bank which states that major issues in road projects occurred because of traffic performance has been overestimated. Findings disclose that 1/2 of toll road projects failed to meet their early-year forecasts; often by some margin (errors of 50% - 70%).[2]

This pattern of forecasting error and systematic optimism-bias is even more marked in the case of toll roads compared to toll-free road as illustrated in figure 1, which compares two samples of international transport projects.[3,4]

Commonly reported drivers for these inaccuracies include the complexity of the project, the underestimation of the severity and duration of ramp-up, the overestimation of the value of time and the dependence on macro-economic projections.

Recognizing the potential risk caused by inaccurate forecasts for the viability of PPP projects, the rest of the paper will examine the case of the Bangkok BTS project to see how this issue has impacted the project and what solutions have been found.

Figure 1 : Actual/Forecast Traffic



BANGKOK BTS: CASE SUMMARY

Bangkok covers about 606 square miles and is densely populated. By 1990 it was renowned for its chronic traffic congestion, and over the subsequent decade vehicle ownership more than doubled. Heavy traffic volume which is caused by bus, car and motorbike journeys was making Bangkok one of the worst cities in the world in terms of congestion and air pollution caused by vehicles.

With support of developing partners several studies have been conducted which recommended to establish a rail transit system in Bangkok to help develop the outer areas and to help mitigate the congestion problems in Bangkok's city centre. However, the cost of the system - estimated at over US$1 billion – was more than the government was able to fund on its own.

The government decided then to develop a 30-year Build-Operate-Transfer (BOT) scheme for the elevated rail transit system.

ESCAP supports governments in Asia-Pacific in implementing measures to efficiently involve the private sector in infrastructure development. This case study is part of this effort and promotes exchange of experience among the countries of the region

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Total cost was estimated at $1.4bn and was financed 1/3 by equity and 2/3 by debt

Financing Package

The total cost of the BTS was estimated at THB 55.5 bn ($1.4 bn), financing came from both equity and debt funding. The debt to equity ratio was determined at 2:1. Debt came from two development banks - the International Finance Corporation (IFC) and the Kreditanstalt für Wiederaufbau (KfW) as well as from Thai banks.[5]

The three main banks (KfW, IFC and Siam Commercial bank) involved agreed upon three principles in structuring the project finances:

- A major portion of the loans coming from local banks to safeguard the project from political interferences and reduce foreign exchange risk;
- The construction consortium sharing the risks of the initial operations to ensure completion on time and high quality;
- The financing package, including support loans, adapted to the expected cash flow to allow for weakness during the start-up period.

Partnership Structure

The initial partnership structure of the PPP is illustrated in Figure 2. On one hand, the public partner was the Bangkok Metropolitan Administration (BMA), which is the local government of the city. Several agencies of BMA have been involved in this PPP.

One the other hand the private partner was the Bangkok Transit System Corporation (BTSC), which was formed in 1992 to implement the project. The BTSC was permitted to retain all revenue deriving from the system operation for 30 years.[6]

Infrastructure

The SkyTrain system entered into service in 1999. The original network comprises 23.5km of elevated trackwork and 23 stations built on a single column support structure, which runs through the heart of Bangkok's commercial, business and tourist districts.

Tariff

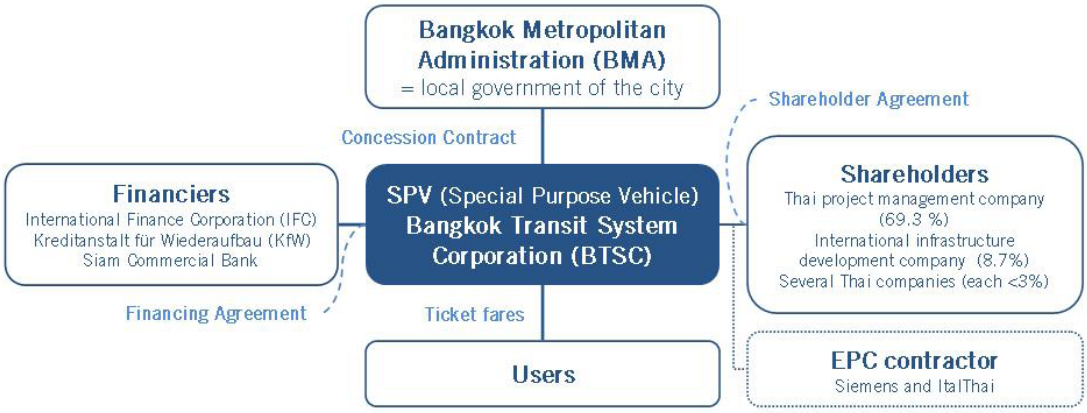
Skytrain ticket fares were priced below the cost of a taxi (for a single person), but above the cost of other public transportation services like buses. There was no integration of fare with other transport modes, which had a negative impact on BTSC's ridership.

