

Financing Infrastructure Projects

By

Serge Emile Eid

Bachelor of Engineering, Civil and Environmental Engineering
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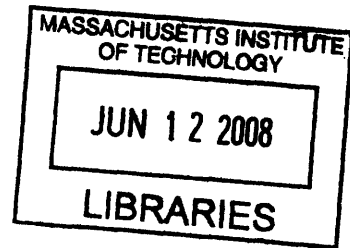
Submitted to the Department of Civil and Environmental Engineering
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Signature of Author.....

Department of Civil and Environmental Engineering
May 9, 2008

Certified by.....

✓ Fred Moavenzadeh
James Mason Crafts Professor of Civil and Environmental Engineering and
Engineering Systems and Director of Technology and Development Program
Thesis Supervisor

Accepted by.....

Daniele Veneziano
Chairman, Departmental Committee for Graduate Students

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ABSTRACT

Infrastructure is of great importance to the development and economic growth of communities. Due to the increased demand on sophisticated infrastructure, governments' budgets are not anymore able to satisfy this growing need. The role of the private sector in infrastructure finance is essential, and the amount of private investments in infrastructure projects has been dramatically increasing over the last few years. Public Private Partnerships, Private Finance Initiatives, and Alternative Service Delivery methods are becoming the trends for procuring infrastructure, and by relying on Project Finance, the private sector is more willing to be involved in these projects. These methods, combined with effective risk management techniques, would provide a solution to the decreasing governments' budget. Meanwhile, the construction experience, operation efficiency, and financial capabilities of the private sector may be a way to relieve governments from the burden of infrastructure development.

Thesis Supervisor: Fred Moavenzadeh

Title: James Mason Crafts Professor of Civil and Environmental Engineering and
Engineering Systems

Director, Technology and Development Program

To My Dear

Father Emile

Mother Leila

Brother Fadi & Sister Noha

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CHAPTER 1

Infrastructure: Definition, Importance, and Challenges

Our daily life depends on infrastructure. Electricity, water, gas, and oil are necessities for every human being. Telecommunication links the world and facilitates information transfer. Harbors, bridges, and airports transfer goods and people efficiently. All these services require the development of infrastructure. Therefore, without sound infrastructure, people are not able to move, communicate, or even satisfy their basic daily needs. On the other hand, there is a general agreement about the important contribution of infrastructure to growth of economies. Infrastructure development would result in higher GDP growth and help poverty reduction in developing countries; thus, sound infrastructure forms the backbone that is critical to maintaining and enhancing competitiveness¹, productivity, and quality of life. Therefore, the following paper aims to analyze the different ways of financing infrastructure projects. This chapter defines infrastructure and highlights its importance.

1. Definition of Infrastructure

Since 1927, the term infrastructure has been used to refer collectively to the roads, bridges, rail lines, and similar public works that are required for an industrial economy to function. (7)

In its 2006 report, the United Nation ESCAP² defines infrastructure as the following:

The expanded definition of infrastructure includes transport (roads, railways, ports and airports), public utilities (electricity and water supply), public services (fire service, flood protection, police), national services (the defense, monetary

¹ Source: Jonathan D. Miller, Infrastructure 2007 a Global Perspective

² ESCAP: United Nations Economic and Social Commission for Asia and the Pacific

and postal systems and the legal and regulatory system) along with “soft infrastructure,” which denotes institutions that maintain the health and cultural standards of the population (public education, health and social welfare).

Infrastructure can be divided into two parts; the first is the assets or the facilities themselves while the second is the delivery of infrastructure service. (7) The delivery is often more complex because it involves the interaction of multiple actors.

Infrastructure assets are usually divided into two major categories which are social infrastructure and economic infrastructure. Many infrastructure facilities serve both economic and social purposes at the same time; therefore, drawing the line between them is difficult. Social infrastructure usually refers to universities, schools, hospitals, prisons, public housing, community facilities, convention centers, and sports facilities (7). Economic infrastructure refers to transport, energy, communication, and utilities infrastructure. (7) Another type of infrastructure referred to as disaster management infrastructure has been gaining more importance recently.

2. Importance of Infrastructure

Infrastructure development is considered a key element in fostering economic growth. Lack of infrastructure facilities is a major weakness which holds back economic development. Maintaining high quality infrastructure is an important parameter that increases trade competitiveness by providing more efficient means to participate in international trade. The World Economic Forum (2006-2007) listed infrastructure as one of nine elements crucial to a country’s productivity and competitiveness.

Infrastructure development does not only serve as the catalyst for economic growth, but also helps spread the benefits of this growth to distant areas which are away from commercial hubs. Infrastructure plays an important role in poverty reduction in developing countries due to two reasons. First infrastructure plays a prominent role in increasing employment and incomes for the poor; second, availability of infrastructure ensures delivery of a number of basic needs and strengthens the sharing of the benefits of growth (7).

Infrastructure development is crucial for developing countries to be on the world economic map. Meanwhile, developed countries are required to maintain their existing infrastructure and develop new innovative infrastructure in order for their economies to remain competitive.

3. Reasons for Increased Infrastructure Demand

In the last decades, there has been an increased demand for development in various services in the public sector such as transport, energy, telecommunication, water, and disaster management infrastructure. This increase is attributed to the recognition of governments that sound infrastructure is a must to achieve economic growth and provide better quality of life for people.

Transport Infrastructure

Transportation facilities are a major component of infrastructure. Recently, they are gaining more importance due to an increased recognition of their role in globalization (7). Besides, due to the increase in average personal mobility levels associated with the increase in vehicle ownership, more transport infrastructure development is a must. There has been an increase in the need to access major facilities such as airports, ports, and financial centers.

The cost savings due to more efficient transport system are tremendous. For example, according to the UN ESCAP Report (2006), India loses about 20% of total agricultural output and 40% of fruits and vegetables on the journey from farm to consumer as a result of weakness in transport and logistics services. (7) Furthermore, in developed countries, there has been more concern about the development of safe, reliable, and most importantly environmentally friendly transportation systems.

Communication Infrastructure

Communication Technology Infrastructure (CTI) plays an essential role in development, trade, and business (7). Telecommunication links the world together, and without viable communication infrastructure economies cannot be competitive. On the other hand, CTI are essential tools to stimulate developing economies and integrate them into the world economy (7).

Energy Infrastructure

Energy is critical for economic growth, social development, and poverty reduction. An adequate and affordable energy supply is needed to meet the demands of industry, commerce, and domestic users and to enable the movement of people and goods. (7) Therefore, the development of energy infrastructure that enhances the exploration, production, distribution, and storage of energy is essential for economic growth. Due to its importance of energy, it is approximated that the total global investment in energy infrastructure will reach approximately \$16.5 trillion between 2001 and 2030³.

Water Infrastructure

As the population is increasing, the need for fresh water is increasing; thus, more wastewater plants are needed to treat effluents. Water is also essential for industry and agriculture, which makes water infrastructure crucial for growth.

Adequate water infrastructure such as dams and reservoirs is required to ensure the sustainability of water resources and overcome scarcity problems. Lack of insufficient infrastructure keeps a large part of the world's population in developing countries from obtaining safe water and decent sanitation (7).

Disaster Management Infrastructure

Another set of infrastructure class has been gaining greater importance in the last few decades, which is infrastructure development relating to disaster management. This is attributed to the sharp increase in economic losses caused by natural disasters in the past three decades (5).

While underdeveloped countries account for the majority of death due to natural hazards, developed countries seem also to suffer from the lack of adequate infrastructure. Katrina's⁴ disaster in the US is a major example of the adverse consequences of lack of disaster management infrastructure; therefore, demand for its development is increasing.

The reasons for increased infrastructure demand can all be gathered to one main reason, which is infrastructure drastically enhances the quality of life of communities.

³ Source: UN ESCAP Report (2006)

⁴ One of the deadliest hurricanes that struck the US Gulf Coast in 2005 causing loss of life and property damage

4. Challenges Facing Infrastructure

The challenges to the infrastructure sector are increasing due to several reasons. As mentioned earlier economic growth and increased global competition pressure governments to develop their infrastructure; however, keeping up the required pace is almost impossible. Population growth, combined with increased urbanism and higher income, is dramatically increasing the demand on infrastructure. Meanwhile, the cost of development of this infrastructure is dramatically increasing over the years.

On the other hand, the governments have to deal with aging and deteriorating infrastructure due to poorly planned infrastructure development over the years. They are currently faced by the adverse consequences of underdevelopment over the past decades.

Infrastructure is also facing other threats, and more security is needed in order to increase public safety and provide protection against failures and terrorist attacks. The increased security requirements, combined with environmental concerns, are making infrastructure development more sophisticated.

5. Infrastructure Investment

From all of the above reasons, it can be inferred that the global economy pressures countries to upgrade infrastructure. However, as infrastructure projects are becoming more complex, the financing of such large scale facilities is becoming more intricate. Infrastructure projects are now multi billion dollar projects that require innovative ways to procure their funding, and they are emerging as a new asset class for investors, alongside stocks, bonds, and real estate (10). The World Bank forecasts Asia's infrastructure needs to be \$1 trillion (equivalent to 9% of its GDP) between 2007 and 2012. In Asian and Pacific countries, if investment in infrastructure continues at its current level, the gap between supply and demand could be \$180 billion per year⁵.

India budgets 3.5% (\$25.5 billion), the US budgets \$112.9 billion, and Japan has traditionally budgeted more than 10% of its spending on infrastructure. Governments in

⁵ Source: UN ESCAP Report (2006)

Australia forecast a need for a A\$100 billion in new infrastructure investments over the next ten years, and Canada expects expenditures worth CAN\$ 300 billion through 2025⁶.

From the above we can conclude the difficulty of providing the funds necessary to build new infrastructure or maintain the old ones. Thus, the following will analyze the different methods of financing infrastructure projects whether through public money, private money, or project finance.

Chapter 2 discusses public financing of infrastructure projects.

⁶ Source: Jonathan D. Miller, *Infrastructure 2007 a Global Perspective*

CHAPTER 2

Public Financing of Infrastructure

Most of the existing infrastructure in the world has been financed by the public sector due to the significant impact of infrastructure development on economies and governments. The majority of infrastructure services in developing and developed countries continue to be public financed, even though the role of private sector has been increasing in recent years.

1. Rationales for Public Financing

Public financing advocates provide several rationales which favor public financing of infrastructure. The most important one is economies of scale in production. As the production is on larger scale, the cost of providing a service becomes lower, thus giving the production to a single entity would decrease the cost, but at the same time would create a monopoly, and the easiest monopoly to regulate is a public one (8). Another rationale is that the role of a government is to maximize social welfare by providing and regulating infrastructure services which frequently provide public goods (8). Besides, it is considered that the government has a competitive advantage since infrastructure usually involves very large investments, and capital and sunk costs of infrastructure are generally large relative to the running costs (8).

There remains broad agreement among economists that infrastructure is an area in which government economic policy is required. There is a network of services that provides activities that bind economic activity together (8). In addition, the government is considered in a better position to control the externalities associated with any project.

There is no doubt that the role of the government is to protect the public interest, and the advantage of economies of scale in reducing unit price is evident; however, governments can still protect the public interest by regulating infrastructure services rather than acting as providers; in addition, the private sector may sometimes be in a better position in

benefiting from economies of scale, which cause price reduction. These points will be further elaborated in the discussion of private financing.

2. Sources of Funds

Considered less complicated than private financing, public financing relies on taxes such as income tax, corporation tax, property tax, value added tax, and national lottery tax. In addition, duties on fuel, alcohol, tobacco, and vehicle excise significantly contribute to the sources of funding. Other sources include insurance, business rates, and privatization proceeds. (1)

Some sources of funding for infrastructure projects vary between Europe and the United States. In the US, money raised from treasury bonds are often used to finance infrastructure projects. Treasury bonds are considered the safest investment in the world because they have full-faith-and-credit backing of the US government. (1)

Many projects in the European Union member countries often receive an element of their funding through EU grants or loans. In addition, a special type of tax called hypothecated tax has been introduced in Europe by governments, which is a tax raised specifically for one project or one end use. (1)

The reliance on taxes in public financing of infrastructure treats all taxpayers similarly disregarding the fact that some people are not benefiting from the infrastructure facility. Therefore, taxpayers are not getting the benefits that they are paying for. Tax funds may be diverted to other purposes that do not serve directly the taxpayer.

The public financing plans assume that the cost should be recovered based on several economic concepts such as Short-run marginal cost, Long-run marginal cost, two-part tariffs, borrowing, and earmarking.

Short-run marginal cost (SRMC)

The cost of infrastructure service production typically decreases in the long-run; therefore, average cost falls as production is increased up to a level often referred to as the minimum efficient scale. Beyond that point, cost per unit becomes roughly

constant until production capacity is reached. However, this method is criticized to lead to price volatility and it would most likely be insufficient to cover total costs. (8)

Long-run marginal cost (LRMC)

LRMC is considered a better method to approximate cost. LRMC is defined as the cost of producing an extra unit when capacity adjustments can be made over time. Ideally, this method should allow a well-managed public enterprise to cover all of its operating expenses and debt services. (8)

Two-part tariff

In this case, the price of the service is composed of a lump-sum fee in addition to a per-unit-charge. However, it is considered a kind of discrimination and may occur in partially or fully monopolistic markets. A version of such a tariff scheme may involve charging the users a constant price per unit purchased equal to the SRMC and a fixed annual charge to buy any additional amount of the service. (8)

Borrowing

Economists agree that borrowing is a more efficient way to finance a temporary increase in spending rather than to increase the charges, since charges over time should be designed to include not only interest payments but also depreciation. (8)

Earmarking

It is devoting a portion of a source of revenue to a specific task. In practice however, countries do not always allocate expenditure according to this principle even when economic growth is their principal objective; developing countries often cut expenditures on nonwage operations and maintenance. (8)

According to Swaroop (1996), experience suggests that full cost recovery is more of an exception than a rule, except in the telecommunication sector. (8)

Despite that Public financing is still the most widely used method, according to Berg (2002), purely public approaches to infrastructure brought problems of bureaucracy, political interference, and often poor management and maintenance of facilities. (2)

Therefore, in the last two decades, private financing became an emerging method to finance infrastructure projects. Private financing is analyzed in Chapter 3.

Table 1 shows the private versus public investments in infrastructure between 1997 and 2004.

