Available online at www.sciencedirect.com
ScienceDirect
International Journal of Project Management xxx (2006) xxx–xxx
INTERNATIONAL JOURNAL OF PROJECT MANAGEMENT
www.elsevier.com/locate/ijproman

Risk allocation in the private provision of public infrastructure

A. Ng, Martin Loosemore *

Faculty of the Built Environment, University of New South Wales, Sydney, NSW 2052, Australia

Received 7 March 2006; received in revised form 5 May 2006; accepted 20 June 2006

Abstract

Communities benefit most from the private provision of public infrastructure when project risks are distributed appropriately between private and public sectors. This is not easy given the technical, legal, political and economic complexity of infrastructure projects and the range of constituencies involved. Too often, risks are under estimated and allocated to parties without the knowledge, resources and capabilities to manage them effectively. The result is increased costs, project delays and services which fail to deliver value-for-money to the community. This paper presents a case study of the controversial $920 million New Southern Railway project in Sydney, Australia. It analyses the rationale behind decisions about risk distributions between public and private sectors and their consequences. It also demonstrates the complexity and obscurity of risks facing such projects and the difficulties in distributing them appropriately. The paper concludes with a series of recommendations to better manage risks in such projects.

Keywords: Procurement; Private/public partnerships; Alliances; Risk management; Infrastructure; Community

1. Introduction

In most countries, the stock of public infrastructure represents an enormous asset, which effectively managed, plays a critically important role in attracting foreign investment and supporting a nation's social, cultural and economic stability, productivity, development and prosperity. For example, in 1994, the US Public Accounts Committee predicted that continued reductions in US highway investment could, over 20 years, cause a 3.5% reduction in GDP, an 8% increase in inflation and a 2.2% increase in unemployment [1].

Typically, infrastructure projects can be divided into two broad categories; *economic infrastructure* and *social infrastructure* [2,3]. Economic infrastructure projects include bridges, drainage systems, sewage treatment plants, telecommunications networks and road, rail and air transport facilities, etc. Social infrastructure includes education, prisons, health, tourism and recreational facilities, etc. However, *all* infrastructure projects share several common characteristics:

1. They are generally long lived and typically involve significant technical, legal, political and economic risks, long payback periods, high gearing and negative returns in early years. For example, the consortium which built Australia's largest ever privately funded infrastructure project, the $1.2 billion Melbourne City Link was given a 34 year concession period to operate the private toll road.
2. In fear of monopolies, public authorities sometimes introduce excessive competition, regulation and control which can stifle innovation [a major reason for going to the private sector]. For example, experience has shown that approval processes in such projects can be frustratingly lengthy and costly, government objectives can be unclear, tendering costs can be excessive, government commitment can vary, abatements can be excessive and usage rates of the final facility can be less than anticipated [4,5].
3. Given the importance of infrastructure to the general public and the quality of service provided by private sector operators, levels of community involvement and

* Corresponding author. Tel.: +61 2 9385 6723; fax: +61 2 9385 5613.
E-mail address: m.loosemore@unsw.edu.au (M. Loosemore).

0263-7863/$30.00
doi:10.1016/j.ijproman.2006.06.005

Please cite this article as: A. Ng, Martin Loosemore, Risk allocation in the private provision of public infrastructure, International Journal of Project Management (2006), doi:10.1016/j.ijproman.2006.06.005.

accountability are high, as are political pressures which can interfere with the effective funding, management and procurement of a project. For example, the Victorian Department of Treasury and Finance in Australia, which annually procures over $1.8 billion of public infrastructure, noted that the political and social context in which infrastructure projects are undertaken requires that public consultation be fully integrated into the planning process [6]. It argues that at the core of such projects is a complex web of relationships among bureaucrats, politicians, media, employees, general public [local, national and sometimes global], labour and special interest groups. Irrespective of any ideological preferences that Governments of the day may promote, these interest groups invariably have high expectations in relation to the management of issues such as the environment, health and safety, industrial relations and access and equity. As Sharp [6] notes, any infrastructure project lives or dies on its reputation with these people.

Despite the existence of many complex risks which can interfere with the success of infrastructure projects, the private sector has been keen to take over the traditional role of the public sector in financing, procuring and managing such assets [5,7,8]. However, recent research has indicated that even on the largest Public, Private Partnership (PPP) projects, risk management practices are highly variable, intuitive, subjective and unsophisticated [4]. In this context, the aim of this paper is to explore the considerations to be made in effective risk distribution between the public and private sectors on such projects.

2. The structure of PPP agreements

PPP is an evolving concept which takes many forms around the world. However, it is essentially an arrangement by which private parties participate in, or provide support for the provision of infrastructure-base services. In contrast to traditional public procurement which involves the public sector purchasing an asset, the PPP system involves the purchase of a stream of services, defined in a detailed service agreement under specified terms and conditions [9,12]. In simple terms, this is done via a concession contract which involves a host government granting a licence or concession to a private consortium [concessionaire, promoter or sponsor] which sets up a single purpose entity known as a Special Purpose Vehicle (SPV) using contracts secondary to the concession, to finance, design, build, operate and maintain an infrastructure project for a set period of time known as the concession period. The private consortium is normally formed by a joint venture (JV) between a range of organisations including contractors, facilities managers, banks, investors and suppliers, which are willing to commit equity and/or resources to the project. Payments to the SPV to fund debt service normally commence after completion of the construction – when the services have be made available to the public. During the operating period, the SPV receives income based on the usage of the facility [which may be guaranteed] assuming that the service provided meets a range of key performance indicators. For example, the Colombian government agreed to reimburse the consortium which constructed the recent El Cortijo-El Vino Toll road in Colombia, if traffic was less than 90% of a specified level and went even further in the new runway at Bogota's El Dorado Airport, guaranteeing a minimum revenue. There are normally abatement clauses in the concession contract, which can penalise [sometimes excessively] the SPV for falling below these standards. Furthermore, there are sometimes penalty points, which if accumulated to a certain level can lead to termination of the contract for poor performance. At the end of the operating period, the fully operational project is transferred back to the host government, usually at nominal or no cost [10].

