

PITFALLS OF PUBLIC PRIVATE PARTNERSHIP
IN TOLL ROADS

by

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Abstract

PITFALLS OF PUBLIC PRIVATE PARTNERSHIP IN TOLL ROADS

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Public-Private Partnership (PPP) has been one of the most effective concepts in developing infrastructure projects. By bringing in creative skills and management efficiency from business practice, private companies can potentially improve efficiency and productivity in implementation of major capital projects and provide an effective approach to meet project objectives.

The main idea behind the partnership in toll roads delivery is putting together the strengths of both public and private sectors in order to provide services in the most cost-effective manner, on time, and with the highest quality. However, the criteria with which governments judge the "success" of PPP projects are still considered ambiguous. Having multiple goals, PPPs make it very hard and complicated to decide whether the project is a success or a failure.

To highlight the underperformance that happens on PPP toll roads, two case studies were chosen for study and are compared based on success criteria for PPP projects, and a survey was conducted. The findings in this thesis show that PPP projects are believed to limit government's flexibility, as it will be very hard for the government to change their funding allocation to reflect new priorities after the contract has been signed.

In addition, this thesis shows that inappropriate sharing of risks could lead to serious problems in PPP toll roads. Therefore, much emphasis is placed on having a solid legal framework at the beginning of the project. Allocating the risks to the party that is best able to deal with them is the main concept behind managing high risk projects.

The length of the contract period is considered one of the main factors that affect the success of PPP toll roads. It is concluded that PPP contract periods lasting over 75 years can lead to problems for both private and public sectors, causing underperformance in PPP toll roads. Moreover, inadequate feasibility studies that include unrealistic traffic and revenue forecasts are the main causes of underperformance in PPP toll roads.

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Chapter 1

Introduction and Rationale

1.1 Introduction

In general, Public-Private Partnerships (PPPs) for infrastructure are contractual agreements between public and private sectors where the skills of each sector are shared in delivering a service or facility in different areas such as power, transportation, water, health, and education. Public agencies are increasingly using PPPs to deliver new transportation capacity whereby improve road access can be improved without having to increase the burden to taxpayers.

Providing numerous benefits to all parties, PPPs have provided government agencies and public sectors with cash payments that are often used to supplement local and state transportation budgets. This kind of partnership has provided innovative financing alternatives to the government entities and delivered high-quality projects by bringing the concept of risk sharing to the risk-averse public sector.

Although, PPPs have a lot of advantages, they can sometimes cause projects to underperform. This thesis identifies the problems that have occurred in PPP projects, discussing the causes of these problems, the economic impacts, and most importantly, the public and social impacts. Moreover, this research will suggest different ways to prevent problems in toll road projects that fall under the delivery of public private partnerships. The results of the survey conducted in this thesis were compared with the results of the literature research and case studies. Final results and conclusions will offer a summary and recommendations based on this research.

1.2 Objectives

The main objective of this thesis is to highlight the pitfalls that are likely to occur when public and private sectors collaborate in transportation projects such as toll roads.

Also, this thesis investigates the probable causes of underperformance in PPP toll road management, and identifies how to prevent failure in PPP toll roads by discussing some of the critical success factors that will improve the effectiveness of the PPP in toll road projects.

1.3 Scope

When compared to traditional projects, PPP projects are found to provide solutions to reduce cost overruns and delays, by offering the government a way to address different types of problems such as aging infrastructure and constrained budgets. However, in some cases the *traditional* delivery of projects (not using PPP) appears to have more benefits because of past problems experienced in PPPs affecting results.

Although many types of problems in PPP toll roads will be discussed and analyzed, there will be other unpredicted causes of underperformance that will not be discussed. Plus, there might be some problems that cannot be prevented; these kinds of problems need further research to find a solution. The scope of this research is limited to how PPP might fail in toll roads in the United States. Due to time and resource limitations, only PPP pitfalls in U.S. toll road construction projects are not discussed.

1.4 Research Needs

There are many research papers discussing the effectiveness and benefits of PPPs in toll roads. However, according to the databases checked and references listed in this thesis, no comprehensive study exists which has successfully analyzed the factors that cause PPPs not to meet their project objectives. Reasons for PPP underachievement in U.S. toll roads, has not been adequately addressed nor has anyone provided a prevention plan showing how to manage and control the failures and pitfalls of the toll roads that fall under the PPP delivery method.

Doran Bosso (2008) recommends conducting more case studies that will lead to a more accurate evaluation tool to assure the success of PPP projects. In addition, Bosso mentions that more research is needed to increase the body of knowledge on the PPP projects success, in order to better understand P3 delivery systems and provide a basis for discussion on how to improve them.

Moreover, Cui and Lindy (2010) stated that more research is urgently needed to help engineers understand PPP guidelines as they pertain to long-term lease agreements by discussing the outcomes of different PPP toll road projects.

1.5 Expected Outcome

This research is expected to provide a comprehensive understanding of PPP pitfalls in toll roads, probable causes of underperformance, critical success factors, and suggest a failure prevention plan. Moreover, it will provide general knowledge about public-private partnership history, benefits, types, and risks.