Table 1: Investment in Infrastructure (Million \$US)

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Private	25369	38996	47009	15822	16350	28466	18390	18416	17252	no data
Public	38132	40121	41975	37131	40948	35842	24037	29077	20103	4337
Total	63501	79117	88984	52953	57298	64308	42427	47493	37355	

Source: IMF, Government Finance Statistics August 2005, Private Participation in Infrastructure Database, <<http://ppi.worldbank.org>>

CHAPTER 3

Private Financing of Infrastructure

As mentioned earlier, during the past century, most of the infrastructure projects around the world, both in developed and in developing countries, have been either funded by the public sector or through a combination of public funds and foreign assistance. Due to the importance of infrastructure development on the economies of countries, governments realized the necessity of the participation of the private sector in infrastructure financing. Therefore, governments are becoming the facilitators of infrastructure facilities rather than providers.

1. Definition of Privatization

Privatization refers to a shift of responsibilities from the public to the private sector in construction, operation, management, or maintenance of infrastructure (2). Any combination of these elements would lead to privatization. Starr (1988) notes that privatization is defined as any shift of the production of goods and services from public to private. (2) When an entity is privatized, the private firm does not only provide the service but also assumes the responsibility for service delivery. The quality is insured through competition of the firm with other firms in the market.

Privatization is of two types, either privatizing an existing infrastructure facility or developing a new facility by the private sector (Greenfield projects). Privatization can take the form of Alternative Service Delivery, Private Finance Initiative, or Public-Private Partnership (3).

2. Sources of Funds

The private investment in infrastructure can take the form of equity investment or debt financing. Both of these financing methods can be direct or indirect.

Equity Investment

Direct Equity investment is mainly through the involvement of the investors in projects based on privatization and Public Private Partnership schemes. In case of privatization, the private sector can acquire the public assets themselves or invest in state-owned companies. In case of PPP projects, the private sector can invest to develop and operate a new project (Greenfield project) or simply operate an existing asset through a concession contract. Indirect equity investments refer to infrastructure listed funds, which are estimated to be \$US 2.1 trillion or 5% of the global equities market, and unlisted infrastructure funds, which are growing and are approximated to be \$US 38 billion⁷.

Debt Financing

Debt financing can also take two forms, either project based or asset based. Project based are loans used to finance projects that aim to build and operate a new infrastructure. Asset based financing include loans for private companies to operate existing infrastructure. Indirect debt financing refer to infrastructure bond funds.(6)

The investment funds, sponsored by global investments banks, private equity firms, and institutional money managers are considered new to the game. Various new global infrastructure funds have raised about \$100 billion to invest in infrastructure assets with an initial focus on Europe, where PPP have been well established in many countries. (10)

3. Financing Instruments

Financial instruments are either in the form of debt, equity, or mezzanine finances, which are new instruments that share the characteristics of both debt and equity. Usually financial instruments are divided according to their maturity periods into short term or long term instruments (1).

⁷ Source: Ernst & Young 2007

3.1 Long-term Financing Instruments

Long term financing refers to raising debt, equity, or mezzanine finance, which have a repayment obligation beyond 1 year.

Debt Instruments

They refer to loans from banks, financial institutions, and export credit agencies.

- **Term loans:** they are loans provided usually by more than one bank or financial institution. The term and conditions of loans vary from lender to lender and borrower to borrower, and they are negotiated between the two parties. The servicing of the loan can take various forms. Loans can have a fixed interest rate or a floating interest rate. The cost of raising debt capital includes certain fees besides the interest: management fee, commitment fee, agency fee, underwriting fee, success fee, and guarantee fee. (1)
- **Subordinated debt:** it is the debt subordinated to the senior debt. It has usually a higher interest rate because the risk for the lenders is higher.
- **Euro currency loans:** they are loans provided by banks, but the loans are denominated in a currency other than that of the country where the bank initiating the transaction is located. Euro currency markets are also known as Eurodollar market because the largest number of loans in this market is in US dollars. (1)
- **Debentures:** It is similar to a term loan, but the only difference is that in this case the loan is divided into securities and sold through the stock market to a variety of investors. (1)
- **Export credit:** they are loans provided by exporters or governments to finance projects in other countries in order to promote the countries' exports. For example, a government providing loans for an infrastructure project in another country under the condition that the equipment used in the facility are the lender's products.

Equity

Money provided by the investors or owners of the project. Entities providing equity are the shareholders in the project.

Mezzanine finance instruments

Mezzanine instruments are senior with respect to an equity issue and subordinate to debt (1). These include the different types of bonds such as coupon bonds, zero coupon bonds, etc.

Other financing instruments

They may include the following:

- **Depository receipts:** They are securities that are issued by foreign publicly listed companies; however, they are transferable and can be traded on a local stock exchange. (1)
- **Lease finance:** A contractual agreement established between two entities where the lessee has the right to use an asset and in return must make periodic payment to the owner of the asset. They can be operating lease or financial lease. *In a financial lease the user identifies an asset in which it wishes to invest, negotiates a price and delivery, and then seeks a supplier of finance to buy it.* (1)
- **Aid:** amount of money usually provided to developing countries through multi-lateral and bi-lateral agencies. Multi-lateral agencies include development banks such as The World Bank, the Asian Development Bank, and the African Development Bank. Bilateral aids are usually provided by the government of a country to finance a project in a developing country. Most developed countries have their own government bi-lateral development agencies. These aids are usually conditional and often tied with political interest.

3.2 Short-term Financing Instruments

Short-term financing refers to financial instruments, which normally have a repayment obligation of up to 1 year. Projects require short-term debt for two reasons. Short-term debt covers the working capital needed once the project is commissioned. On the other hand, short-term debt is required as bridging finance to make payments when there is a known future source of funds. The possible sources are unsecured bank borrowing, secured borrowing, and other sources. (1)

4. Reasons that Attract Private Infrastructure Investors

According to Ernst & Young Infrastructure Report (2007), the next 10 years is likely to experience the same explosive growth in infrastructure as an asset class that real estate has experienced in the last decade.

There are several reasons that encourage private investors to expand their portfolios in infrastructure assets. The most important ones being the following:

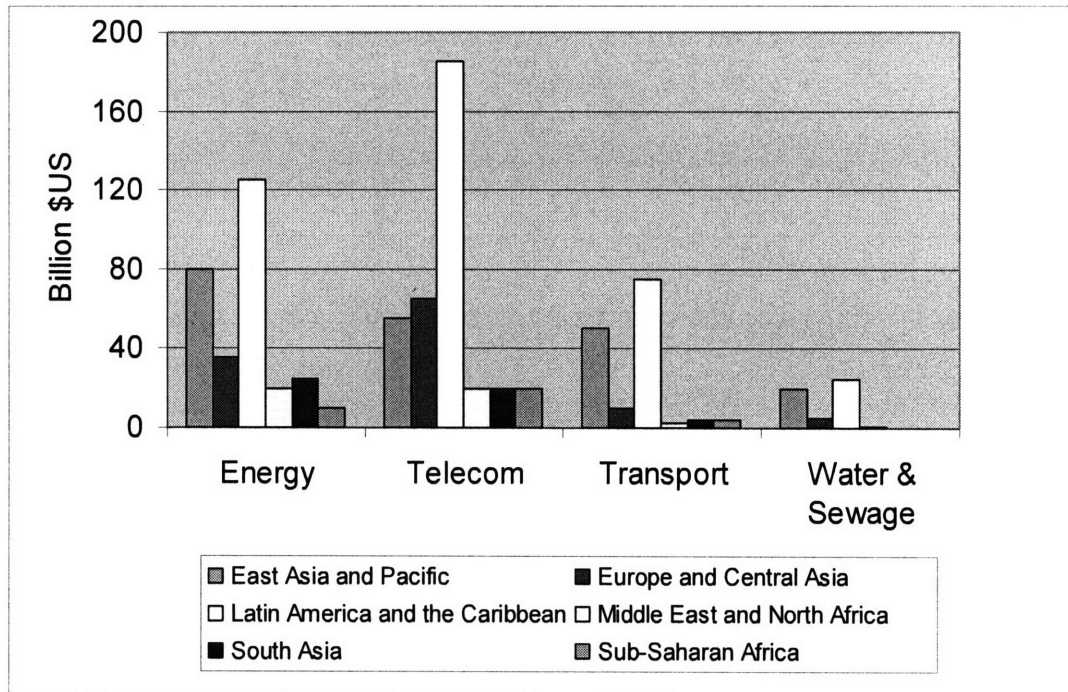
- Infrastructure investments provide more stable cash-flows that are adjusted for inflation. Infrastructure is considered a safer asset than real estate because demand for services is less fluctuating, and it is less affected by the economic situation of the country.
- There is an increase in competition between private investors to invest globally. Capital budgets are increasing, and investors are looking for various sectors to invest in. (6)
- After realizing that they have greater need than ever for capital for infrastructure funding, governments are becoming more receptive to private investments. Developing countries are attracting so much international investments in their infrastructure. Some developing countries provide infrastructure specific tax incentives designed to encourage private investment (6). New markets are opening up such as the Middle East, India, and China while the United States is considered to be the biggest market in

future private infrastructure investment after PPP projects started picking up (13).

- Besides, infrastructure assets allow investors to diversify their portfolios depending on varying risk profiles; they can invest in a risky Greenfield project in an unstable country, or simply invest in an already operating project in a stable developed country.

Figure 1 presents the international private investment in infrastructure project in the world between 1990 and 2002.

Figure 1: Total International Private Investment in Infrastructure (1990-2002)



Source: J. Saghir, "Financing Water and Environmental Infrastructure for All", Opening Speech at the OECD Global Forum on Sustainable Development, Paris, December 2003

Figure 1 shows that the highest foreign investment in infrastructure is in Latin America and the Caribbean.

5. The Private Finance Initiative

PFI started through denationalization where the government sells the public assets to the private individuals or firms, to the management and employees, or to the public with equity shares (3). This program was first introduced in 1980s by England's Prime Minister Margaret Thatcher. The Channel Tunnel project was the first project to be privately financed in 1987.

The PFI was developed as an alternative method of procuring services for the public sector in 1992. Since then, PFI has become very popular throughout Europe as a way to cut public expenditures.

The private sector is responsible to provide the infrastructure and the associated services to the public without the interference of the government. The private sector is responsible to fund, build, and operate the facility, and is allowed to get profit either from revenues directly collected from the user, or through a payment mechanism negotiated with the public sector. The role of the governments should not exceed more than ensuring adequate investment, competitive climate, and open and stable economy. (4)

One of the guiding philosophies of the PFI is that the public bodies allow the private sector the freedom to determine how it is to provide a service to meet the relevant specification. The major difference between privatization and PFI is that the emphasis in PFI is on the "Procurement of Service" and not on "Asset Acquisition". (3)

5.1 Implementing PFI

PFI can take various forms:

Financially free-standing projects

They are financed and managed entirely by the private sector without any input from the public sector. (1)

Joint ventures

They may be done between the public and private sector; however, the private sector retains control. There is a clear definition of the government contribution and its

limitation. There is a clear agreement about risk and reward allocation, defined and agreed in advance, ensuring that the private sector returns are running some risk. Typically, governments contribute through aiding in the initial planning or through a grant subsidy. (1)

Services sold

They can take various forms where a private firm provides services to the government in return for a specific fee.

5.2 Role of Governments in PFI

In PFI projects, the government is becoming a regulator that protects the interest of the public rather than a provider of infrastructure facilities. The government's major role is in protecting the public interest without interfering in the method of procurement. According to Mody (1996), the trend is towards regulating the outcomes rather than the process.

Entrepreneurial governments are increasing the scope of competition by unbundling activities in which economies of scale have limited importance. Creative restructuring of sectors, eliminating barriers to entry, and rules for fair competition are needed. (8)

Where competition is not enough to provide the required output, government regulations should come in to protect the public's interest and prevent abuse of a dominant market position. Regulatory instruments, such as price caps, seek to limit service prices while maintaining private provider incentives for cost reduction. (8)

According to Mody (1996), regulatory instruments may include the following:

Cost Plus or Embedded Cost Regulation

They serve to set limits on the infrastructure provider's rate of return. The method allows the provider to charge a price that covers costs and allows a fair return on the capital invested. However, in this case, providers will have an incentive to inflate costs while the regulators are not in a good position to monitor cost. (8)

Price Cap Regulation

It was designed in the 1980s by UK Treasury economist Stephen Littlechild, which has been applied to all of the privatized British network utilities. The allowable rate increase is equal to the economy rate of inflation, measured by a retail price index (RPI), less the X-factor, which measures the extent to which the sectoral productivity growth is higher than in the rest of the economy. However, practice is beginning to diverge from the conceptual idea. In the United Kingdom, the regulators have made adjustments to the X-factor when profits in the telecommunication sector have grown too rapidly. (8)

Other Alternatives

A firm may be allowed to choose one of many available alternative plans.

The private financing is based on user charge fees. To ensure that infrastructure services are produced efficiently, user charges should provide a balance between efficiency and cost recovery objectives. (8) User charges that reflect cost would be one major requirement for private provision.

Governments should monitor activities in order to create more accountability. Setting private incentives in a competitive atmosphere would increase efficiency and decrease cost since more entities would be willing to provide a service at the lowest price possible and highest quality. (2)

Moreover, the need for government financing is rarely eliminated; there will still be a need for the combination of government and private financing in a project. The Public and Private sector should always collaborate together to provide the most efficient output (8). Public Private Partnership in infrastructure procurement is discussed in the following section.

6. Public Private Partnership

The Public-Private Partnership Program was set in the UK in April 1996 (3). The benefit of Public-Private Partnership is that it allows projects that are not financially robust to be totally financed by the private sector to be realized (1). The public sector's role is to close the gap between commercial financial analysis and social cost-benefit analysis.

Public Private Partnerships as defined by the US DOT Report (2004):

“A public-private partnership is a contractual agreement formed between public and private sector partners, which allows more private sector participation than is traditional. The agreements usually involve a government agency contracting with a private company to renovate, construct, operate, maintain, and/or manage a facility or system. While the public sector usually retains ownership in the facility or system, the private party will be given additional decision rights in determining how the project or task will be completed.”

PPPs usually run over a long term period (15-30 years and may go up to 99 years, e.g., Chicago Skyway concession agreement). In PPPs the public sector is just concerned with the output specifications and performance criteria without addressing the means of delivery, and the public sector provides no funding during the construction phase. Construction and operation risks remain with the private sector, which relies either on the operations of facility or availability payments to generate revenue. Therefore, no payments are made until the asset is delivered and working (2).