3. Balancing public/private risks and rewards in PPP projects

In investing in a PPP project, private sector companies aim to achieve a return on their investment in generating sufficient future cash flows to cover initial capital costs and finance charges, thereby providing enough profit to invest in future projects and pay shareholder dividends. In contrast, the aim of the public sector is to ensure a level of service to the community which is timelier, more cost efficient and higher quality than if the public sector had retained responsibility. While some rather anecdotal evidence exists to indicate that PPP projects can better serve community objectives, than traditional public provision, by reducing risk exposure, the debate is likely to continue until a sufficient number of projects have been studied in detail over their entire life-cycle. Nevertheless, the current arguments from each side of the fence are summarised below.

3.1. Risks in the private provision of infrastructure

It has been argued that concession contracts involve relatively high waste, rework and transaction costs due to lengthy and complex tendering arrangements and post-tender negotiations resulting from overly optimistic public sector comparators, large numbers of stakeholders and the complex web of contracts and financial structuring needed to bind them together. It also has been argued that the complexity of these arrangements increase public sector risk rather than reduce it, increases service costs for the public and represent a barrier to entry to small companies which is unfair and reduces competition [7].

Another argument against PPPs is that in some situations, they are not economically viable for the private sector without exorbitant risk-related service charges for the public. A good example in Australia are rural roads which do not provide the volume of traffic needed to justify a user-pays approach which lies at the heart of concession

Please cite this article as: A. Ng, Martin Loosemore, Risk allocation in the private provision of public infrastructure, International Journal of Project Management (2006), doi:10.1016/j.ijproman.2006.06.005.

contracts [11]. In this situation a DCM contract is likely to provide better value for money to the public, while still providing the private sector with an incentive to consider the whole life cycle costs of an asset. It does this by comparing costs with a public sector comparator, which represents a hypothetical risk adjusted cost estimate based on an assumption that assets are acquired through conventional procurement routes and that the procurer retains significant risk exposure [12].

Furthermore, in order to compensate for the largely unknown risks involved over periods of up to 35 years, the private sector will inevitably demand high risk premiums, as will the financial institutions and members of supply chains which serve them. The result is an accumulation of risk premiums throughout the project supply chain, reflecting more a public inability and/or unwillingness to manage risk rather than a more efficient transfer of responsibility. It is argued that this uncertainty is inevitably transferred to the public in the form of higher charges for the services delivered. There is also substantial evidence that it is difficult to predict the extent of risk in such projects, of inappropriate risk distribution between the public and private sectors and of overly optimistic businesses cases and resulting in some very high profile debacles, which have cost taxpayers many millions of dollars. For example, in the recently completed Sydney Cross City tunnel, which was completed 6 weeks ahead of schedule, initial predictions of initial usage rates of 35,000 per day, one month after opening, it was only 20,000 per day after 6 weeks. When the government introduced a 5 week toll-free period to encourage usage, patronage only rose to 55,000 per day and it is now faced with the prospect of paying compensation to the project consortium [13]. Similar experiences have been reported on other major projects such as the Sydney Airport Rail Link and Eurotunnel project where government business cases were also too optimistic and ignored other competition [14]. Even today, Eurotunnel is operating at about half its capacity and there are continuous attempts to attract business from cut price ferries and airlines and expand the business by increasing the freight arm – including attracting long-haul rail freight.

There are also serious questions of effectiveness in some sectors. For example, in the health care sector and other highly specialised areas, the outsourcing of projects to the private sector has led to problems associated with a lack of understanding of the unique technologies, cultures and politics involved in this sector [15,16]. This is particularly the case when they are contractor-led rather than Facility Manager-led. For example in the UK, research shows that in the prison sector, where all SPVs are facility management led, the clients feel more understood and happier than in education, where SPVs tend to be contractor-led [17].

Finally, there are fears among public interest groups such as unions that the private provision of infrastructure effectively represents the privatisation of public services. It has been argued that this will result in a major loss of control over working conditions for public sector employees, abuses of monopoly power to the detriment of public interest, lower national security and less incentive to control the potentially huge impact of infrastructure developments on the environment [5,9]. In recent years, environmental and anti-globalisation pressure groups have become particularly vocal and active in highlighting the social, cultural and ecological impact of large international PPP projects. These activists can expose participating organisations to unbearable reputational risks, as was illustrated in the case of Balfour Beaty and Skanska which recently pulled-out of the Llisu Dam project in Turkey in fear of the adverse publicity it would bring [18].

3.2. Risks in the public provision of infrastructure

Critics of the public provision of public infrastructure argue that given proper incentives, regulation and control, the private sector is better placed to deliver value for money to the public [19,11]. This derives from shareholder pressures for performance and accountability, greater clarity of objectives, higher management expertise and autonomy, lower levels of regulation and control, a competitive environment, continuous improvement against clear key performance indicators, access to a wider range of equity not available to the public sector and managerial incentives and rewards for innovations. Advocates of PPP projects argue that these benefits are vividly illustrated in successful concession projects such as the privately funded M4 freeway in Sydney which was completed 6 months ahead of schedule, the third runway at Sydney Airport which was completed 15 weeks ahead of schedule and $30 million under budget, offering a total saving of $200 million and, Junee Prison in Australia which was completed 3 months ahead of schedule and under budget saving an estimated $3 million in procurement costs.