Under the terms of the concession contract, BTSC required BMA's approval before adjusting system fares (formula based on inflation, interest rates, power tariffs, devaluation of Baht and any major new investment requested by BMA). The system's current fare structure is zone based with options for monthly passes.[7]

Risk and reward allocation

In 1992, the BOT agreement between the BMA and the BTSC was signed. The private partner BTSC was responsible for 100% of design, financing, construction and operation and further has to ensure adequate levels of safety in operations and security. Whereas the public partner provided the right-of-way and assisted in relocation of utilities along route during construction.[8]

Figure 2 : Structure



In accordance with the contract, the revenue stream for BTSC is based completely on fares; the government does not provide any funds to BTSC for operating the transit system (also called the "Net Cost" model). BTSC retains however all advertising revenue and revenues from right-of-ways. BTSC also had not to pay a licensing fee to BMA for the first ten years of the contract.

Given these provisions and projected ridership, it was estimated that BTSC would recover its costs within the first ten years with at least a 16% rate of return.

RIDERSHIP FORECAST

Even though the forecast predicted 600,000 riders per day for the opening of the system, the actual initial ridership was 150,000 (25% of forecast). By 2006 ridership increased to 380,000 riders per day, still significantly below predicted levels.[9,10]

Several reasons explain the lower-than-expected ridership:

- **Missing integration** with other public transport modes led to low acceptance. Some other mass transit projects were also delayed/cancelled or not optimally interconnected with the BTS.[11]
- **Accessibility**: the accessibility of the Skytrain stations was not sufficiently considered during the design. The line had few direct ramps into malls and lacked escalators. Bit by bit, while escalators were installed and side bridges built, ridership increased.[12]
- **Limited network**: In the beginning the BTS only covered 23.5km along two routes in the centre of Bangkok thereby not meeting the needs of many potential customers.
- **Fare level**: the BTS fares are higher compared to other public transport modes like buses or government-subsidized ordinary trains which might have impacted ridership level (the more wealthy population tends to use personal cars).
- **Lack of benchmark**: there was no previous mass rapid transit system in Bangkok that could serve as a reference for traffic modelling. Therefore models from other countries had to be used and these models most likely overlooked some local characteristics. For instance, the weather as well as the footpath infrastructure in Bangkok is not conducive for walking. This means that the catchment area of each BTS station might be limited unless these stations are well integrated with other public transport modes or easily accessible from residential and commercial centres.

The inaccuracy of traffic forecast is actually not particular to the BTS project. The other mass rapid transport project in Bangkok implemented as PPP: the MRT Blue Line faced the same issue (the MRT blue Line is the underground metro line opened in 2004). In 2013, the actual number of passengers per day for the MRT Blue Line is barely 30% what was forecasted initially.

FINANCIAL IMPACT

This inaccurate forecast (figure 3) has led to several major financial problems for the elevated transit system and the near collapse of the private company BTSC, which was created for the project. The depreciation of the Thai Baht in 1997 even worsened the situation as the debt burden significantly increased.

This led to BTSC default on payment in 2002 and to the launch of discussions with creditors on debt restructuring plan. As little progress were made, BTSC decided in 2006 to bring the issue to the Bankruptcy court and filed for business rehabilitation on 20 February 2006, which was approved on 31 January 2007. According to the plan, BTSC converted a large part of debt to equity (the leverage ratio dropped from 2:1 to less than 0.3:1) and large write offs of both equity and debt were made.

On 29 October 2008. BTSC was released from business rehabilitation and started to make its first profit. Shortly after, BTSC benefited from a surge in ridership due to two line extensions (a 2.2 km line extension in 2009 and a 5.5 km extension in 2011). Unlike the initial system, these extensions were fully funded by BMA (i.e. Civil Works and Mechanical & Electrical Investments).

In April 2013, an infrastructure fund backed by revenues from the BTS SkyTrain, the