Grimsey (2004) clearly differentiates privatization from PPPs. *“The regulation imposed on the privatized firm is quite different from that under a PPP, and this is a reason why PPPs are not privatization. A PPP is a formal business arrangement between the public and private sectors. The nature of this business activity, the outcomes required, the prices paid for the services along with the general rights and obligations of the various parties are specified in considerable detail in the contract or concession agreement. Consequently regulation does not come from market forces, but is a direct result of an explicit contract stating performance and quality standards. Regulation through contract and the lack of government disengagement define the difference between PPP and privatization.”*

6.1 Payment Mechanism

The private sector is investing in a project for a long concession period. The investors rely on the operation of the facility in order to generate revenue. Mainly there are two ways by which the private concessionaires generate revenues, either direct fees to the users such as toll roads or availability payments from the public sector. While direct fees to the users are the most common, sometimes these fees are not reasonable to impose on users. For example, in the Port of Miami Tunnel Project⁸ tolls were not feasible since vehicular traffic would divert to the existing bridges or some cargo traffic would divert to other competing ports. Instead of receiving revenue from direct user tolls, the concessionaire will receive availability payments from FDOT⁹ throughout the duration of the contract to repay the up-front private sector financing of the design and construction of the tunnel plus the costs of operating and maintenance. The payments would be fixed monthly and any deductions will be assessed based on contractual performance standards. In this way the government benefited from the partnership in the sense that it shifted all the construction risk to the private sector. In addition, it made the realization of the project feasible because funds are not available to be paid now; however, it is easier to pay monthly payments to the concessionaires.

6.2 Types of Partnerships

Public Private Partnerships vary in the magnitude of the role of each of the private and the public sectors. Therefore, they are divided into three general types of partnerships: shared, dominant and independent. (3)

Shared partnership

The public sector shares additional risk in order to increase the robustness of the project. This will encourage the participation of the private sector because investors would be less worried about the risks that are not controlled.

⁸ Developed as a PPP project under a Concession Agreement (Expected Date of Completion: 2012)

⁹ Florida Department of Transportation

Dominant Partnership

In case the public sector is not willing to handle the risk, the role of the private sector will dominate. The public sector may offer the promoter additional equity through offering him the use, the revenue, and the operation and maintenance of existing facilities to generate revenue during the critical stage of debt. (1)

Independent or indirect options

They include tax holidays, grace periods, and soft loans.

- Tax holiday: Tax holidays are mainly used in developing countries in order to attract foreign investments in their infrastructure projects. Governments tend to lower or totally eliminate tax for a certain period of time to make projects more financially feasible for investors.
- Grace period: Grace period is defined as a period of time after a deadline where the investors will not be subject to additional penalties. (17)
- Soft loan: Soft loans are loans with longer repayment periods, lower rate of interest, or with interest holidays. The World Bank and other development institutions provide soft loans to developing countries to foster economic growth. (1)

6.3 Forms of Partnerships

Public Private Partnerships in infrastructure projects can take different forms. The different forms are elaborated in this section. (3)

6.3.1 Alternative Delivery Methods

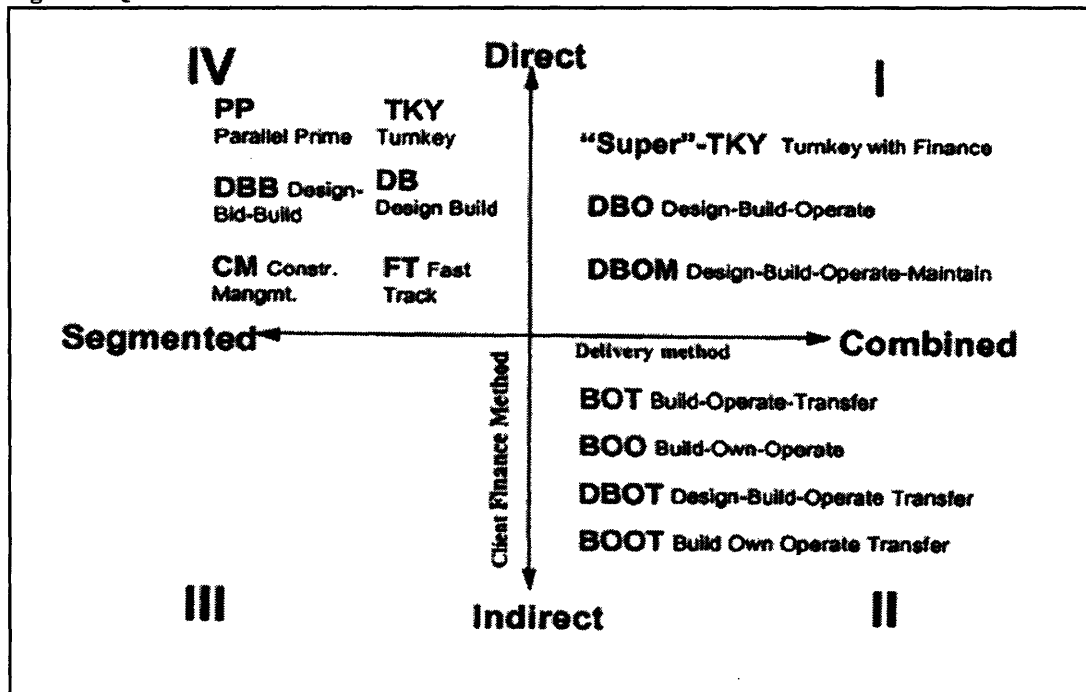
Miller (2000) divided the project delivery alternatives into five: Design-Bid-Build (DBB), Design-Build (DB), Design-Build-Operate (DBO), Design-Build-Finance-Operate (DBFO), and Pure Operations and Maintenance. According to him, the rest are minor variations or combinations of these five methods.

What is called now alternative or innovative delivery methods are Design-Build, Design-Build-Operate, and Design-Build-Finance-Operate. The difference between DBO and DBFO is that in DBFO cash flows necessary to build and operate a DBFO project are

generated only from the financial viability of the project or the financial strength of private developer. (9) There advantages are that they mainly save time, reduce risk for owners, and involve innovative technologies.

The research at the Civil and Environmental Engineering Department at Massachusetts Institute of Technology led to the development of what is called the Quadrant Framework (Figure 1) to select the suitable delivery method. The quadrant includes two strategies, one along the vertical axis and other along the horizontal axis. The vertical axis provides a set of delivery methods that range from the government directly financing the project to the private sector financing the project through the indirect interference of the government in providing encouraging incentives. The horizontal axis describes how the government can approach the planning, design, construction, operation, and maintenance of a project. These phases of a project can be dealt with separately in a “segmented” way or all the aspects of the project are “combined”. (9)

Figure 2: Quadrant Framework



Source: Miller (2000), Case Studies In Infrastructure Delivery

According to Miller (2000), there is no project delivery that is considered the best for all infrastructure delivery. Every case is separate; therefore, an infrastructure portfolio set by the government is important. The government should apply multiple delivery methods that allow it to set up the pace of infrastructure renewal, maintenance, and replacement.

BOOT Projects

The term BOT (build-operate-transfer) was first introduced in the early 90's by Turkey's Prime Minister, Targut Ozal. BOOT contracts require the promoter to finance, design, construct and operate the facility over a period of time and transfer it. The difference between BOOT and BOO is the transfer part. During the concession period, the promoter owns the facility and operates it to generate revenues. The length of the concession period is determined by the length of time needed for the facility's revenue to pay off the company's debt and provide a reasonable rate of return. (1)

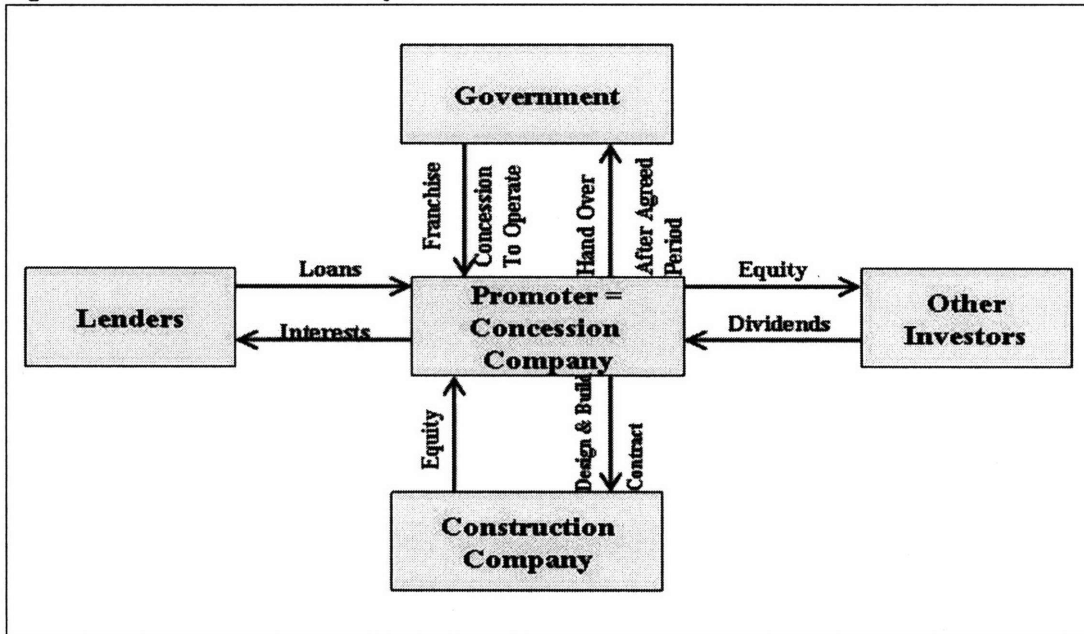
Structure of BOOT Projects

In a BOOT project the relation of the government is just with the promoter. The host government is referred as the principal who is responsible for granting a concession. A concession agreement is the contract between the two parties which lists the rights and obligations of both. In addition to that, the agreement refers to the technical and financial requirements with regard to the construction, operation, and maintenance of the project.

Usually the role of the host government does not extend to more than furnishing part of the land required or providing some support loans. Most BOOT projects are structured without any assistance from the host government. The promoter, which is responsible to build, own, operate and transfer the facility, is required to borrow funds to finance the project. The promoter is responsible for all the aspects of the project (1). Figure 3 shows the structure and the flow of money in a BOOT arrangement between the different participants in the project.

Several agreements and contracts organize the relation between the promoter and each of the suppliers, lenders, investors, users, operator, and constructors. However, in case of market-led projects, there is no contract between the user and the promoter.

Figure 3: Structure of a BOOT Project



Source: Moavenzadeh F., Lecture Notes 2008

The investors and the lenders are responsible for financing. The lenders provide loans while the investors are the equity holders that receive dividends on return to their investments. The lenders have a priority to receiving their money in case of liquidity, and equity holders are at a more risky situation.

6.3.2 Private Contract Fee Services

Another form of partnership may be through private contract fee services. In this case, the government would contract with a private company to provide a service, and the private company is paid a fee as a return to the service. The most common private contract fee services include Contract Planning, Environmental Studies, Facility and Right Of Way Maintenance, and Operation. (3)

6.3.3 Multimodal Partnership

They are partnerships between the government and the private sector to provide a set of services. Moavenzadeh (2008) lists several forms.

- **Park and Ride:** Parking for cars is provided next to a public transportation stop. The fee is set to encourage people to use the public transportation system.
- **High Occupancy Lanes:** High occupancy lanes are certain lanes on a highway where the use is limited just to vehicles with a minimum number of passengers. This is considered a way to encourage people to use fewer cars and decrease traffic.
- **Tolled Lanes:** Tolled lanes are certain lanes on a highway that require a fee.
- **Bus Rapid Transit (BRT):** A set of transportation systems that tend to provide public transportation with a better quality than ordinary busses.
- **Airport Transit Extension:** Developing transit extensions to airports in order to facilitate the movement of goods and people from and to the airport.
- **Truck/Rail Transfer Facilities:** Roads or rails to be used by trucks and cargo trains in order to decrease traffic on highways and increase safety.

6.3.4 Joint Development

They are developments taken by the private and public sectors jointly. These developments can be transit-oriented or economic development based partnerships.

- **Transit – Oriented Development:** It is the creation of communities centered on high quality public transportation systems. In some cases, new train stations are located in certain areas to create value and enhance development. (3)
- **Economic Development Based Partnerships:** The government encourages economic development in order to provide access to additional capital and operating revenues through receipt of tax increment financing, business improvement, and access fees. (3)

6.3.5 Long-Term Lease or Concession Agreements

The government basically gives the public sector long term lease to operate public financed facilities such as toll roads, air rights, and parking garages.

6.4 PPP in the World

PPP is becoming a trend in infrastructure procurement. Governments realized that they can shift risk to the private sector and increase efficiency.

Britain is the leading country, where under the Private Finance Initiative, the government has secured projects worth £45 billion (6). As mentioned earlier, Britain is the country where PFI/PPP models were first introduced; therefore, the country has the most mature PPP/PFI regulations in the world.

France has about three-fourths of its 7,400 mile motorway system tolled and managed by various private and semiprivate companies to which the government has sold concession through 2032. (10)

In Germany, according to the German Institute for Urban Affairs, there was a 100% increase in 2004 and 2005 of signed PPP deals. While the public building sector has experienced a greater level of activity over the last few years, the road sector is finally seeing an upturn in the development of PPP/PFI projects after a very slow start. Until now, the German's PPP performance has not been up to the level of other EU countries such as the United Kingdom with 20% mark of PPP/PFI deals; however, the number of projects is growing every month, and German PPP is a potentially vast market. The reasons for adopting PPP/PFI are because the estimated funds needed to meet the country's infrastructure needs over the next decade are €690 billion (7). Therefore, the government will have no choice but resort to PPP/PFI to satisfy the growing demand for additional modernized infrastructure and the need to achieve greater efficiency. Projects undertaking PPP/PFI have proven value for money gains of 9% to 15% against a Public Sector Comparator in Germany. (12)

Japanese PPP limit risk transfer and operate more on trust, an abiding cultural governor. Company cartels tied into the government control the bidding process. The downside is that foreign companies are kept out, and lack of competition increases cost. (10)

Australia follows the UK PPP model. The Government is increasingly relying on public private partnerships (PPPs) to fund new investment in roads, rail, ports, airports and power (21). The introduction of private ownership of infrastructure enabled a more efficient operation and management of these services. Major Banks are investing in

infrastructure, and several infrastructure Australian investors are leading the infrastructure investment in the world such as Macquarie and Babcock & Brown.