It has also been argued that the shift of funding responsibility to the private sector reduces public debt and finance costs, freeing up money to invest in other areas of public interest such as education and welfare. It is also possible for the public sector to reduce its in-house project management and maintenance workforce and equipment. Not only does this release more money to invest in public services but due to the almost unlimited finance capacity of the entire private sector, projects that otherwise might not have been built for some time, can be delivered many years earlier than anticipated. For example, in Australia, it has been argued that the private involvement in the new Port Macquarie hospital has delivered an upgrade in health services to the community long before the public sector alone could have done so.

Another benefit of PPP projects is the whole of life cycle approach it encourages in the procurement and management of public sector assets. By creating a single point of responsibility for an entire project from inception through design, construction and operation, a strong incentive is created to think about the implications which a design or construction decision will have on the operating effective-

Please cite this article as: A. Ng, Martin Loosemore, Risk allocation in the private provision of public infrastructure, International Journal of Project Management (2006), doi:10.1016/j.ijproman.2006.06.005.

ness and costs of a managing and maintaining a facility during its operational life. Since over a 25-year period, these costs can be as high as 10 times initial capital costs, this results in enormous savings for the public sector [20,21]. For example, it has been estimated that as much as 10% of the capital investments made in health facilities in Australia are wasted due to poor facilities which create huge maintenance liabilities [22]. When one considers the amount of money being spent, this is an enormous problem. For example, with the overall health related capital investment in Australia being about $3.9 billion a year, the potential savings of improving the health facilities planning process could be $390 million per year [22].

4. Risk classifications in PPP projects

Given the complexity, size and time frame of concession contracts, there are an enormous range of potential risks which can affect expected outcomes. Nevertheless, in very simple terms, these can be classified into two main groups: *general risks* or *project risks*.

Project risks arise from the way a project is managed or from events in its immediate microenvironment. They may include natural risks such as ground problems and weather conditions, technical problems associated with designs, plant and equipment, materials problems associated with suppliers, organisational problems associated with subcontractors, manpower problems associated with unions, contractual problems associated with JV agreements and environmental problems associated with pollution, etc.

In contrast, *general risks* are not directly associated with project strategies, yet can have a significant impact on its outcome. These normally arise from natural, political, regulatory, legal and economic events in the general macroenvironment surrounding the project. For example, the 2.015 MW Dabhol Power Plant in India was ordered to stop by the newly elected Maharashtra government in August 1995; the Tiananmen Square incident in China on 4th June 1989 resulted in the syndication of loans for the new Guanzho–Shenzen–Zhuhai super highway to be delayed until 1991 and; a 45 km BOT toll road in Shenzhen was delayed because the consortium and government could not agree on appropriate toll charges [9,23]. In other examples of poorly managed general risks, the US$2.5 billion Malaysia North-South highway suffered a 75% cost overrun largely due to inadequate allowances being made for inflation. Furthermore, in the 1970s, the Spanish government guaranteed 75% of the loans on its new highway network and assumed the full exchange-rate risk, a decision that eventually cost the Spanish Taxpayer an estimated US$2.7 billion. To help mitigate such risks, governments often guarantee exchange rates. For example, in a major road project in Vietnam, assurances were given by the government bank on the right to convert Dong (Vietnam's Currency) into foreign currency at a certain rate of exchange. Similarly, on the North-South Highway project in Malaysia, the government undertook to compensate the project consortium if traffic flows and resulting toll income fell below a certain level [23].

While general risk classifications such as the above are useful, it is also useful to consider the special risks associated with the PPP procurement process. After all, it is quite different to the traditional procurement process which separates financing, design, construction and operational responsibilities. In doing so, Standard and Poor's considers several broad areas that can potentially affect a PPP project's creditworthiness. These are:

- Credit risk of the public sector entity – Since the SPV relies on a payment stream from the government counterparty to satisfy its debt service obligations there is a significant risk in the counterparty's creditworthiness.
- Construction risks – although construction covers only 3–4 years of perhaps a 30 year total debt exposure, the successful completion of the construction period is paramount to servicing that debt. Delays can be disastrous and their potential is related to the design and technological complexity of construction; the contractor's management team and approach; existing workloads and problems on other projects; reputation; third party support via bonds and guarantees and; the contractor's experience, resources and capabilities.
- Revenue structure – How certain or controllable is the revenue stream, what is the level of penalty and abatement for under performance, what are the index linked payment periods, etc.
- Operating risk – What are the maintenance and replacement regimes and costs? Is service provider liability for poor performance capped? Are levels of abatement appropriate and fair? How reliable are service providers? Do they have a presence in the bidding consortium? What are the levels of competition for service providers? etc.
- Financial and legal structure – Typically, PPP projects have fully amortizing debt maturing in 30 years. Projects are typically highly geared at around 80–90%. Thus the sufficiency and sensitivity of cash flows to different potential risks is crucial to establish how debt will be serviced. To manage this, structural protective mechanisms and financial security packages can be useful such as guarantees or bonds, operating accounts and reserves, etc.