Initial ridership was only 25% of the forecasted level

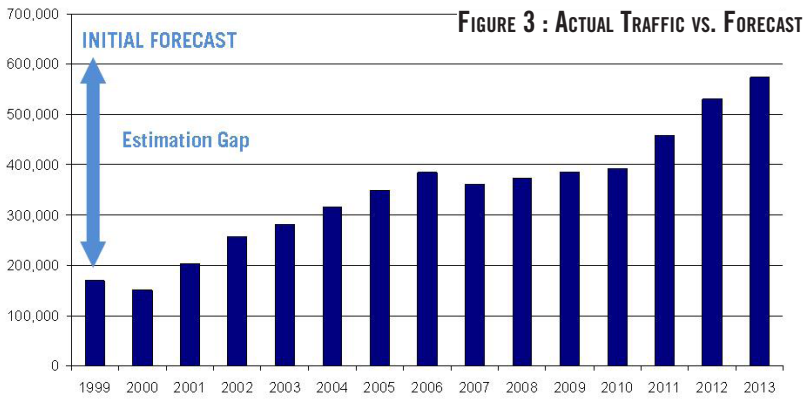
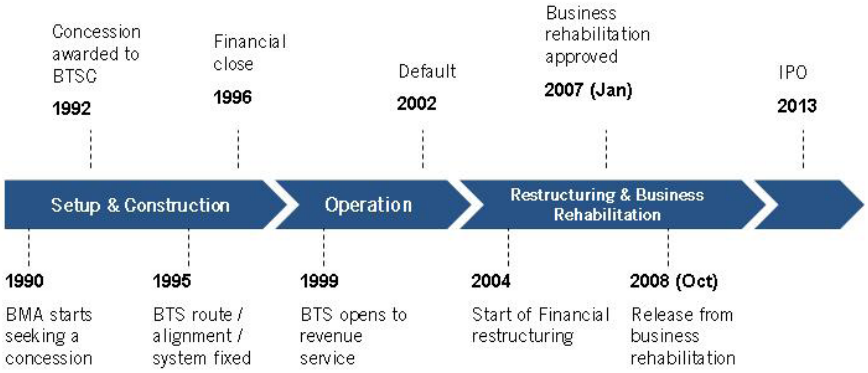


Figure 3 : Actual Traffic vs. Forecast

Figure 4 : Timeline



Due to financial difficulties, a large part of debt was converted into equity

BTS Rail Mass Transit Growth Infrastructure Fund (BTSGIF), raised about US$ 2.13 bn in the biggest Initial Public Offering (IPO) in Thailand's history. Proceeds from the IPO were used to buy BTSC rights to future net farebox revenues for the remaining concession years (i.e. until 2039 / netfarebox revenues = farebox revenues - operating costs and capital expenditure).[13]

BTSC remains however the exclusive concessionaire, the exclusive operator as well as the largest economic stakeholder in revenues of the core network via its main shareholder BTS group, which also hold 1/3 of BTSGIF shares. BTSGIF hopes to finance new mass-transit projects in the future.

CONCLUSION AND OUTLOOK

The BTS project can be considered as successful from an operational point of view. It has contributed to ease traffic congestion in central Bangkok and the project took only 9 years from the initial concept phase to commercial operation, which is short period of time for this type of project.

The public investment has also been very limited as only land was provided for the initial network. On the contrary, for the MRT Blue Line, the government had to finance the civil works in addition to the right of way, thereby financing 85% of the total project cost.

The inaccurate ridership forecast made however the BTS project very unsuccessful for the investors and the financiers. This will most likely have an impact for future mass rapid transit projects in Bangkok as private investors might be reluctant to support demand risk in the future (i.e. to rely on fares collected to repay for their investment). For example, the lack of private sector's appetite for demand risk might explain why the government opted for a "Gross Cost" concession type for the next MRT line currently under construction: the MRT Purple Line. In a Gross Cost model, the government retains all revenues collected and pays the concessionaire an amount to cover its cost and profit, provided that the agreed service standards are met. This means that private operator's revenues are no longer linked to the actual ridership level. This also means that the operator has less incentives for increasing this level.

To conclude, the BTS case illustrates the difficulties of transferring demand risk to the private partner in a context of inaccurate forecasts. Retaining demand risk creates however other issues like a sub-optimal incentive structure. In this respect, considerations might be given to hybrid solutions like the "Modified Gross Cost" model where the concessionaire's remuneration incorporates a component that is related to patronage (e.g. bonus payment for achievement patronage targets). As usual in PPP projects, finding the right balance in risk allocation will be critical to the success of these projects.

End Notes

[1,4] **Bain, R. (2009)**: Error and optimism bias in toll road traffic forecasts. Springer Science.

[2] **Bain, R. (2009)**: Review of Lessons from Completed PPP Projects Financed by the EIB.

[3] **Flyvbjerg, B., Holm, M., Buhl, S. (2005):** How (in)accurate are demand forecasts in public works projects?

[5] **World Bank (2004)**: A Tale of Three Cities: Urban Rail Concessions in Bangkok, Kuala Lumpur and Manila. London: Halcrow Group Limited.

[6, 12] **Tris Rating (2009)**: Credit News. Bangkok Mass Transit System Public Company Limited. Available at http://capital.sec.or.th/webapp/corp_fin/datafile/dsf/1076122009-07-28TD104L02083.PDF.

[7,11] **Mandri-Perrott, C. (2010)**: Private Sector Participation in Light-Rail-Light Metro Transit Initiatives. World Bank/PPIAF.

[8,9] **Spicer, M. (2006)**: BTS Skytrain Case Study – The experience of Bangkok's first private mass-transit concession. IFC (International Finance Corporation). Presented at the WB Transport Learning Week 2006.

[10] **UNDP (2013)**: Bangkok Thailand, Rapid Transit System.

[13] **infrapppworld.com (2014)**: Bangkok's skytrain operator raises $2.13 billion in IPO. Available at: http://infrapppworld.com/

Picture on page 2: Stefan Ray (from flickr)