PPP in the United States will be introduced in Chapter 5, which studies infrastructure in the US. Table 2 presents the largest ten PPP/PFI transactions in the world.

Table 2: Ten Largest PPP/PFI Transactions in the World

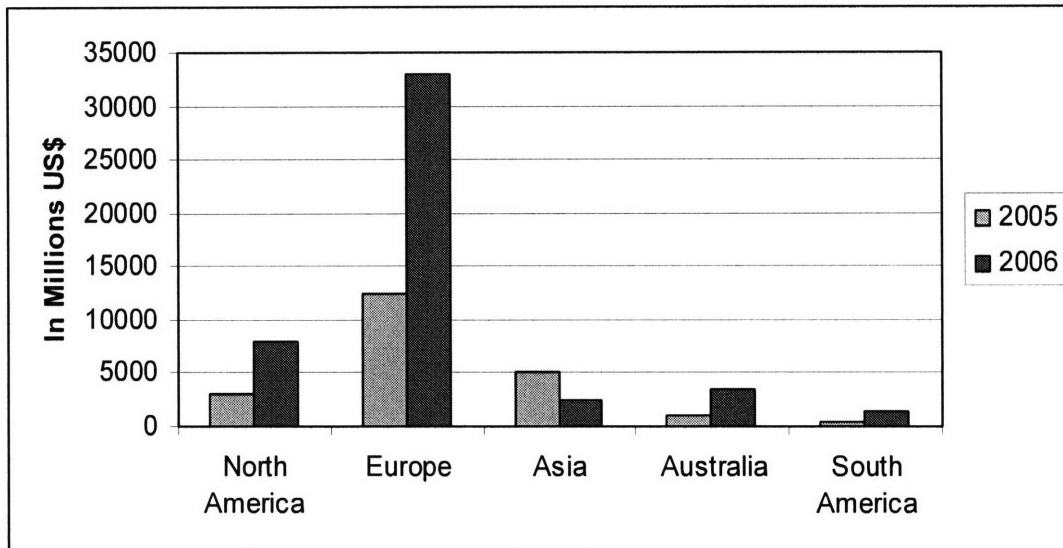
Project Name	Projected Value (US\$M)	Country
Abertis Acquisition of SANEF	10,000	France
APRR (Autoroutes Paris-Rhine-Rhone) Privatization	9,130	France
Indiana Toll Road	4,823	United States
Madrid Calle 30 OFI	3,709	Spain
Gautrain Rapid Rail Link	3,300	South Africa
Reliance Rail PPP	2,839	Australia
Budapest Airport Privatization	2,133	Hungary
Richmond Airport Vancouver Rapid Transit Project	1,660	Canada
South Korean Incheon Grand Bridge	1,600	South Korea
Bundang Railroad Project PFI	1,580	South Korea
Metro de Madrid PPP	1,470	Spain
Total	42,244	

Source: Jonathan D. Miller, Infrastructure 2007 a Global Perspective

Figure 4 shows the value of all PPP/PFI transactions in the world in years 2005 and 2006. The value of these transactions dramatically increased between 2005 and 2006.

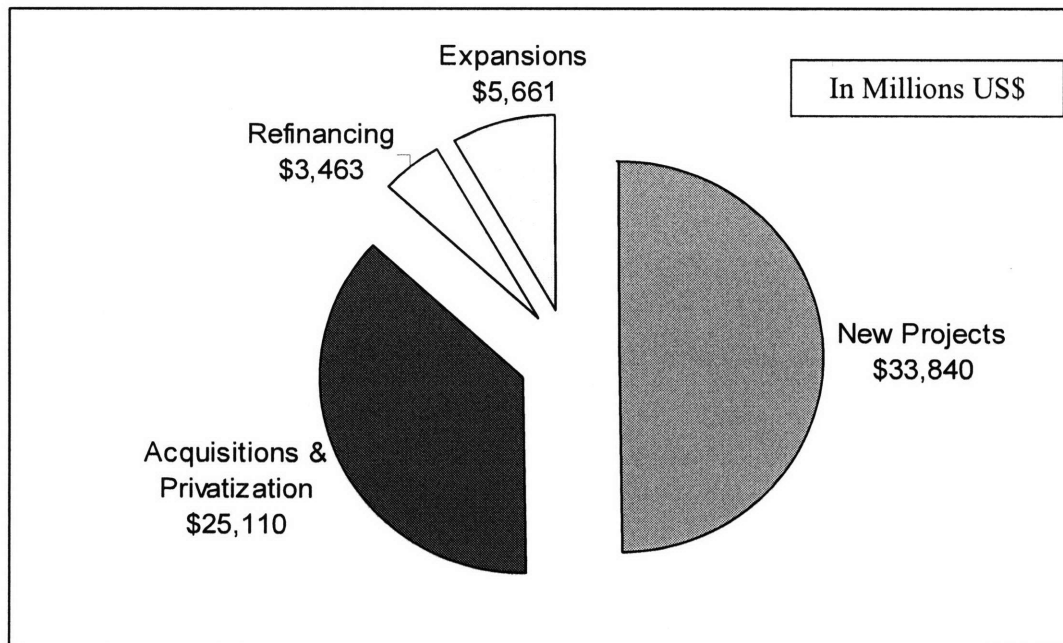
Figure 5 breaks down the value of PPP transportation infrastructure deals between new project, refinancing, acquisition and privatization, and expansions. The value of the new projects constitutes approximately half the total value.

Figure 4: Value of PPP/PFI Transactions in the World (2005-2006)



Source: Jonathan D. Miller, Infrastructure 2007 a Global Perspective

Figure 5: Breakdown of PPP Transportation Infrastructure Deals (Jan 2005-Feb 2007)



Source: Jonathan D. Miller, Infrastructure 2007 a Global Perspective

7. Alternative Service Delivery

According to Moavenzadeh (2008), governments provide services in several ways. These methods range from total production of the service, which is done in communist countries only, to the complete reliance of the government on the private sector to deliver services. Between these two options services can be delivered through contracting, franchises, grants or subsidies, or vouchers. These methods are mainly differentiated based on which party arranges the services, who supplies it, and who pays for it. The involvement of the government versus the private sector in those aspects sets the different delivery methods apart. Table 3 shows the different service delivery alternatives and the level of participation of each of the private and public sector in them.

Table 3: Service Delivery Alternatives

Service Delivery	Arrange Service	Supplier	Pays Supplier
Gov Production	Gov	Gov	N/A
Contracting	Gov	Private	Gov
Franchise	Gov	Private	Consumer
Grant or Subsidy	Gov & Consumer	Private	Gov & Consumer
Voucher	Consumer	Private	Gov & Consumer
Market	Consumer	Private	Consumer

Source: Moavenzadeh F., Lecture Notes 2008

The main difference between contracting and franchise is the payments' supplier; in franchise, the consumer directly pays the private supplier (e.g. toll roads) while in contracting the government pays the private supplier (e.g. shadow tolls). This is mainly done when it is not feasible to impose fees on users. The voucher system is when the government gives money to the public to spend; this can be useful in recession periods in order to encourage people to spend more and boost the economic activity. (3)

The effectiveness of service delivery varies with the nature of industry. In services where quality and quantity is not specified, such as fire protection, government supply is the most effective method. On the other hand, when there is competition among producers such as airlines the voucher and the market system are the most effective. Voucher system has the same effectiveness as market system because the demand and supply

regulate the market. Where economies of scale are important such as in the energy, power, and telecommunication sectors, contracting and franchising (provided competition) are the most effective ways. Franchising is considered to be the best way in delivering specific products where there are few producers (e.g.: hospitals). (3)

Table 4 shows the effectiveness of the service delivery methods based on the nature of industry.

Table 4: Effectiveness of Delivery Methods Based on Nature of Industry

Nature of Industry	Gov Supply	Contract	Franchise	Grant or Subsidy	Voucher	Market
Service Quality/Quantity not easily specified	Most	Least	Least	Somewhat	Somewhat	Somewhat
Competition among producers	Least	Most	Least	Somewhat	Most	Most
Economies of scale	Somewhat	Most	Most	Somewhat	Somewhat	Somewhat
Consumer comparison shopping	Least	Least	Least	Somewhat	Most	Most
Few producers	Somewhat	Somewhat	Most	Somewhat	Least	Somewhat

Source: Moavenzadeh F., Lecture Notes 2008

The voucher and market service delivery are the two methods that almost serve all government privatization goals because the services are arranged, supplied, and paid for by the private sector.

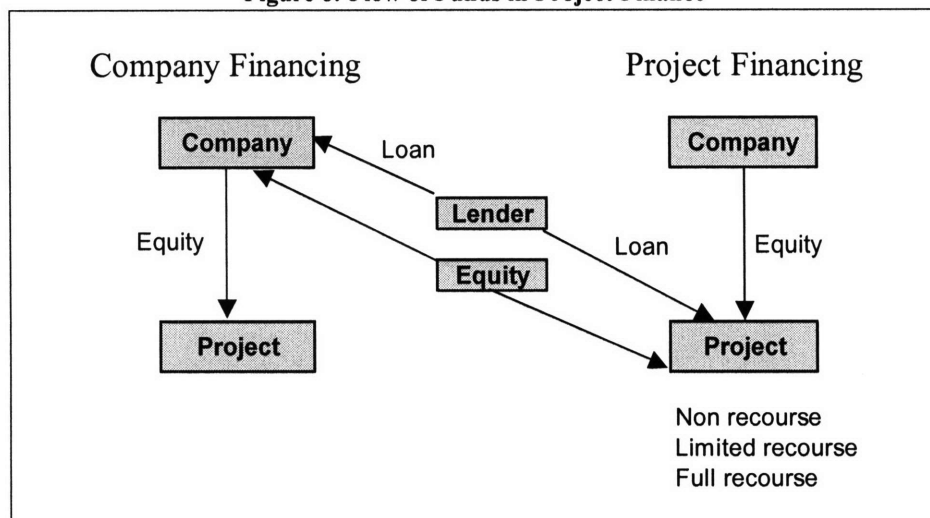
8. Project Finance

Project finance is being used in infrastructure finance as opposed to corporate finance due to the increased need for large capital.

8.1 Features of Project Finance

The main features of project finance are that the project is economically separable capital investment, and assets of the project are the only source used as collateral. The lenders do not have access to the assets of the sponsoring company because the loans are given on a non-recourse basis as the cash flow of the project is the main source of the capital recovery. The serving of debt has a priority over investors' equity. On the other hand, the interest on the debt starts accumulating during construction as a part of debt. (3)

Figure 6: Flow of Funds in Project Finance



Source: Massood S., Project Evaluation and Finance: An International Perspective 2006

Over the last few years, banks have become more accustomed to lending on a non-recourse basis. Developers are moving away from syndicated loan sources because they are trying to achieve a broader portfolio of funding solutions. (1)

Merna and Owen (1998) define project finance as the following:

Financing of a stand-alone project in which the lender looks primarily to the revenue stream created by the project for repayment, at least once operations have commenced, and to the assets of the project as collateral for the loan. The lender has limited recourse to the project sponsors. (1)

In project finance, the project is taken by a special project vehicle (SPV or the Project Company). The non-recourse nature of project finance provides a unique tool to project sponsors to fund the project outside their balance sheet. This involves a variety of financial instruments such as debt, equity, and mezzanine finance. The operation and management is in the hand of the project company for a concession that is given for a limited period of time. (1)

Project finance is not the same as privatization because in privatization, companies can rely on corporate finance to finance the project. Besides, privatization may not require additional expenses in some cases where the services used to be supplied by the public sector and then moved to the private sector. Although preferred by project companies, ownership of the assets is not essential element of project finance. Project finance is mainly used in infrastructure development in BOOT, BOT, BTO, and BOO projects. It is also attractive method in concession agreements and take-off contracts. It is important to note that the real value of project finance is in the right to receive cash flows. (3)

8.2 Advantages and Disadvantages

Project Finance is becoming attractive to investors for several reasons:

- The capital formation will not impact debt capacity of the company because it is based on an off balance sheet where the debt is only recovered by the revenue of the project.
- Risk exposure is limited because the parent company holds no responsibility in case of liquidity of the project company; thus, lenders have no access to the assets of the company.
- In project finance, it is easier to bundle activities which makes it easier to take advantage of tax shield due to depreciation.

- The cash flow is directly to the investors and not subject to any corporate policies.
- Project finance projects are highly leveraged, and they involve a big amount of long-term financing. (3)

However, at the same time, Project Finance has several drawbacks:

- The setting of the Project Company is costly while in case of corporate finance there is no need to any additional resources.
- The project company borrows at a higher interest rate because it has no track record.
- The oversight by the sponsors in project finance is very demanding while in company finance it is not even needed. (3)

CHAPTER 4

Advantages & Disadvantages of Private Financing

Private Financing of infrastructure projects has a set of advantages, and this is the reason why it is becoming more widely used. Higher efficiency, improved quality, and more access to capital highlight these advantages. Meanwhile, the drawbacks of these methods are mainly concentrated in the increased level of uncertainty and risk in these large projects.

1. Advantages

Some of the reasons why public sector entities might be attracted to PPPs involve the potential to get off-balance sheet status.

The public financing resulted in negative effects on supporting governments. It had increased inflation and affected macroeconomic balances since governments are almost bearing all the risks. Unable to meet the demand of the large cost of modern infrastructure projects, the public sector performed poorly because of widespread misallocation of resources. (1)

The private financing of infrastructure has a direct beneficial effect in that it eases the burden on governments and enhances accountability, monitoring, and efficiency in management of infrastructure services. In addition to providing new sources of capital, the private sector provides reduced schedule and cost and reallocates the risk from the public to the private sector (2). According to the World Bank, increased private sector involvement in infrastructure projects offers the twin benefit of additional funds and more efficient provision.

Privatization is a way to attract foreign investment that lead to increased revenues and decreased debt. Privatization increases quantity of production, improves quality of output, and generates new technologies. The transfer of risk to the private sector

provides incentive for private entities to maximize efficiency. Many reviewers claim that it reduces unit price; however, experience did not prove this issue yet.

On the other hand, the pricing philosophy in the private financing makes the beneficiaries of the service the direct payers for the services they are getting; thus, relieving other taxpayers from the burden of paying for services they are not benefiting from.

As a reply to the rationale given for public funding regarding governments running monopolies associated by the low production costs with large-scale operations and by the need to protect consumers from private monopolies, there is a growing recognition that private financing is disciplined by competitive market forces, thus resulting in more efficiency in delivering infrastructure. The private sector is sometimes in a better position in terms of economies of scale. For example, the operation of wastewater treatment plants in the US is done by the private sector. Private companies would be operating in several cities and can provide much more competitive prices than local governments.