More recently, Grimsey and Lewis have identified six areas of risk associated with PPP projects, namely; public risk; asset risk, operating risk, sponsor risk, financial risk and default risk [14]. Public risk relates to the government's duty to ensure that the facilities are constructed in accordance with legislation and codes of practices to ensure the well being of workers and consumers. Step-in rights usually exist in most PPP contracts to allow the government to intervene if this risk eventuates. Asset risk can arise if the life of a facility proves to be shorter than anticipated, if the costs of maintenance exceed that expected, the asset may be damaged or destroyed by a force majeure event,

Please cite this article as: A. Ng, Martin Loosemore, Risk allocation in the private provision of public infrastructure, International Journal of Project Management (2006), doi:10.1016/j.ijproman.2006.06.005.

etc. These risks can be mitigated by agreed maintenance and refurbishment scheduled, etc. Operating risk reflect the chance that the purchased services are not delivered as agreed in terms of specification, costs or timing. Sponsor risk arises when the SPV is unable to meet its contractual obligations and the government is unable to enforce them or recover compensation. Normally, parent company guarantees, performance bonds and sureties are used to mitigate operating and sponsor risks. Financial risk can arise from prices and costs increases, financiers withdrawing, interest rates increasing or from poorly designed financial structures. Finally, default risk can arise when a party is unable to perform its contractual obligations on time or to defined standards. In this case the contract will provide for remedies such as obligations to rectify, abatements, step-in rights, termination and the transfer of completed assets according to a predefined valuation mechanism.

Although we have a good understanding of the risks associated with PPP projects, what is less known is how these risks change over the duration of a project [24]. While there have been some attempts to broadly define risk profiles over the term of a PPP project [25], such models remain rudimentary making it difficult to produce an overall risk allocation structure with mechanisms which coordinate to ensure that all risks are appropriately managed during all stages of a project. This should be a priority for future research.

5. Risk allocation in PPP projects

As Grimsey and Lewis point out, risk allocation is PPP projects is fundamentally different to that in traditional projects [14]. In the latter, the public sector purchases an asset from private sector contractors and consultants whose liability is limited to the design and construction of the asset. Finance and operational risks remain with the public sector. In contrast, the PPP model involves the purchase of a relatively risk-free long-term service and the government accepts no asset-based risk and does not pay, or is entitled to reduce payments, abatements and compensation if the service is not delivered to the specified standards, as defined in a service agreement. They key driver of any PPP project is value for money and driven by this requirement, the government has to decide how the risks identified above must be best distributed between the parties to a PPP project. Conceptually, as service recipient paying only for satisfactory service, the assumption is made that all project risks should be borne by the private sector. In theory, the idea of transferring a risk is that some other party is provided with an incentive to manage it effectively. However, in reality, the government has to determine, on a value-for-money basis, what risks it should take back to achieve an optimal risk distribution. This involves ''taking back'' risks which are more efficiently managed by it and this is normally done via three mechanisms: specified service obligations, payment mechanisms and contractual provisions [14]. However, in achieving an optimal distribution there are several important and well established rules to follow [24]. They are, that a risk should only be given to someone who:

- Has been made fully aware of the risks they are taking.
- Has the greatest capacity [expertise and authority] to manage the risk effectively and efficiently (and thus charge the lowest risk premium).
- Has the capability and resources to cope with the risk eventuating.
- Has the necessary risk appetite to want to take the risk.
- Has been given the chance to charge an appropriate premium for taking it.

Not following these simple rules will compromise the success and efficiency of the project since it will produce higher risk premiums than necessary, increase the chance of risks arising and the consequences if they do arise [14]. Further inefficiencies can arise from confused responsibility for monitoring and responding to risks; resentment for being forced to take them and; denial, conflict and dispute to avoid responsibility when they do arise. In effect, by not following the above rules, the public sector is merely gaining the illusion of risk transfer, since it is likely that the risk will be transferred back to them in the form of higher risks, risk premiums and project problems.

To help ensue that this does not happen, a number of standard risk allocation matrices have been produced to guide appropriate risk allocation in PPP projects, most of which agree on the general allocation of risks [14,26]. Grimsey and Lewis's model is typical and is presented in Table 1.

While useful as a guide to government and private sectors, it is very important to realise the limitation of such models and that risks must be analysed and managed on a project-by-project basis. First the above table presents broad categories of risk and every project has a different array of risks, which need to be thoroughly analysed and understood. It is also important to recognise that the appropriate distribution of risks is dependent on the resources and capabilities of the parties to a contract and this can vary considerably. This is brought into focus when a risk is completely outside the control of both parties. Here risks are often identified as being shared or insured against but in reality the best allocation of risk will depend on how the private parties price the risk, whether this is reasonable for the public sector and how it compares to the potential risk (in cost and probability terms) if retained by the public sector. Finally, these are static models of risk and risk distribution mechanisms need to reflect that risks change considerably over the life of a project.

Unfortunately, there is considerable evidence to suggest that risk transfer is often handled poorly between parties to many PPP projects and that these types of problems are common in PPP projects. For a host of reasons, parties to concession projects take risks which they are not clear of, that they are not able to cope with, that they do not

Please cite this article as: A. Ng, Martin Loosemore, Risk allocation in the private provision of public infrastructure, International Journal of Project Management (2006), doi:10.1016/j.ijproman.2006.06.005.