Furthermore, two underperforming toll roads cases will be discussed and analyzed in order to highlight the causes of underperformance and to compare the results with the information gathered from a literature research obtained from different sources such as the American Society of Civil Engineers (ASCE), UTA Thesis and Dissertation Database, ProQuest and Engineering Village.

This research also provides responses and comments from professionals, experts and other stakeholders associated with PPP projects. This includes comments from individuals in the public and private sectors. All responses were analyzed to come up with a final result and provide suggestions on how to control PPP failures in toll roads.

Figure 1.1 presents a flow diagram for the methodology used for this thesis.

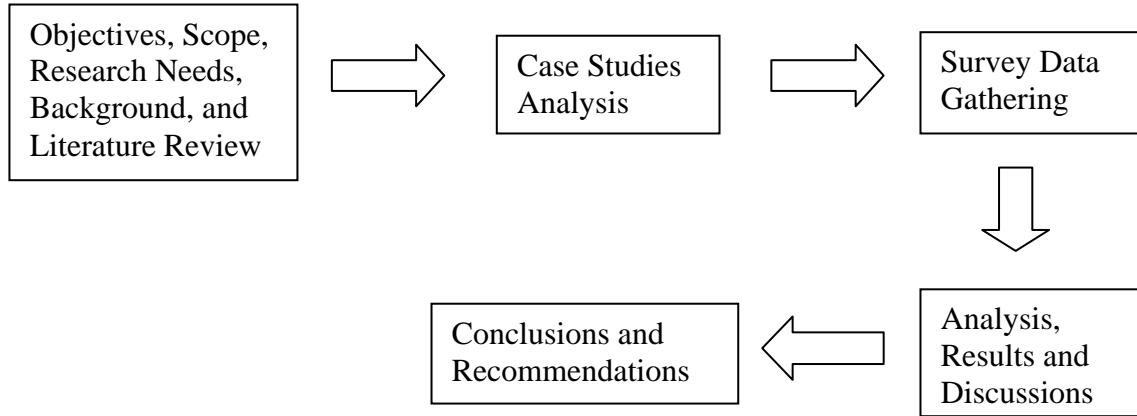


Figure 1.1 - Flow Diagram of Research Methodology

1.6 Chapter Summary

There is a need to identify factors that cause public-private partnership projects to underperform such as not meeting the expected objectives, going over the estimated budget, or causing political, environmental, and social problems. The analysis of PPP project pitfalls can serve as a valuable tool for implementing future transportation projects.

Chapter 2

Background

Chapter 1 provided an introduction, objectives and work scope for this research, research needs, and expected outcomes. This chapter provides a literature review on the subject of PPP pitfalls in toll roads. It also covers some of the research that has been conducted previously.

2.1 PPP Definition

A Public-Private Partnership is "a contractual agreement between a public agency and private sector entity that allows for greater private sector participation in the delivery of transportation projects" (FHWA 2008). Public Private Partnerships can provide services or infrastructure in a cost-effective manner by combining the strengths of the public sector and their financial stability, willingness to invest, and the innovative management techniques of the private sector. Throughout the past 30 years, PPP arrangements have been used in different kinds of projects and it have proven to be efficient in many of them (Spiering and Dewulf, 2006).

A PPP is an arrangement where the government agencies state their needs for long-lived, financially stable and capital-intensive transportation projects. It can also be defined as "any medium to long-term relationship between public and private sectors, involving the sharing of risks and rewards of multi sector skills, expertise and finance to deliver desired policy outcomes" (Standard and Poor, 2005).

The PPP procurement process normally starts with bidders prequalifying by responding to requests for qualifications (RFQs). After qualified bidders have been selected, the agency will issue a request for proposals (RFPs). Companies then submit proposals in response to the RFP. The government then evaluates all proposals and chooses a certain number to move to a final round where the government starts

requesting detailed information in order to select a winning proposal based on the project type and objectives. The winning proposal doesn't have to be the least costly or the most technology advanced, it basically should consist of all the factors that offer the best value proposition (Feigenbaum, 2011).

The main characteristics of public-private partnerships are a willing public participant that needs to provide a better level of service, and savings to the general public, and a willing private participant that is financially stable, and able to provide a more efficient, cost effective, and on time delivery of the project. The keys to PPP success are providing an opportunity for innovation, the establishment of an enduring relationship, fair and reasonable contribution of resources, and sharing of risk and responsibilities while establishing a shared vision based on trust between the participants.

There are five main stages to the PPP arrangements, the first stage is the investment decision stage where the participants study their need to take the decision of partnering and that usually is based on a robust business case. The second stage is the procurement method which is based on options analysis. The third stage is the service transfer stages, where the service is transferred from the public sector to the private sector giving them the authority to start collecting fees. The last two stages are contract management, and contract renewal and reassignment stage, respectively (PPP Canada, 2007).