PPP projects provide a better whole-of-life project evaluation because in case of conventional procurement, individual private sector companies do not evaluate the whole-of-life viability of a project because they are only invited to tender for portions of the project. Therefore, in case of PPP, the design and maintenance during the whole life cycle of a project are optimized. On the other hand, the assessment of the project is done more realistically by the private sector than by the public sector which is usually very optimistic (15). Infrastructure developments are very tied with politics, and usually politicians that start developing an infrastructure facility are not in charge when the facility is completed. A study by Flyvbjerg examined 258 large transport infrastructure projects covering 20 countries; most of the projects were developed using conventional approaches. Costs were found to be underestimated in 90% of the cases. Rails come in the first position of average cost escalation of 44.7%, then bridges and tunnel for 33.8%, and finally roads for 20.4%. (2)

PPP encourages more innovation since this approach focuses on output specifications and provides enhanced opportunities and incentives for bidders to fashion innovative solutions to meet those requirements.

The discipline of market led forces the concessionaires to improve efficiency in construction and operations and complete projects at the lowest cost and in the shortest time possible.

Klein and Roger (1995) stated that although governments are able to borrow at a lower cost to fund infrastructure projects, private management of the facilities is better and more efficient. (2) Mott Macdonald examined 50 projects in the UK out of which 11 were undertaken by the UK PPP/PFI model. Due to better risk allocation in PPP/PFI projects, the results were in favor of these projects in terms of schedule and cost overrun. Capital expenditure resulted in a 1 % cost overrun on average for PPP/PFI projects (relative to an average of 47% for traditional procurement projects). On average, the PPP/PFI projects came in under time (compared to 17% over time for those under conventional methods). (2) Review of PFIs HM Treasury¹⁰ (July 2003) examined that 89% of projects were delivered on time or earlier and all PFI projects in the HM Treasury sample were delivered within public sector budgets. Three quarters of public sector managers stated that their project was meeting their initial expectations. (2)

The participation of both the public and the private sectors would provide access to additional capital. In addition, the public sector will allocate the risk to the private party, which can manage it at less cost, this can substantially lower the overall cost to government. The high contracting cost of PPP is viewed by some people to be deceptive since the apparent lower cost of traditional procurement methods is underestimated because the risk analysis may be less thorough, and the results are always cost overruns and project delays. (1)

PPP projects that follow the BOOT character help transfer technology, skills, and expertise to local personnel through training. Used as a benchmark to measure the efficiency of similar public sector project, according to Merna (2002), BOOT projects are the first step in governments' policies to privatize infrastructure. (1)

PPPs cover many areas of infrastructure services (prisons, hospitals, wastewater treatment plants, etc.) where tolls and user fees and cannot be levied; thus, allowing the public sector to provide funds for projects that cannot be regulated by the market.

Despite the advantages of PPP/PFI projects, these procurement methods have many drawbacks and have been criticized by many reviewers.

¹⁰ The government department in the United Kingdom responsible for developing and executing the British government's public finance policy and economic policy

2. Disadvantages

In a study done by Mott MacDonald in the United Kingdom, the results were that public managers accept that there can be value for money because the private sector is able to deliver sufficient cost savings in other aspects of the project (design, operation, management); nevertheless, they concede that private borrowing costs are higher. (2)

There is a concern that allowing the private sector to dictate terms that it would bid for would allow it to pick and choose profitable projects, leaving the less attractive ones; thus, projects will be chosen on the basis of economic viability rather than need. Projects that are attractive to the private sector are also profitable for the public sector; hence, the public sector would end up financing projects that are not financially feasible for the private sector in order to close the gap between financial feasibility and social benefit.

There is a growing concern that value for money (VFM) may not be achieved because of the relatively large risk in projects (1). As a result, the public sector may pick up the burden, and the project will be paid for by taxpayers in the long run.

On the other hand, there are concerns regarding cost of compulsory evaluation of projects to see if the PFI is the suitable strategy, and the cost of the assessment if the project does meet the VFM criteria (1). The high bidding cost and the risk that the project may be cancelled would make only few companies able to bid, thus decreasing the role of competition and market forces in lowering price.

The PFI created so much debate in England after the government sold many public entities to the management with certain arrangements that allow the new owners to make profit in case they increase efficiency. The new owners ended up decreasing the number of employees in the overstaffed public entities and made huge amount of profit without improving the output. (3)

PPP contracts are typically much more complicated than conventional procurement contracts. They may be renegotiated since it is difficult to anticipate all contingencies due to the length of the relationships created by PPPs. Besides, since it is difficult to estimate all financial outcomes, the private sector may either make very large profits or go bankrupt. Enforcement of performance specification may be one of the major difficulties. Critics question the practicality of long concession terms in early deals because can

predict the needs and requirements 30 or 40 years from now. No one knows what to expect despite many contract contingencies. (15) Pahlman (1996) commented that BOOT has no track record and, until now, no major BOOT project has successfully completed all the stages (build, own, operate, transfer) according to the original plans. (1)

In addition to that, many critics are raising the issue of who would protect the public interest if the public sector loses control over assets. Moral hazard arises because an individual or institution does not bear the full consequences of its actions, and therefore has a tendency to act less carefully than it otherwise would, leaving another party to bear some responsibility for the consequences of those actions. The private sector is less concerned with externalities associated with a project. There will be a difficulty in drawing the line between economic versus social and environmental analyses of projects.

Concerns have also been voiced as to whether private sector participation in infrastructure will dilute accountability and erode the public interest. However, according to Grimsey (2004), PPP offer the opportunity to expand the level of public interest. The framework of a PPP relies on a transparent and open process of consultation with affected parties. (2)

PPPs are too complex and costly for many small projects. Forecasts suggest that only about 10% of US roads will attract Public Private Partnership, and these will focus mostly on new interstate and highway construction using toll concessions. Even in the UK, where PPP has been embraced for more than a decade, only about 16% of the country's infrastructure has been ripe for privatization models. (10) Nonetheless, it is guaranteed that PPPs will continue to be an important component of infrastructure policy.

BOOT projects are usually very complicated and require planning, time, and money; therefore, few BOOT projects actually reach the construction stage due to the lack of experienced developers and investors and the disability of governments to provide support and workability of corporate and financial structures (1). Quiggin (1998) stated that BOOT schemes are usually bad arrangements because companies that are good at construction are not necessarily good at operation and maintenance. (2)

Given that the extra cost of private sector funding vis-à-vis public borrowing is likely to be between 1 to 3 percent, some have argued that PPP/PFI can never be cost effective. (2)

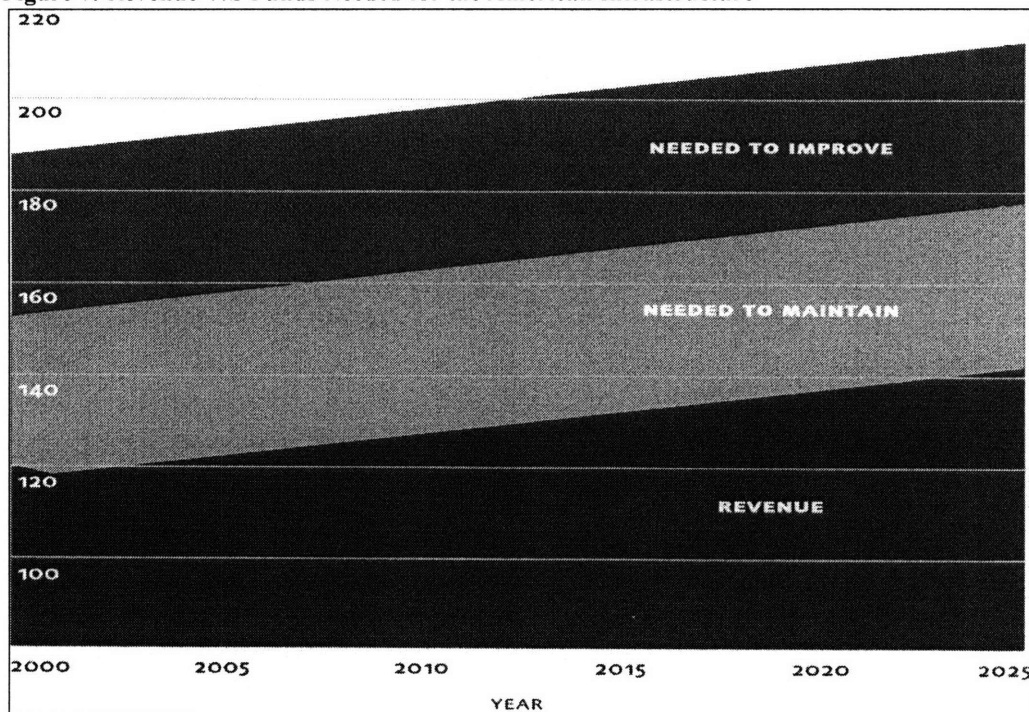
PPPs are generally entered into for a lengthy period of time, usually 20 to 30 years, and are developed in an environment of uncertainty. There are many risks associated with the long term concession period, and the risks associated with private financing of infrastructure projects will be analyzed in Chapter 6.

CHAPTER 5

Infrastructure in the United States

As mentioned earlier, projected funding gaps for infrastructure are enormous and threatening in the United States where an estimated \$1.6 trillion are needed over the next five years to keep up with the demand. According to the Economic Policy Institute Report (EPI), the infrastructure investment in the US is the least compared to the industrialized countries as a percentage of GDP; it is less than 1% of GDP¹¹. Figure 7 shows the additional funds needed to maintain and improve the American Infrastructure.

Figure 7: Revenue V/S Funds Needed for the American Infrastructure



Source: Jonathan D. Miller, Infrastructure 2007 a Global Perspective

¹¹ Source: Jonathan D. Miller, Infrastructure 2007 a Global Perspective

1. Conditions of US Infrastructure

Despite the importance of infrastructure, the US infrastructure is deteriorating, unreliable, and congested. According to the American Society of Civil Engineers, the highest grade that an infrastructure facility can get is C. According to the House of Representatives Report, almost one-fourth of the American highways are in poor or mediocre condition; another 36% are rated fair. One in five of the country's bridges is structurally deficient, meaning weight restrictions have been set to limit truck traffic. There are estimated 74,000 structurally deficient bridges that may collapse just as Interstate-35W bridge in Minneapolis did (13). There are unacceptable flights delays at 33 of the country's major airports, and 40% of the nation's locks are more than half a century old. Wastewater treatment infrastructure remains inadequate to the task of cleaning up the country's waters. (22)

On the other hand, highway construction costs have increase by about 50% between 1999 and 2006 (Producer Price Index for Highway and Street Construction), which is increasing the cost of infrastructure renewal or replacement. Noting that the deterioration of infrastructure is exponential, the more maintenance is postponed, the higher the cost will be. The argument presented by many critics is whether the US should keep the 3,871,020 miles¹² of highways that are currently present and whether they are all needed.

2. Financing the US Infrastructure

Over the last century, the US infrastructure has been financed in several methods. Different level of governments financed infrastructure facilities through money raised from property tax assessments, dedicated gas and tax licensing fee revenue, and general tax revenue (22). Another source of financing for the US infrastructure is Tax Incremental Financing which started in California in 1952 (10).

Privatizing infrastructure in the United States is not new; railroads, mass transit, telecommunication, and power systems have been traditionally developed and operated by publicly regulated private companies. Over the past two decades, a number of toll roads have also been privatized, with about \$25 billion worth of projects proposed or

¹² Source: Moavenzadeh F., Lecture Notes 2008

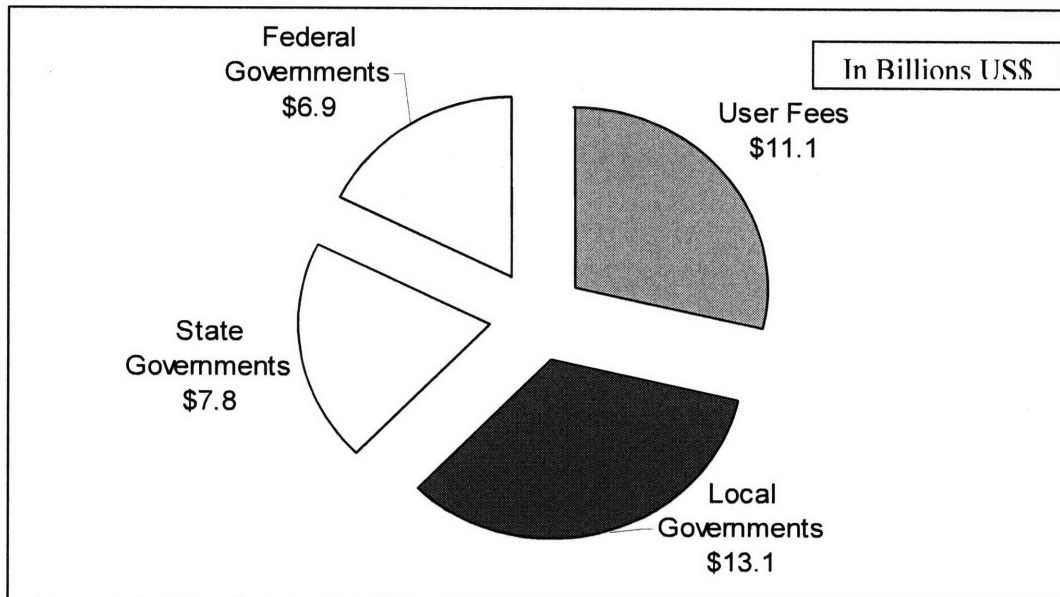
under development (22). The infrastructure in the US went into a full circle from privately owned in the 19th century to publicly owned in the 20th century, and now it is going back to being developed through PPP and privatization schemes (3).

Roads and streets, which constitute an important chunk of infrastructure facilities, were financed through real estate developers, private turnpike companies, tolls, and public funding. Real estate developers and property owners financed roads because they increase value to their property by providing better access, more public space, and personal mobility. For long term financing, they relied on assessments by property law associations in addition to charges for parking. (22)

In the 19th century, state charters and franchises for turnpike companies raised money from tolls and real estate developments. However, during the mid 20th century, tolls owned by governmental and quasi-governmental authorities became an important source of road financing.

The public financing of infrastructure is still dominating the private sector. Out of the \$39 billion transit revenue sources in 2004, 27.8 were from government funds while 11.1 were from users' fee. (10) Figure 8 shows the sources of transit revenues in year 2004 in the US.