Table 1
Risk matrix for public sector/private sector of infrastructure investments (Source: Grimsey and Lewis [12])

Type of risk	Source of risk	Risk taken by
Site risks		
Site conditions	Ground conditions, supporting structures	Construction contractor
Site preparation	Site redemption, tenure, pollution/discharge, obtaining permits, community liaison	Operating company/project company
	Pre-existing liability	Government
Land use	Native title, cultural heritage	Government
Technical risks	Fault in tender specifications	Government
	Contractor design fault	Design contractor
Construction risks		
Cost overrun	Inefficient work practices and wastage of materials	Construction contractor
	Changes in law, delays in approval, etc.	Project company/investors
Delay in completion	Lack of coordination of contractors, Failure to obtain standard planning approvals	Construction contractor
	Insured *force majeure* events	Insurer
Failure to meet performance criteria	Quality shortfall/defects in construction/ commissioning tests failure	Construction contractor/project company
Operating risks		
Operating cost overrun	Project company request or change in practice	Project company/investors
	Industrial relations, repairs occupational health and safety, maintenance, other costs	Operator
	Government change to output specifications	Government
Delays or interruption in operation	Operator fault	Operator
	Government delays in granting or renewing approvals providing contracted inputs	Government
Shortfall in service quality	Operator fault	Operator
	Project company fault	Project company/investors
Revenue risks		
Increase in input prices	Contractual violations by government-owned support network	Government
	Contractual violations by private supplier	Private supplier
	Other	Project company/investors
Changes in taxes, tariffs	Fall in revenue	Project company/investors
Demand for output	Decreased demand	Project company/investors
Financial risks		
Interest rates	Fluctuations with insufficient hedging	Project company/government
Inflation	Payments eroded by inflation	Project company/government
Force majeure risk	Floods, earthquakes, riots, strikes	Shared
Regulatory/political risks		
Changes in law	Construction period	Construction contractor
	Operating period	Project company, with government compensation as per contract
Political interference	Breach/cancellation of licence	Government
	Expropriation	Insurer, project company/investor
	Failure to renew approvals discriminatory taxes, import restrictions	Government
Project default risks	Combination of risks	Equity investors followed by banks, bondholders and institutional lenders
	Sponsor suitability risk	Government
Asset risks	Technical obsolescence	Project company
	Termination	Project company/operator
	Residual transfer value	Government, with compensation for maintenance obligation

Please cite this article as: A. Ng, Martin Loosemore, Risk allocation in the private provision of public infrastructure, International Journal of Project Management (2006), doi:10.1016/j.ijproman.2006.06.005.

have the appetite for and cannot charge for [24,27]. It would seem that all too often the distribution of risk is influenced more by economics, commercial requirements, debt financier's requirements, bargaining power and company culture and policies than by the principles identified above. Given the above problems and the major risks involved in concession contracts, the remainder of this paper presents a case study of the $920 million New Southern Railway project in Sydney Australia. This was one of the first major privatised railways in the State of New South Wales and has been a highly controversial project which has received much public criticism.

6. Method

Data were collected about the New Southern Railway project from a range of sources including: semi-structured interviews with key project stakeholders from the public and private sector, primary documentary analysis of contract documentation and secondary documentary analysis of government and private sector reports, respectable newspaper articles, journal articles and conferences. The objectives of the data collection were to identify the main project risks perceived by both public and private sector stakeholders and to assess the process and rationale underpinning the distribution of risks between them. Six detailed interviews were conducted with managers who were involved, at various stages of the negotiation processes where risks were allocated. The respondents' details are provided in more detail in Table 2.

The following sections presents the information gained from above process in a descriptive case study which documents the project's controversial genesis, the rationale underpinning the distribution of risks and the effectiveness of the risk management process.

7. Case study – The New Southern Railway

The New Southern Railway (NSR) project was a 10 km underground two-track railway which was designed to provide rail services between Sydney [Kingsford Smith] Airport and Sydney Central Station. The $920 million project which commenced in June 1995 and finished in May 2000 included four new underground stations and was financed by the State Government to the value of $700 million, the remaining $220 million being provided by the National Australia Bank [$190m] and shareholder equity [$30m]. This is a debt/equity ratio of approximately 86%. The concession period was 30 years and the concession contract was a BOOT agreement with fast track design and construct.

The history of the project started in 1915 when predictions of urban consolidation first highlighted the potential benefits of a city to airport rail link grew. However, it was not until the late 1980s that momentum for the idea grew and a range of alternative options was considered [such as a metro, bus services and light rail]. After the rail option was chosen, five alternative rail corridors were assessed for their feasibility, resulting in a preferred route being chosen. At this stage, the project was planned to have no cost to the government but to have numerous benefits. For example, it would create approximately 3000 construction jobs and provide greatly improved links to the airport and result in a reduction of 25% in road traffic between city and airport. It would also act as a catalyst for urban consolidation and foster growth in an area, which was serviced by three universities and recreational facilities such as beaches, parks and golf courses. Finally, by increasing rail network capacity in the area, it would prevent the need for another planned rail extension, thereby releasing an additional $60 million of funds. Given widespread community support for the project, pressure mounted to "sign off" the scheme prior to a forthcoming election. It was signed off in record time.

The project was initially considered in 1990 as an unsolicited bid by a consortium comprising CRI Ltd., Qantas and Westpac Bank. However, the government State Rail Authority (SRA) subsequently called for open tenders and received four bids. Two were short-listed – CRI and Transfield/Bouygues and, in 1991, these bidders were encouraged to form a single consortium [calling the SPV

Table 2
Respondents' details

Sector	Position	Role
Public	Project Director, State Rail Authority	Project director for government. Involved in all stages of risk allocation negotiations. Particularly in final 100 days of finalising concession contract
	Project Finance Manager, State Rail Authority	Responsible for financial feasibility and control of project. Involved in final stages of risk negotiation
	Manager of Planning Department and Rail Access Corporation, State Rail Authority	Member of the risk allocation team for the government. Involved in all project negotiations
Private	General Manager of SPV	Involved throughout life of consortium in all risk-related negotiations. Particularly in final 100 days of finalising concession contract
	CEO of major JV partner	Responsible for negotiations with JV partners, government stakeholders and private sector Banks
	Chief Financial Officer of major JV partner	Responsible for financing and negotiations with funders – refinancing

Please cite this article as: A. Ng, Martin Loosemore, Risk allocation in the private provision of public infrastructure, International Journal of Project Management (2006), doi:10.1016/j.ijproman.2006.06.005.

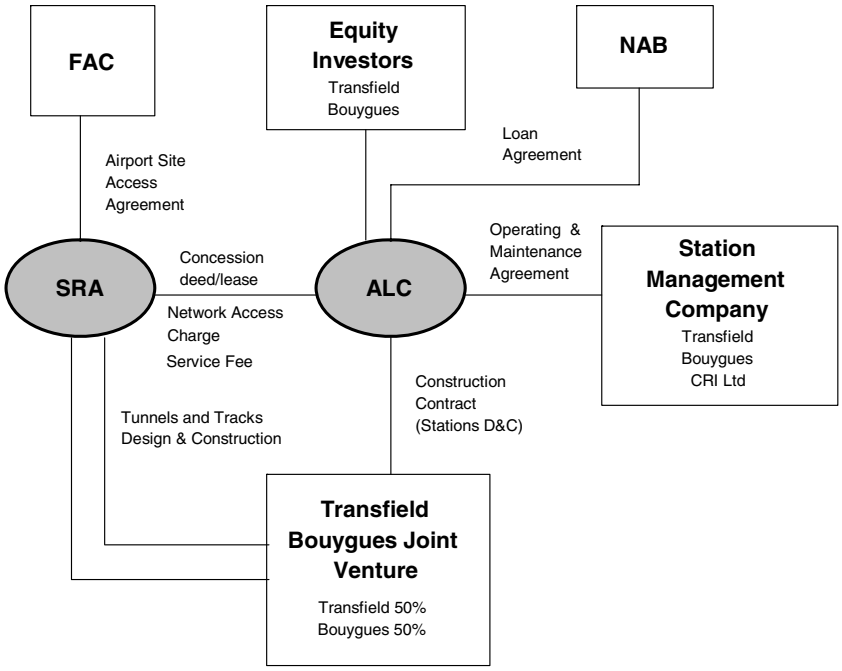

Fig. 1. Contractual relationships in NSR concession contract (Source: SRA 1995). *Key*: NAB – National Australia Bank, SAC – Federal Airports Corporation, and ALC – Airport link Company.

the Airport Link Company – ALC], which eventually rebid for the project in 1993. This bid was accepted and the project then began to move forward, final contracts being signed in February 1995. Fig. 1 illustrates the contractual relationships between key project stakeholders.

7.1. Risk allocation

This section provides a very board overview of the main risks allocated in this project. Given the complexity and scope of this project, it is beyond the scope of this paper to review them all.

Under the concession contract, ALC agreed to finance, design, construct and operate the tracks, tunnels and four new stations over 30 years. The land on which the stations were built remained under SRA ownership with ALC paying a lease for its use. ALC was to recover its initial capital costs through levying a station fee on the tickets of passengers using the new rail service. ALC was also able to earn income from retail activities at the stations. Favourable tax concessions were also granted to limit tax liability until after debt servicing.

In the pre-design stage of the project, SRA took all approval risks – these being made a condition precedent to the contract. The airport link approval process was complex because the project passed through five local government areas in addition to the airport, which is located on Commonwealth territory. Given the complexity of the approval process under the existing state environmental legislation, the Minister of Planning streamlined the decision-making process and formulated a new State Environmental Planning Policy.

In the design stage, SRA carried the risks associated with delays or costs associated with dealing with the Federal Airports Commission (FAC). ALC took the risk of providing full design for tracks, tunnels and station infrastructure for a lump-sum price. The design of stations had to be fit for intended use and ensure efficient operation once completed. Since most of the tracks were underground, the design risk was substantial.

During the construction stage, SRA purchased land along the track route and took the risk of site accessibility. This risk was minimised since SRA could use the government's powers of compulsory purchase if necessary. However, if the site had been delivered to ALC after the agreed time, the concession term could have been extended or compensation be payable. This issue was particularly important for the two stations at the airport, which were sited on Commonwealth land administered by the Federal Airports Commission. To mitigate this risk, the SRA entered into a separate agreement with the Federal Airports Commission to provide the land required for the stations and tunnels by certain dates. SRA also bore risk of force majeure and of general industrial disputes aimed at government policy. Finally, SRA was also responsible for the provision of airline pedestrian links.

During the construction phase, ALC took the Construction risk of delivering the stations, tracks, tunnels and associated infrastructure on time and within a lump-sum price [including fixed inflation allowance] and to an agreed level of quality. It also bore the risk of industrial disputes arising directly from its actions.

During the operational phase, SRA took the risk of operating trains, selling tickets and meeting agreed service

Please cite this article as: A. Ng, Martin Loosemore, Risk allocation in the private provision of public infrastructure, International Journal of Project Management (2006), doi:10.1016/j.ijproman.2006.06.005.

standards. SRA also carried the risk of changes in requirements and changes in the law or government policies, which could have directly or indirectly affected the usage of the rail link. Furthermore, since ALC had to pay a network access fee and a service fee to SRA, which was based on net revenues generated by ALC determined on a five yearly basis, SRA was also exposed to patronage risks. This risk was greater because SRA also earned direct revenue from ticket sales to users of the railway. Finally, since revenues received by SRA in the form of the network access fee were also contingent on the debt being paid off, SRA also had some exposure to interest rate risks.