Figure 8: Transit Revenue Sources in the US (2004)



Source: Jonathan D. Miller, Infrastructure 2007 a Global Perspective

3. Public Private Partnership in the US

The use of public-private partnerships (PPPs) in the US transportation infrastructure in the 20th century emerged in the mid 1990s with the Dulles Greenway toll road in Virginia, the SR 91 tolled express lanes in California, and JFK Airport Terminal 4 in New York (9). Since then, PPP projects have picked up with Texas being at forefront of PPP transportation projects.

Dulles Greenway in Virginia, which opened in late 1995, was the first major privately funded toll road in the United States for more than 50 years. The cost of the project was \$125 million with a 35 years concession period. (9)

The United States is an emerging market for infrastructure investment with a large number of potential opportunities (10). Therefore, PPP models are capturing the attention and becoming important alternatives to procure infrastructure projects.

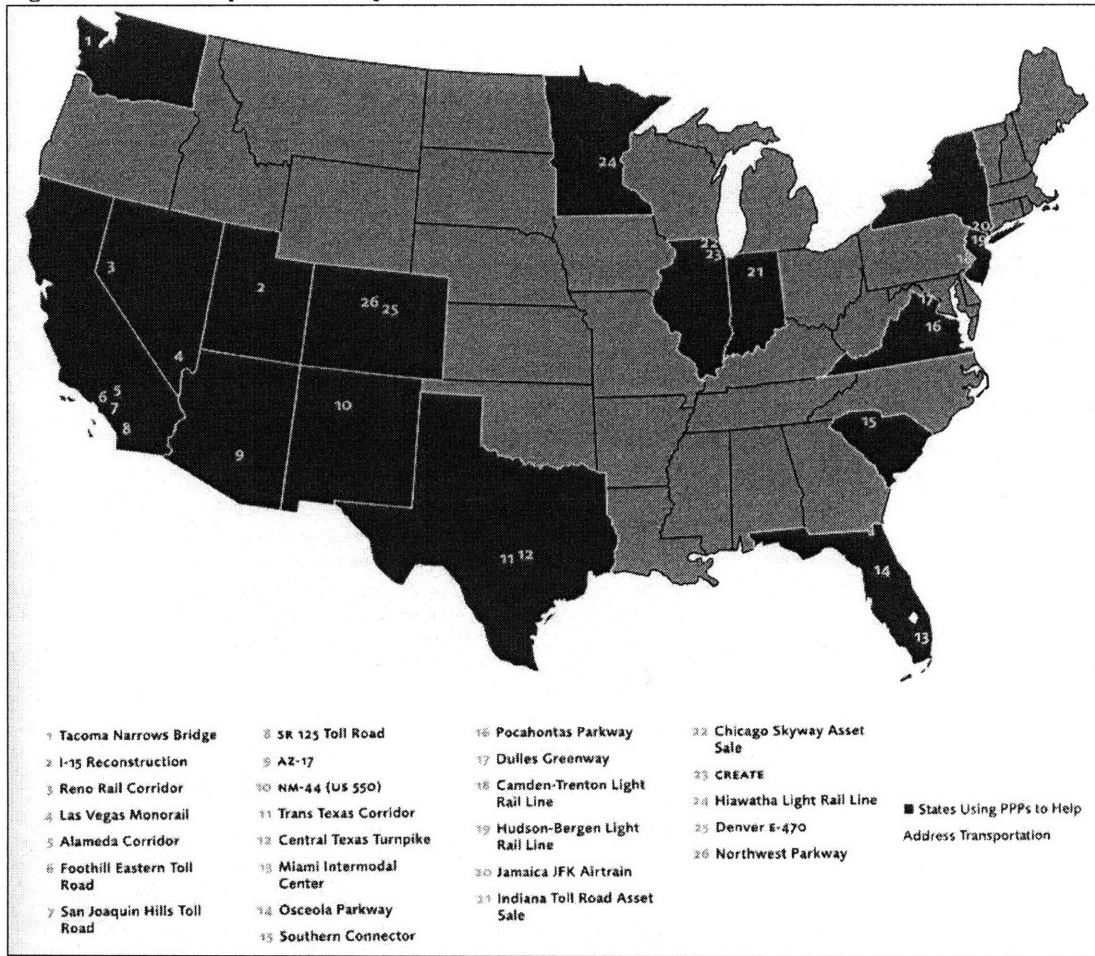
In addition, the US governments are encouraging PPPs. In 1998, the US Department of Transportation set the Transportation Infrastructure Finance and Innovation Act (TIFIA) program which provides direct loans, loan guarantees, and lines of credit to help cover up to 33% of the cost of transportation infrastructure projects, including PPPs, that are valued at least \$50 million. Approximately half the states have enacted legislation to accommodate the use of PPPs including authorization for the tolling of designated roadways, the leasing of existing facilities to private concessionaires, and the development and operation of new transportation infrastructure projects under PPP structures. (13)

However, at the same time, PPP projects are facing several challenges. Many members in the Congress are urging the creation of a new gas tax backed Federal Trust Fund to repair the country's deteriorating bridges and opposing the increased implementation of PPP (13). Airport privatization in the US seems to be far of reach. In January 2007, the Port Authority of New York and New Jersey approved the acquisition of the privatized Stewart International Airport in Newburgh, New York. (20)

Despite the challenges, the PPP evolution continues, and several projects are being procured through PPP schemes.

Figure 9 shows the current PPP transportation projects in the United States.

Figure 9: PPP Transportation Projects in the US



Source: Jonathan D. Miller, Infrastructure 2007 a Global Perspective

Table 5: Value of Selected PPP Projects in the US

State	Projects	Value
Texas	• North Tarrant Expressway	~ \$2 billion
	• SH-161 Toll Road	\$500 million
	• Segments 5 and 6 of SH-130	\$1.35 billion
Missouri	• Missouri 800 Bridges	\$600 million
Colorado	• Northwest Parkway	\$603 million
Florida	• Port of Miami Access Tunnel	\$1.4 billion
Virginia	• I-495 Toll Lanes	\$900 million
	• HOT lanes project on I-95 and I-395	\$882 million

In 2005, a 99-year concession to operate the Chicago Skyway Toll Bridge was agreed on with a Cintra/Macquarie consortium in exchange for an upfront payment of \$1.87 billion to the City of Chicago. Over the lease term, the concessionaires are responsible of operating, renovating, and even possibly replacing the bridge. However, the question here is how the investment equation will turn if within the next 20 or 30 years some technology or new competing transport solutions make these road systems obsolete. (10)

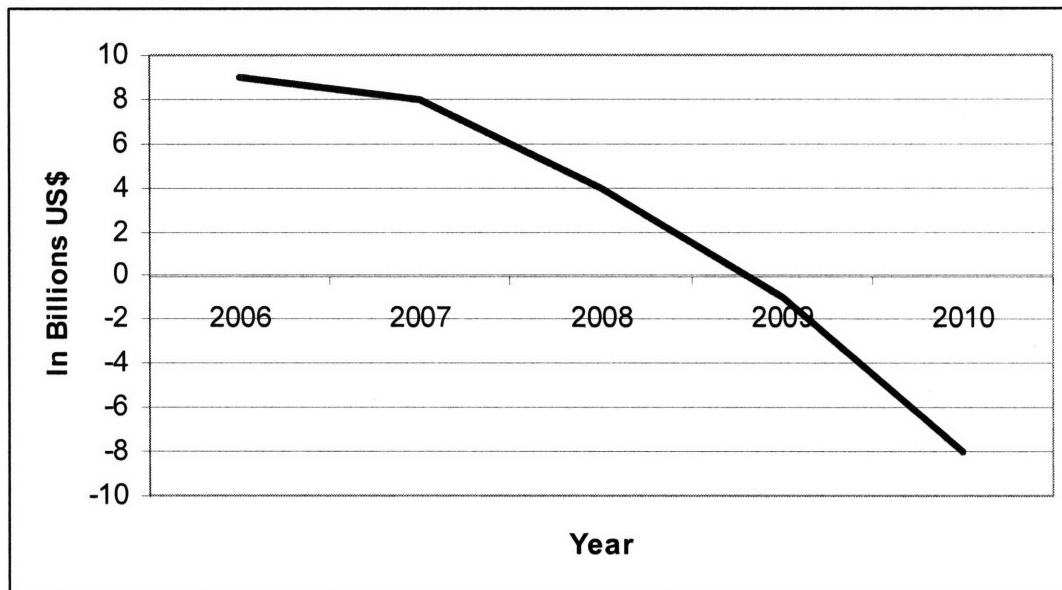
In 2006, another Cintra/Macquarie consortium was awarded the 75-year concession for the 157-mile Indiana Toll Road (ITR) in exchange for the payment of \$3.85 billion to the State of Indiana. (13)

The success of the Skyway and ITR transactions attracted much attention from government officials and politicians because of the large up front payments that were realized from selling assets that had been owned by the public sector for a long time.

4. Future of Infrastructure Finance in the US

According to Miller (2007), the US Federal Government needs to define its policy regarding funding infrastructure. Federal and state governments will ultimately not have a choice; either they raise funds or watch roads decay. According to him, state and local governments must become more self-sufficient for funding infrastructure improvements, encouraging PPP and relying on user fees. Counties and cities should formulate comprehensive plans together to help the country compete globally, and a more centralized control and planning will be prerequisites for tackling America's future infrastructure needs. (10) On the other hand, users and governments should understand the full cost price of infrastructure, not just the building, but also the maintenance and repair. Figure 10 shows the projected end-of-year balance of the Highway Trust Fund, and it is clear that the public sector is not anymore able to provide the required fund.

Figure 10: Projected End-of-Year Balance of the Highway Trust Fund



Source: Jonathan D. Miller, *Infrastructure 2007 a Global Perspective*

Therefore, the trend in the US will be the construction of highways using PPP models. New innovative techniques are being considered such as charging by mile; studies are underway to assess the viability of utilizing GPS technologies and electronic tolling systems to charge drivers simply based on mileage traveled. (10)

CHAPTER 6

Risk in Infrastructure Development

Infrastructure projects are now multi billion dollar projects, and the risks associated with them are significant. Any change in construction cost, interest rate, or exchange value may cause the project developers to go bankrupt if they are not well prepared to identify and manage the associated risks. Therefore, identifying, analyzing, and mitigating the risks prior to investing into a project is crucial. Pinpointing the risks is a concern to project sponsors and financiers. The commercial viability of a project is always in risk, and the projected revenues may never materialize.

1. Classification of Risks

Risk is the chance that the actual outcome turns to be different than what is expected. Risk is distinguished from uncertainty because risk is usually known and can be attached with a certain probability. (1) When feasible, risk can be numerically quantified through a standard deviation.

Risk is classified in several ways. Drawing the line between the different types is not always easy.

Merna and Smith (1996) categorize risks as “global” or “elemental”. Global risks are the risks that are generally not controllable by the project participants (Force Majeure). When the government sponsors political risk, it becomes controllable, and it is no longer viewed as global. Elemental risks are in control of one of the participants. (1)

Miller and Lessard (2001) classify risks into three categories. Market-related risks are due to revenue risk and financial markets, completion risks are related to the construction and operation of the facility, and finally institutional risks are the result of laws, regulations, and public pressure. (2)

2. Types of Risk

Different authors have different classifications; therefore, the following will provide a list of risks, which I found the most comprehensive one.

2.1 Commercial Risk

One of the major risks associated with large infrastructure projects is commercial risk. Commercial risks cover all the technical and market risks inherent in any major infrastructure project. They are primarily related to construction and operation phases.

Technical Risk

It is the risk that results from engineering and design failures. (2) Usually, it involves a certain defect in the final project or a technical problem that may delay the project. Design changes may be required, and in case the facility was already built, the changes would significantly escalate cost and postpone the start of operation.

Construction Risk

New projects usually involve substantial civil construction works. They are considered more risky to finance because of construction hazards, cost overruns, and completion delays (2). Construction risk may be due to faulty construction techniques or due to the above mentioned technical problems. Inexperienced project managers and lack of skilled labor may be a major source of delays and problems especially in case of technically challenging projects. The increase in the price of construction material is a major source of construction cost increase. It should be noted that the price of steel has dramatically increased over the last few years; even well experienced construction companies faced financial losses due to the rapid increase in price accompanied with lack of enough resources due to increased demand in China.

Another important source of construction risk is the geotechnical risk due to uncertainty in ground and soil conditions. Unexpected soil conditions may increase the price of excavation and foundation. Besides, in some areas, the discovery of ruins or cultural heritage may force construction work to stop waiting for lengthy archeological excavations that cause delays resulting in price escalation. Other

sources of construction delays are environmental, legal and regulatory, and force majeure risks, which will be detailed later.

Operation Risk

Due to the long concession periods, operation risks carried by concessionaires directly affect revenues, and thus directly affect the financial stability of a project. The project may not operate with the desired efficiency or desired service quality. Besides, operating risks may include interruption and delays in operation due to technical problems, change in specification of output, and certain legal liabilities. The cost and the need of maintenance may be much higher than what expected by the developers due to unexpected level of usage.

Environmental Risk

Environmental risks can be due to the discovery of hazards such as contamination in the construction site. On the other hand, they can be due to the lengthy environmental reviews and approvals that could delay project initiation and add to cost. Environmental reviews are becoming one of the major risks facing project sponsors since reviews may take up to ten to fifteen years, thus dramatically increasing cost of the project, and in case of adverse environmental impact, the project may be totally cancelled.

Risks of Input

As mentioned earlier, the risk in input may both affect the construction and the operation of the project. This risk is due to shortfall of resources or due to the volatility of prices and the inability of the contractor or the operator to buy the required input material. The increase in input prices may be either due to global market forces or due to contractual violations by the private suppliers or the government which were supposed to provide the required material. (5)

Revenue Risk

The revenue risk occurs when the revenue of the project is less than what was anticipated. This can be due to decrease in demand, decrease in price, or both. On the demand side, the risk could be an inadequate demand for the project output. (1) This can be due to change in the market or the introduction of a competitive service. New technologies may make some products obsolete; however, in free-standing infrastructure projects such as roads and bridges, technology may help cost reduction (e.g., electronic tolling) (14). On the price side, the project operators may be forced to

decrease prices due to competition or due to public pressure in case the charges imposed were too high. Due to long concession periods, the revenue risk is of greatest concern because no entity can predict the value of the service in 30 years; the facility may become totally obsolete due to the introduction of new technologies.