During the operational phase, ALC was responsible for station operation and maintenance costs associated with tracks, tunnels, stations and associated infrastructure. Other risks taken by ALC included the risk of fluctuating interest rates. However, ALC hedged this risk by interest rate swaps to fix the interest rates for its loans. Finally, ALC also bore any exchange rate risks. While predominantly funded in local currency, some of the major items used in the construction [such as the tunnel boring machine] were imported. It is worth noting that ALC was highly reliant on the SRA operating trains on time and to a frequency as spelt out in the agreements. If service standards from SRA dropped then patronage levels and resultant revenues would also drop. ALC also carried the ongoing market/revenue risk over the 30 year concession period, since the level of revenue was directly dependent on level of patronage using the train line. This was minimised by SRA agreeing to compensate ALC if patronage levels fell below the expected 48,000 trips per day [from extensive modelling which was carried out at the time]. For example, the contract had a clause that required the government to purchase the four privately built stations if the rate of usage caused the consortium to default on their loans. ALC also was entitled to demand $15 million compensation for low ticket sales. However, SRA considered this to be a relatively low risk and predicted that patronage would increase to 68,000 per day by 2013 due to population growth and development of the south Sydney area for business and residential developments.

7.2. Effectiveness of risk management

The project outcomes in terms of urban development have been entirely consistent with the aims of state government urban policies. The project supports planning policies, which encourage the role of Sydney's Airports and ports as a national and international gateway. Despite this success, the project has attracted considerable public criticism and continues, to this day, to be labelled as a debacle. For example, six months after the line was opened passenger rates were only 12,000 per day rather than the 46,000 predicted. While the terrorists attack in the US and Bali and the collapse of Ansett Airlines [Australia's second most important airline] exacerbated the problem, it seems that the issue of poor patronage stemmed more from the poor management of risks early on in the project. For instance, the $10 premium rail fare which was charged to customers using the link turned out to be well above the competitive price offered by alternative modes of transport such as busses and taxis. A taxi fare to the CBD from Sydney airport was approximately $20 and there was waiting or baggage handling involved. This fare could be reduced to $10 by sharing with one other person. Furthermore, the CBD was only 15 min by taxi using the newly built Eastern Distributor road and the new trains on the rail link did not have enough baggage room for tourists travelling to and from the airport. Another problem was that the service was part of an existing rail network that carried large numbers of computers. Many potential travellers, tired after a flight, were put-off by the full trains as they arrive at the airport. Finally, the appearance of the City Rail trains did not entice people to use them and there were few incentives offered to do so.

These problems caused ALC to default on its $200 million loan from the NAB only 6 months after the line opened and eventually fall into receivership. In response, the government also had to intervene to boost patronage from 12,000 people per day to 48,000 per day as stipulated in the contract and keep this growing at a rate which would maintain the viability of the project. This involved offering concession fares to groups and multi-ticketing by offering combined airline and train tickets packages. Eventually, the state government shut down the airport bus service to force people to use the rail link. The cost of this and the contractual compensation to which SRA was exposed, was estimated to be an extra $200 million at the time, bringing the prospect of tax payer funding for the project to a total of $900 million. Rather predictably, this generated a considerable amount of negative publicity for the project at the time.

In the end, rather than resume control of the project as a government enterprise, the government decided that the four station airport rail link should remain in private hands, the private consortium being heavily compensated for the shortfall in passenger rates which continue to this day. Not surprisingly, this series of events has led to continued public criticism. Today, patronage is still far lower than predicted by the government and the private consortium continues to be compensated for patronage levels, which have achieved less than 30% of that forecasted. Furthermore, fares on the line still cost approximately four times the cost of an equivalent trip on the public rail service and in November 2004 the state government announced it was contributing another $98.3 million to the failed project. To date, the state government has paid the private consortium approximately $700 million from tax payer revenues. This is a project that in 1990 was originally intended to be 100% privately funded. With problems of low patronage continuing to beset the rail link, the government is now faced with the prospect of continuing to compensate the private consortium into the future, buying out the contract for an extra $300 million or being forced to renegotiate the

Please cite this article as: A. Ng, Martin Loosemore, Risk allocation in the private provision of public infrastructure, International Journal of Project Management (2006), doi:10.1016/j.ijproman.2006.06.005.

contract. The problem is that if the new arrangements do not result in the lowering of the ticket surcharge and thus lower fares, then the project will continue to be under utilised.

8. Conclusion

This paper has presented review of risk allocation in PPP projects and a case study of the controversial $920 million New Southern Railway project in Sydney, Australia. It has analysed the rationale behind decisions about risk distributions between public and private sectors and their consequences. It has also demonstrated the complexity and obscurity of risks facing such projects and the difficulties in distributing them appropriately. It is clear that the risks involved in concession projects are significant and need to be thoroughly analysed, researched and managed. This includes Public perceptions of risk, which have become negative as a result of high profile failures like this project. While the technical risks in such projects are enormous and complex, the success of large PPP infrastructure projects also depends on the support and behaviour of key stakeholders in the community. These risks can be far more unpredictable and difficult to manage than first thought and very difficult to distribute effectively. More than any other type of project, concession projects should be based on the need for service in the community rather than on commercial viability alone. What is needed is an objective assessment of the quality of service, optimal asset utilisation and value for money to the public over the entire life cycle of an asset and of the risk distributions between private and public sector parties that facilitate this – being guided by the basic principles of sound risk management. This must be done on a project-by-project basis, keeping in mind that using an inappropriate distribution of risks can lead to project failure.