2.2 Financial Risk

Financial risks threaten the financial stability of project sponsors especially in project finance where the sources of funds rely only on the cash flow of the project. Financing risks mainly arise from inadequate hedging of revenue and increased financing costs.

Interest Rate Risk

The ability of the project sponsors to pay back their debt is directly affected by changes in interest rate, which may significantly increase the required loan payments. Interest rate risk varies between financial instruments used for raising short-term finances and financial instruments that have a longer maturity. (1) Financial instruments with longer maturity rates are considered much riskier and are more prone to interest rate risk.

Currency Risk/ Devaluation Risk

Currency risk is becoming a major threat for developers with growing privatization since funds are flowing across borders of countries. Exchange transactions across borders involving any currency are directly affected by this kind of risk. Most of the international investments are in developing countries, and the public infrastructure services in these countries usually do not generate revenues in foreign currency; currencies of these countries are more prone to this risk because of the generally high levels of inflation. (1) Besides, these countries do not have a well-established debt markets, and the financiers do not have the ability to hedge the currency risk.

Equity Risk

Equity Risk is associated with the variation in share prices. The shareholders are affected by this risk because the debt financing has a payment priority. A large decrease in share prices may cause bankruptcy especially when borrowers have issued warrants and convertibles. (1)

Accounting & Economic Risk

Accounting risk is determined by measuring how much a financial change would affect the cash flows generated by the project. The maturity structure of the balance sheet enables an objective assessment to be made of the magnitude of risks faced by the company in case of corporate finance; however, in project finance this sheet is not available. Economic risk is more concerned with the broader impact of risk on an entity's entire operations. (1)

Liquidity Risk

Governments can raise taxes or increase inflation in order to meet their financial obligations. Unlike the government debt, for private debt there is a risk of default. Liquidity risk occurs when a project is not able to generate sufficient resources to meet its liabilities. Liquidity risk is the result of one or combination of several of the other mentioned risks. Usually the default premium is a measure of this risk, and it is determined by calculating the probability of default and the financial loss in the event of default.

Bankruptcy Risk

It is the risk that a company will be unable to meet its debt obligations. Bankruptcy is the result of default. Most of the borrowing, whether a loan or a bond, has a cross default clause. This means that if the company has defaulted on any of its obligations, lenders may call back all their debt even before the due date; thus, the company may face even more liquidity problems and may be forced to declare bankruptcy (1). In case of project finance, the project bankruptcy does affect the parent company because of the non-recourse lending; the lenders cannot have access to the assets of the parent company.

Counterparty Risk

All parties involved in a financial transaction run the potential risk of default by the other party. (1) Therefore, there is always a risk of losses faced by debt providers in lending to project sponsors and also a risk of losses faced by equity investors in investing in the project.

In project finance, because the project is undertaken by a special project vehicle (SPV) and is an off-balance sheet transaction, lenders will face losses if the project fails because they do not have any recourse to the main organization's assets. The only assets they have recourse to are the facilities of the project.

Refinancing Risk

Due to current low interest rates, infrastructure investors have been able to finance their projects relatively cheap. The debt often constitutes more than 50% of the total financing, and it is usually of long-term nature. Therefore, investors will face a refinancing risk at some stage, even if they have long-term hedging programs in place, due to an increased exposure related to the obligation of refinancing the debt at higher rates in the future. (14)

Tax Risk

Unlike the public sector, the private sector is exposed to taxation risk. Also, projects utilizing project finance are often highly leveraged, and the margins are very tight. Because the margins are so low, the financing requires a high level of security and predictability of cash flow. Taxes, especially unplanned taxes, unacceptably reduce this cash flow; thus, awareness of all potential tax implications throughout the life of the project is essential. (1)

2.3 Country and Community Acceptance Risk

These risks are all related to the political and legal conditions, in addition to the public opinion in a country. They may be classified in several ways. The following is a list of these risks.

Expropriation

The host government may appropriate the project facilities such as in the case of nationalization. Besides, governments may take actions to reduce ownership or control over the facility, to eliminate the right to make profit, or simply to hold the money of investors (4). Governments may hold money of some of the investors for political reasons, and this has been a concern even in the United States where the government has frozen the bank accounts of some foreign businessmen for political reasons.

Riots and Domestic Disturbance

Riots and violence may cause damage to the project assets, prevent the facility from operating properly, or prevent the project sponsors from raising fees.

Currency Inconvertibility and Transfer Risk

These risks are due to the inability of the project sponsors to transfer funds outside the country or the inability to convert local currency into foreign exchange. (4)

Breach of Contract

The host government may violate the contract signed with the private sector. Public sector enterprises can fail to provide contracted inputs such as fuel or fail to pay for the project production in case the government was supposed to provide payments as a source of revenue. (2)

Arbitration Award Default

The losses in this case occur when the government refuses to pay to the project sponsors, and the judicial verdict cannot be enforced on the government. (4)

Regulatory Risk

Regulations may negatively affect the work of the project. Unsupportive government policies such as delays in approvals, import restriction, and discriminatory taxes are a major risk for developers in developing countries. Governments may also enact laws that may adversely affect the operations of the project, cancel previously awarded licenses, or introduce planning changes. (4)

Community Acceptance Risks

Privately financed projects could run into community opposition because of high usage fees. Since the public interest is above the interest of any private entity, a court might decide against the rights of the private partners. (14)

Lack of Experience

Political risks can be particularly higher in countries where laws that govern private financing contracts are new and untested. These risks are not bound to developing countries; the disagreements about PPPs at the federal level and among the states in the United States are creating challenges for investors, mainly foreign ones (4).

2.4 Force Majeure

The term force majeure refers to the risks that are beyond the control of any participant in the project. These may include the following:

Natural Disasters

Natural disasters include earthquake, rainstorm and flood, windstorm, and other acts of nature. The losses due to natural disasters have been dramatically increasing over the past few decades. It is estimated that \$US 20 billion of infrastructure is lost to natural disasters globally each year (4).

Terrorism

Terrorism is increasingly becoming a major threat for infrastructure facilities. Since infrastructure facilities are essential components of countries' economies, they are prone to these attacks. This threat is imposing new challenges in the design and construction of infrastructure and significantly increasing insurance premiums. According to Matsukawa (2007), the premium paid for Chicago's International Airport was US\$ 125,000 annually for \$750 million of coverage; after 9/11, for only US \$ 150 million of coverage, the premium had mounted to US \$ 6.9 million.

War

A major source of losses in infrastructure facilities in developing countries is damages to or destruction of the facilities' assets. There is also a risk of being unable to operate due to war and political violence.

2.5 Other Sources

Infidelity and Theft (5)

Infidelity of employees and theft would be a source of increased costs. In many facilities, employees tend to steal money and possessions from workplace.

Residual Value Risk (6)

In case of privately operated infrastructure facilities, there may be a concern that the private concessionaires would neglect maintenance toward the end of the concession

period. However, critics consider that the transfer of facilities to the public sector after the concession period is not a reality. Until now, no BOT project has been transferred, and critics stress on the idea that the public sector will not be able to operate the project after the private sector operates it for years.

The above was a list of the major risks associated with infrastructure projects. It is important to note that the nature and magnitude of risk vary between projects; the risk in a toll road project is much less than that of an exploration of an oil field. Besides, a Greenfield project in a developing country is considered much riskier than a concession to operate an existing toll road in a developed country.

Based on a study by Millar and Lessard of 60 large engineering projects around the world, managers ranked market-related risks as dominant in 42 % of projects, followed by technical risks (38%) and institutional risks (20%). (2)

Besides, many risks alter over the duration of the project. For example, construction phase will give rise to different risks from those during the operation phase. Some technical design risks diminish once the engineering work is done. Other risks such as market related risks may continue over the life cycle of the project, and as mentioned earlier, some risks may lie outside anyone's control. (2)

CHAPTER 7

Risk Management in Infrastructure Development

Faced with all of the risks mentioned in Chapter 6, the project sponsors resort to risk management techniques in order to protect themselves. Risk management consists of identifying the risk, analyzing it, and afterward responding to this risk.

1. Risk Identification

There are several risk identification techniques. Merna (2002) classifies risk identification techniques into three categories: intuitive, inductive, and deductive. Usually the three categories are combined together in each of the available methods. (1)

Some of the major methods used to identify risks are brainstorming, The Delphi technique, and risk registers. (1)

- **Brainstorming:** A group of people that are involved in the project meet together and start building on each other's ideas. The ideas are classified, developed, and verified.
- **The Delphi technique:** Individuals are asked to give their opinions regarding the risks of a project. The ideas are collected and summarized by the chairperson to be sent back for revision until consensus is received.
- **Risk Registers:** A risk register is a document or database that records each risk pertaining to a project.

In addition to that, interviews and checklists may be also used. (1)

2. Risk Analysis

Risk analysis can be done both qualitatively and quantitatively. Qualitative risk analysis consists of compiling the major risks after identification. Usually risks such as country and regulation risks are analyzed qualitatively. (1)

However, the major risk analysis is done using quantitative analysis. The most widely techniques used in quantitative analysis are sensitivity analysis and stochastic analysis. Sensitivity analysis checks the change in the value of variables. It mainly utilizes the net present value (NPV), internal rate of return (IRR), pay-back period, and profitability index. The drawback of this method is that there is no indication of the probability of change occurrence in variables. The probability analysis or stochastic analysis can specify the frequency of each risk, and it is considered a better way to analyze risks associated with infrastructure finance.

Net Present Value

In this method, the projected future cash flows of a project are discounted to present time using the appropriate cost of capital value. For a single project, the project is chosen if its NPV is positive, for many independent projects, the projects with positive NPV are chosen, for mutually exclusive projects, the project with positive and highest NPV is chosen. NPV uses cash flows and not accounting earnings, disregards sunk costs, and includes opportunity costs of using existing facilities. (18)

Discounted Payback Period

This method calculates the period needed for the project to pay back its expenses; however, its drawback is that it ignores the cash flows after the payback period. (18)

Internal Rate of Return

This method calculates the rate of return required for the net present value of the project to be zero. If this rate is greater than the minimum required rate of return, then the project is financially feasible.

Profitability Index

It measures the ratio of the present value of future cash flows and the initial cost of a project; however, this method has a scaling problem. (18)

The most widely used methods are NPV and IRR with many finance experts preferring the NPV method. (18)

Example of a Stochastic Model

Multiple simulations of the performance of the project are done based on the probability distributions of a certain risky parameter. A statistical analysis of the results can then help determine the probability that the project will provide the desired performance. (17)

3. Risk Response

Risk treatment can be done through two approaches, either risk control or risk finance. Risk control aims to avoid or reduce the risk while risk finance aims to finding methods to finance losses (1).

Risk can be avoided, reduced, transferred, or retained. It is up to the project sponsors to decide how to deal with the risk. It usually depends on the expertise and financial strength of the sponsors. It should be noted that risk and profit are usually directly proportional.

Risk is avoided by eliminating the source of the risk. This is not usually an available option because the source of the risk may be an essential element of the project; therefore, another option is simply to eliminate the risky project.

Risk reduction may be done though lowering the probability of risk, through decreasing its impact, or through the combination of both. (1) Risk minimization depends on an array of techniques that attempt to either reduce the amount of assets at risk or to minimize the incidence of a loss.

Sometimes risk is retained because there is a positive correlation between risk and returns. When the party has identified the risk properly and is aware that it has the capacity to handle it, it might decide to retain this risk. The advantage is that there is always a premium that this party can impose as a result of holding risk. In case of inexperienced entities, the risk may be retained not because of an intention to maximize profit, but due to the lack of ability to identify the risk properly.

Risk transfer is done by transferring the risk of a specific activity to the entity that has most experience in. (2) This is a very effective method because there are risks inherent to a project that cannot be avoided or reduced; therefore, the most effective way to handle the risk is to give it to the entity that can best deal with it. Transfer of risk is one of the major reasons why PPP schemes are being adopted by governments; shifting the construction and maintenance risk to the more experienced private sector is a way to decrease the burden on the public sector.

4. PPP Projects

PPPs are generally entered for a long period of time, usually 15 to 30 years, and they are developed in an environment of uncertainty (2); therefore, proper risk analysis followed by mitigation techniques is essential for the success of the project. There is no one universal formula to deal with risk (16); therefore, the risks of every project should be analyzed separately in order to decide on the necessary response techniques.

However, there are some general guidelines that may decrease the risk on all the parties participating in a project. First, it is important that all dispute mechanisms be well established between the different participants in a project (14) to avoid lengthy negotiations and litigations in the future. Second, the risk should be allocated to the party that is the least afraid of it and has the best capabilities to control it since optimal risk allocation minimizes the risk. Grimsey (2004) has set a risk matrix that allocates the risk responsibility to the different parties participating in a project. (2) It is generally recognized that the government is in a better position to handle environmental and regulatory risks than the private sector. It is the role of the government to provide an encouraging environment in order to decrease the risk that the private sector would charge too high to handle. This is a feature of PPP; risks are usually shared between the private sector and the public sector, and the government holds some risks for which private sector would overcharge.

Although the private concessionaires hold many of the risk mentioned earlier, the government may be also indirectly holding these risks because if the project company defaults, the government is responsible to maintain the continuity of the public services in order to satisfy public needs (14). Therefore, the government should check whether the party has the capacity to deliver the project; else, in many cases, the financial losses will end up being paid from the pockets of taxpayers. For these reasons, the government should make sure of the financial and operational capabilities of the sponsors. After this, the government should keep the sponsors subject to the operating risks because the acceptance of these risks is the incentive for the operators to operate efficiently. The government should specify clearly no more than the quality and quantity of output so that it does not shift back the risk (2). The government wants to keep the private sector at risk until it meets its service requirements.

The project company is the party that holds the highest risk. Considering that the reliance is on the cash flow generated by the project, the project company is always facing the risk of these revenues not materializing. Required elements in funding projects are confident project creditors and governments prepared to accept some project risks. (1) The use of project finance or limited and non-recourse credit is essential because in case the project company goes bankrupt, the sponsors may survive. High risk projects use more equity while low-risk projects use higher debt.

The structure of the financial loan package plays an important role in minimizing the risk. Mainly sponsors should minimize refinancing risk and maximize long-term debt at a fixed rate. (14)

5. Risk Mitigation

This section presents some techniques used to mitigate risks.

Construction Risk

The increase in construction cost can be shifted to the contractor by applying a fixed price lump sum contract. However, this is not usually an option due to some design complexities. The construction expertise of the project company affects the choice of contract; if the company is risk averse a lump sum contract is an option. Another important element is choosing the right team with the necessary skills and experience.

The project company can require the contractor to have a set of guarantees in order to ensure performance and completion of the construction. Usually project sponsors require those guarantees in order to attract more banks into the financing (1). The cost of bonding is borne by the sponsors, and the more bonds required by them, the greater the project cost. According to Merna (2002) excessive insurance and bonding do not turn a bad project into a good one. The cost of insurance and bonding depends on the type of project, commercial market conditions, and on the contractor's financial standing. There are several types of these guarantees, the most typical ones being the following:

- Performance guarantees: a performance bond is usually about 10% of the contract sum provided to protect the project sponsors from poor performance of the contractor.

- Advance payment guarantees: these guarantees provide the project sponsors the right to regain any payments made to the contractor in case he/she fails to complete the required contract terms.
- Completion guarantees: a percentage of the contract is retained till the completion of the project to ensure that the contractor will complete all the requirements stated in the contract.
- Maintenance bonds: ensure the contractor will carry out his/her obligations under the maintenance period or defect liability period of the contract.

Usually these bonds are issued by banks and insurance companies; however, in USA and Canada, surety companies are the only source of guarantees where in the event of default of the contractor, the surety company is willing to arrange to provide another contractor to complete the job. (1)

Currency Risk

There are several techniques to mitigate currency risk. Funding a project with debt financing entirely in local currency and equity finance in currencies considered relatively strong provide good protection. (1) Sponsors can match the currencies of the sales contracts with the currencies of supply contracts as far as possible (4). Besides, hedging mechanisms are effective financial engineering tools that provide security against currency devaluation. For currency risk, these instruments mainly include cross-currency swaps and forward exchange rates.

Interest Rate

Since the interest rate affect the commercial viability of the project, especially in case of the high leveraged project finance, sponsors tend to fix interest rates. (1) Besides, sponsors with enough financial expertise may resort to financial engineering instruments such as caps, swaps, and forward interest rates to hedge the risk.

Counterparty Default

Mainly lenders are worried about the default of the project company; therefore, to decrease this risk, lenders should carefully identify size of the project, study the loan, and know the dates that they will see returns on their investments. (1)

Tax

Developing countries often offer tax holidays during the early years of a project. Usually, project sponsors tend to delay deductions and lengthen depreciation to maximize the benefits of tax holidays. (14)

Price Increase

A method to decrease the effect of price fluctuation is payment leads and lags. Futures and Forwards are usually effective instruments to guarantee the input needed in the future. Forward contracts fix the price of exchange.

Political Risks

Consortia should protect themselves in the contracts. The sponsors should share equity ownership with other foreign investors, project financiers, and local interests in the host country. They should sign agreements and obtain insurance from host countries that the project will not be interfered with. Political risk insurance combined with involving financiers from different countries, national export credits, and multilateral institutions would provide good protection against political risk. (16)

Force Majeure

Usually consortia conduct due diligence to determine the probability of occurrence of such events, and they try to allocate the risk to other parties; however, they mainly resort to insurance. (24)

5.1 Financial Engineering Instruments

Financial engineering instruments are usually used to decrease financial risks. This section will provide explanation of the methods mentioned earlier.

Caps

To hedge interest rate, investors resort to caps. A cap would protect sponsors against interest rate increase while allowing them to benefit from interest rate decrease; however, this may increase the cost of debt.

Hedging

Hedging is a strategy to offset risk by shorting certain financial instruments and longing others. The main concept is to sell overpriced financial instruments and buy under priced ones.

Interest Rate Swap

Investors enter into an interest rate swap on a future date. They can be either the payer that have the right to pay the fixed rate in the swap or the receiver that have the right to receive the fixed rate. (1)

Forward Interest Rate

Forward interest rate is the rate for a transaction between two future dates. It provides the option of locking the interest rate for a forward transaction to borrow money in the future.

Cross Currency Swaps

An agreement between two parties to exchange cash flows denominated in the same currency but calculated on different bases.(1) The interest rates can be both fixed, both floating, or one fixed and on floating. (18)

Forward Exchange Rate

They are used to decrease currency risk. The future exchange rate is set for future transactions.

Forward and Future Contracts

They provide the opportunity to make exchanges in the future market. Future contracts provide a good protection from input shortfalls and price fluctuations because the agreement is on the amount and price of the commodity. The difference is that the Future is marked to the market daily.

Accreting swaps

In these swaps the principal starts off small and then increases over time. They are usually attractive for a construction projects because the amount of capital needed in construction projects increases gradually (1).

In case the developers have the enough financial expertise, financial engineering instruments provide a mean to hedge risk and increase profit.

5.2 Insurance

Some risks are not controlled by any of the parties; therefore, none of the participating entities is willing to hold risks related to explosions, earthquakes, and other natural disasters. Sponsors resort to insurance, which is the most expensive way of risk mitigation. The trends in global insurance show an increase in prices because the market has been going through one of the most difficult and unpredictable states (16). However, some multilateral and bilateral agencies provide several insurance and guarantees for infrastructure projects.

According to Matsukawa (2007), there are several types of these guarantees that cover the debt service due to certain causes of default, the major ones are the following:

Credit Guarantees

They cover losses in the event of a debt service default regardless of the cause of the default. They can be Partial Credit Guarantees (PCG), which cover part of the debt service, or Full Credit Guarantees (FCG) (also called Wrap Guarantees), which cover the entire amount of debt. PCG are usually provided by multilateral and few bilateral agencies. FCG are often used by bond issuers to achieve a higher credit rating. In some developing countries, private monoline insurers issue wrap guarantees for bonds issued by infrastructure project companies. (4)

Export Credit Guarantees or Insurance

They cover losses for exporters or lenders financing projects. Export credit guarantees or insurance are normally tied to the nationality of exporters or suppliers, and sometimes to the project sponsors or lenders. They cover some percentages of both political risk and commercial risk. Some bilateral agencies provide Export Credit Guarantees. (4)

Political Risk Guarantees or Insurance

Political Risk Guarantees or Insurance cover losses caused by political events. Partial Risk Guarantees (PRG) cover commercial lenders in private projects, typically for the full amount of debt. PRGs are offered by multilateral development banks and some bilateral agencies. (4)

Political Risk Insurance (PRI) insures equity investors or lenders. PRI can cover the default by a sovereign or corporate entity but only if the reason for a loss is due to political risks. Providers of investment insurance include export credit agencies, investment insurers, private political risk insurers, and multilateral insurers. (4)

These risk mitigation instruments can be used together in many infrastructure projects. A project company may get guarantees from multilateral, bilateral, and private institutions at the same time. The following examples illustrate how risk mitigation instruments were combined in unique manners.

In a toll road in Chile, the Inter-American Development Bank provided Wrap Guarantees combined with Partial Credit Guarantees. (4)

In Peru, Partial Credit Guarantees were combined with Contingent Loan Support. The International Development Bank provided PCG by covering the payment obligations of the government of Peru under a toll road concession; however, these payments will turn into debt of the government to the Bank. (4)

Private guarantees may be combined with PRGs and PRIs. Equity sponsors may be willing to guarantee commercial risks, such as project development, construction, and operation risks, by providing their corporate guarantee to lenders, but they are generally unwilling to take host-country political risks, thus requiring third-party risk mitigation instruments. (4) In a gas project in Mozambique, the sponsor provided a corporate guarantee to lenders; however, the World Bank provided PRG and bilateral insurers and an Export Credit Insurance Company provided PRI for political risk. (4)

Various initiatives have been formulated by multilateral and bilateral donors as well as private institutions to set up global or regional guarantee facilities that support the development of infrastructure projects in developing countries. (4)

5.3 Case Study: Poland's A2 Motorway (4)

The information in this section is taken from Modern Project Finance by Benjamin Esty (2004). As a part of the Polish government's policy to develop infrastructure, the government decided to develop a toll road, A2 Motorway, using a Design Build Operate scheme in 1997. The cost of the project was estimated back then to be €934 million. The aim of this section is just to concentrate on the risks in this project.

The sponsors of the project (ASWA) were aware of several risks related to the project. Due to the long concession agreement (40 years), there were so many uncertainties. The size of the project, which is a motorway that runs from the Eastern to the Western borders of the country, significantly increased risk.

One of the major project risks were the Political/Regulatory/Country Risks. Poland is a former Soviet Union country where the state has owned most of businesses. Meanwhile, a critical risk that faced the project is that there were no previous privately financed projects in the country. There were no precedent regulations, and neither the government nor many of the private participants had previous experience. Due to the hyperinflation and government's deficit, analyzing currency risk was also important.

Another important risk that was difficult to mitigate is the market risk. There were no precedents to this project in the country; thus, the traffic on the toll road was difficult to estimate. The reaction of the people may make toll collection impossible because Poland has been a welfare state for years, and citizens are used to price controls and subsidies; therefore, paying for using a road may be an issue that the public would not accept. Since the Motorway passes through Poland, the revenues depend on the strength of the regional economies, international and local trade patterns, and alternative transportation routes.

Hedging interest rate risk and currency risk was not an option because instruments do not exist in Poland. It is also important to note that the environmental standards in Poland are considered strict.

To analyze the risk, the project sponsors used sensitivity analysis with conservative assumptions related to the traffic and GDP increase. Besides, a survey of more than 50,000 motorists helped identify the public's reaction toward toll roads.

The Consortium used several methods to respond to the risk in the project. Because the project was very large, a staged approach was used. This approach helped maximize early revenue and reduce amount of external financing; in addition, the usage of the road would give data about the viability of the traffic projections.

The financial package had a high debt to equity ratio. However, the bonds will mature by 2014, the longest possible maturity available in zero coupon bond market. The bond was backed by a guarantee from the Polish government for up to 800 million euros.

The Consortium transferred the construction risk by adopting a fixed-price design and construction contract. Besides, the operating cost was fixed contractually; however, ASWA remained responsible for heavy maintenance.

The government agreed not to build or improve any competing road and not to impose tolls on any of the feeder roads, which should be regularly maintained. Since traffic risk was unavoidable, AWSA had the right to adjust tolls to account for inflation and exchange rates; however, this was not viewed as preferred alternative because of the reaction of the public.

The Consortium protected themselves from construction hazards and force majeure risk such as explosions, epidemics, contamination, floods, war, revolution, and riots through insurance.

AWSA had the responsibility to get the local permits required for construction and operation, but the government agreed to support these efforts if delays were due to authorities.

Although, the government had the right to terminate the contract to protect the public interest, it was obliged, in this case, to compensate AWSA for the cost of fully retiring ASWA's debt obligations and for the net present value of the cash flow that would have been generated had the concession not been cancelled.

The performance risk was carried by the consortium, and the government had the right to terminate the concession in case of below standards performance and failure to work by deadlines.

It can be concluded that infrastructure projects, especially Greenfield projects, are associated with great risk and uncertainty. The Motorway case study shows the level of uncertainty and risk the developers are usually subject to. Therefore, it is crucial for developers to identify risk, analyze it, and decide which part of risk they should retain and which part they should shift to the other party. Considering that there is always a positive correlation between profit and risk, project developers may decide to retain certain risk and try to manage it using several techniques such as financial engineering instruments, bonds, and guarantees. Shifting the political, regulatory, and environmental risk to the government while retaining the financial, construction, and operation risk by the private sector is a guiding philosophy for the success of privately financed infrastructure projects. The public and the private sectors would be sharing the risk, where each entity retains the risk that it can best deal with.

CHAPTER 8

Concluding Remarks

The public sector is not able anymore to provide adequate funding for infrastructure maintenance and development. The growing demand for infrastructure and the increase in construction and operation prices pressure governments and make them unable to satisfy the public demand.

Due to the importance of infrastructure in development and economic growth, governments are obliged to maintain sound infrastructure; therefore, the resort is to the private sector, where private investments seem to be the only way to close the funding gaps. Public Private Partnerships, in their different forms, are definitely going to be the trend for infrastructure procurement. The public sector needs the private sector's expertise in construction and maintenance, and the private sector needs new investment options as the amount of funds available in capital markets is increasing. Besides, new technologies and the openness of several markets made it possible for capital to flow to developing countries making PPP projects a valuable option to attract investments.

Despite that, PPPs are not the perfect solution if they are not well organized. Their main drawbacks are the long concession period and the ambiguity of the transfer option back to the public sector in concession agreements. The large scale of PPP projects is relatively new, and both the public and the private sectors may face losses in case these projects were not carefully analyzed and studied by both parties. It is clear that the aim of the public sector is to provide infrastructure projects while the goal of investors is to maximize returns on their investments. Therefore, governments should know how to make use of the private sector's goals. Its efforts should shift from delivering infrastructure projects because there is another party, which is the private sector, that is in a better position to handle it. The effort should be on providing provisions and policies that arrange these projects and set the regulations and limitations that, while encouraging private investment, protects the public interest. The goal of the investors to maximize their returns should be utilized to provide more efficient and high quality services for the public.

The government's role should shift to setting the framework and organizing PPPs. Projects should be dealt with collectively and not on an individual basis. Governments should look at their infrastructure facilities collectively and check how multiple projects in a portfolio of infrastructure affect each other. Government agencies with entrepreneurial skills should hold responsibilities because the infrastructure sector is becoming a new business and not just a duty of the government.

The criteria of selecting the private sponsors should be set. Financial stability and technical expertise are of greatest importance especially in case of project finance where there is no recourse to the sponsor's assets. Since the governments are required to ensure the presence of adequate infrastructure services, they do not want to hold the burden of maintaining an infrastructure service if the private sponsor defaults.

When developing new infrastructures, governments should assess the whole life impact of the project. Public opinion sometimes pressure officials to make decisions that seem to be right in the short term; however, they would result in adverse economic effects in the future. Usually, people that make decisions are not in charge when the facility is developed. The public sector should be more informed and involved in infrastructure development. The public should be more aware of the life cycle cost/benefit analysis and not just the present impact of a project.

Prioritizing the needs and assessing the cost benefit analysis of maintaining current infrastructure is another step. Governments should decide whether they should keep all the infrastructure facilities through an objective cost/benefit analysis that disregards sunk costs. The question is: "Are the millions of miles of highways in the United States needed?" There should be more realism in the assessment of the projects, and the public sector should be less optimistic regarding project costs during evaluation phases.

Finally, the private and the public sector should come in partnership together on a well organized and arranged framework where both the private and public sectors benefit while providing the public with necessary infrastructure facilities and services "*to enhance the life of communities*".

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