In making recommendations for better future practices, we note for following lessons from the literature and case study. First, the scale and prominence of these projects make the approval process long, unwieldy and subject to political manipulation. In this case, the contract was hastily signed in record time just prior to the 1995 elections, arguably, to generate votes for the state government. Indeed, political pressure can grow to such an extent that it blinds policy makers to the risks involved in projects. For example, despite warnings from the state Treasury and the CEO of SRA in 1994 that contrary to original cost predictions, the project would probably cost about $400 million of public money in the first decade, the project still went ahead. This may have also had something to do with the large compensation costs that the government agreed to pay the successful consortium should the project not go ahead. In this way, the government built themselves into a contractual corner from which it became more and more difficult to escape without loss of face and a waste of public money.

Second, it is clear that due to the long time frames of PPP projects such as this, revenues and patronage rates are extremely difficult to predict in advance. In this case, the government took most of this risk, agreeing to compensate the private consortium for any shortfalls in patronage levels. It was a decision, which has cost the public many millions of dollars.

Third, it became evident that the feasibility of projects like this cannot be guaranteed without intervention from the government to change people's behaviour. In this case, people were not educated about the benefits of using rail instead of traditional modes of transport to which people had become accustomed, or indeed, given any reason or incentive to do so. There also has to be considerable market research into consumer purchasing behaviour supported by mutual cooperation between all relevant government departments and project stakeholders in bringing this change of behaviour about. For example, SRA, Sydney Airports Cooperation and airline companies could have done more to encourage people to use the rail link before the project finished. Instead, they have been forced to react by coercing people to use it by stopping other services – a decision, which has caused further consternation and reduced choice and value for money to customers.

References

[1] Public Accounts Committee. Infrastructure, management and finance in New South Wales. Sydney, Australia: Parliament of New South Wales; 1994.
[2] OECD. Urban infrastructure: finance and management. Paris: Organisation for Economics Cooperation and Development; 1991.
[3] Economic Planning and Advisory Commission. Private sector involvement in economic infrastructure in Australia, Private Infrastructure Task Force Interim Report, Canberra, Australia; 1995.
[4] Akintoye A, Beck Hardcastle C, Chinyio E, Assenova D. Framework for risk assessment and management of private finance initiative projects. Glasgow, Scotland, UK: Glasgow Caledonian University; 2001.
[5] Cottle G. Risk associated with public private partnership arrangements; 2003.
[6] Sharpe W. Talking points: managing stakeholder relations in PPP projects, Public Infrastructure Bulletin, March 8–15; 2004.
[7] Moore WB, Muller T. Impacts of development and infrastructure financing. J Urban Plan Dev ASCE 1989;115(2):95–108.
[8] Howe B. Building wealth: a strategy for infrastructure development – investing in infrastructure. Melbourne, Australia: Australian Urban and Regional Development Review; 1995.
[9] Walker C, Smith AJ. Privatised infrastructure: the BOT approach. London: Thomas Telford; 1995.
[10] Vega AO. Risk allocation in infrastructure financing. J Project Finance 1997;3(2):38–42.
[11] Jones D. Providing value for money through public private partnerships: the lessons learnt so far from economic and social infrastructure projects. In: Policy development in Australia for pubic private partnerships – what more is there to do? The Avillion Hotel, Sydney Australia; 2002. p. 99–107.
[12] Grimsey D, Lewis KK. Public private partnerships. Cheltman, UK: Edward Elgar; 2004.
[13] Wikipedia P. Cross city tunnel; 2006. Available from: http://en.wikipedia.org/wiki/cross_city_tunnel.
[14] Milner M. Eurotunnel car traffic declines. The Guardian, 21 March; 2004. p. 14.

Please cite this article as: A. Ng, Martin Loosemore, Risk allocation in the private provision of public infrastructure, International Journal of Project Management (2006), doi:10.1016/j.ijproman.2006.06.005.

[15] Featherstone P, Baldry D. The value of the facilities management function in the UK NHS community health-care sector. J Manage Med 2000;14(5/6):326–38.
[16] Rodney W, Galimore P. Risk assessment in PFI schemes for primary health care. Facilities 2002;20(1/2):52–60.
[17] Prior S, Kline S. Who's going to pay? Icon international construction review. Englemere, UK: CIOB; 2006. p. 14–5.
[18] Richards M. Under the spotlight. Building, 14th June; 2002. p. 41–3.
[19] OECD. Infrastructure and private sector productivity: finance and management. Paris: Organisation for Economics Cooperation and Development; 1992.
[20] Owen K. Life cycle cost management: a client's view. In: James M, editor. Risk management in civil mechanical and structural engineering. London: Thomas Telford; 1996. p. 143–62.
[21] Valins MS, Salter D. Towards a conclusion. In: Valins MS, Salter D, editors. Futurecare – new directions in planning health and care environments. Oxford: Blackwell Scientific Publications; 1996. p. 152–64.
[22] Forbes Ian. In: Proceedings of the Australian State and Territories Capital Management Directors Meeting at UNSW, November 2000. [Unpublished report of the Group for Health Architecture and Planning] UNSW, Sydney; 2000.
[23] Liou DD. Bridging the funding gap. Project Trade Finance 1997;148(8):32–3.
[24] Loosemore M, Raftery J, Reilly C, Higgon D. Risk management in projects. London: Taylor & Francis; 2006.
[25] Chan S, Woodward D. BOOT appeal. The Banker 1992;142(1):13–7.
[26] Smith NJ. Engineering project management. Oxford: Blackwell Scientific Publications; 1996.
[27] Arndt R, Maguire G. Private provision of public infrastructure: risk identification and allocation project, survey report, Department of Treasury and Finance, Melbourne, Victoria; 1999.

Please cite this article as: A. Ng, Martin Loosemore, Risk allocation in the private provision of public infrastructure, International Journal of Project Management (2006), doi:10.1016/j.ijproman.2006.06.005.