2.2 History of PPP

PPP is not a new concept, it has a long history in many countries, but it became popular worldwide in the 1980s. The private sector which was well known for providing higher quality and service for lower cost started involving in the delivery of public services in the U.S. in the 1950s and 1960s when the government was trying to increase the

private investment in cities and was promoting regional privatization in order to reduce their responsibilities and tasks (Spiering and Dewulf, 2006).

Arguably the most influential force in favor of the PPP is a lack of funding for the desired projects. With its assembly bill 680 legislation that allowed for transportation projects, California was one of the first states to embrace PPPs. Other states like Texas, Virginia, Utah, Alabama, Florida, Colorado, and Georgia have legislation in place to promote PPP transportation projects (Bossio, 2008).

Roadways were first developed in the eighteenth century by the private sector in the form of toll ways and turnpikes. The private sector was also involved in the nineteenth century development of canals and railroads. In the twentieth century, with the growing economy and the need for new infrastructure, the state governments and the federal government assumed the responsibility for providing road infrastructure (Kulkarni, 2009).

In the second half of the twentieth century, PPP started growing in Europe on a special emphasis on toll road projects. European Government turned to PPP as the preferred method for economic regeneration after the success of toll roads projects in Spain, the Netherlands, and the United Kingdom (Cui and Lindly, 2010).

2.3 Benefits of PPP

Depending on the job executed, PPP will result in many benefits that allow the business to develop into an exciting merging market. First of all, PPP can provide greater infrastructure solutions as well as faster project completion by reducing delays caused by claims and change orders on infrastructure projects (NCPPP, 2012).

When compared to traditional methods, PPPs' return of investment (ROI) was reported to be greater due to innovative design and financing approaches. FHWA stated that PPP could save 6 to 40 percent of the cost of construction as well as considerably lowering the potential of cost overruns (FHWA, 2004). Another very important benefit of

the PPP is that it helps in encouraging the incorporation of life-cycle costs in both design and construction of infrastructure projects. Moreover, PPP allows a reduced tax payment from private stakeholders, maximizes the use of each sector's strength, and achieves better environmental compliance. The following sections describe other benefits:

2.3.1 Reducing Risk to Public Sector

Since some of the public highway projects require several years to be funded, the inflation related costs will increase, increasing the project's total cost and affecting the project's estimated completion time. Cost overruns in either the design or construction phase are shifted to private sectors when creating PPP arrangements. The allocation of risk to the party best able to manage it (especially when it comes to cost) is the main concept behind the partnership in terms of risk transfer (Ke et al, 2010).

2.3.2 Better Quality of Service

According to the United Nations Development Program, experts suggest that services achieved under a PPP have better quality than that achieved by other traditional procurement. The reason behind this is because in most PPP projects, full payments to a private sector contractor only occurs if the required service standards are met throughout the project (United Nations Development Program, 2010).

2.3.3 Reduced Time on Project Delivery

The ability of private sectors to access available private resources helps shorten the delivery of PPP projects. Also, with the efficiency and innovation in delivery, repair and replacement, PPPs help the project to be constructed faster than traditional projects (NCPPP, 2012).

2.3.4 Enabling Major Innovations

The motivation to innovate to solve difficult problems and improve services is another important advantage of PPPs. For example, a toll company in California

introduced variable pricing that helped in eliminating traffic congestion during peak periods, maximizing throughput while maintaining high speeds (Feigenbaum, 2011).

2.3.5 Delivery of Needed Transportation Infrastructure

Many states are facing financial problems with increasing demands for improved road transportation, and therefore, renovation and maintenance of existing systems are using up available resources, and traffic congestion is getting worse. In long-term PPPs, a private sector business takes the responsibility to finance and construct new highways that otherwise will not be built (Feigenbaum, 2011).

2.3.6 Value for Money (VFM)

Value for money analysis (VFM) is used to compare the cost of PPP-based project delivery to that of traditional project delivery, providing decision makers with a quantitative tool that helps them select the most efficient and appropriate mode of delivery suited for a project. This method of analysis requires different qualitative and quantitative assumptions to be made about operations, finances, and risks associated with projects (NCPPP, 2012).

2.4 Limitations of PPP

According to the Legislative's Analyst's Office (2012), some of the potential PPP limitations are:

2.4.1 Increased Financing Costs

Because private companies pay higher interest rates than government entities to borrow money, financing a project through PPP is usually more expensive than the financing options used under a traditional procurement method.

2.4.2 Greater Possibility for Unforeseen Challenges

Compared to design-build and design-bid-build contracts, PPP contracts cover a longer time period; therefore, a greater possibility of unforeseen problems can arise. Such problems can cause project schedule delays and additional costs to the government.

2.4.3 Limits Government's Flexibility

Long-term PPPs can "lock in" government funding priorities based on the operational needs at the time the contract was signed. Such an arrangement makes it very difficult (if not impossible) to change government's funding allocation to reflect new government priorities.

2.4.4 New Risks from Complex Procurement Process

The procurement process of PPP projects are more complex than traditional procurement methods and involve complex negotiations between government and private developers, who bid on the project therefore, the government can be asked to perform new types of activities and take on risks that it may not be experienced at handling.

2.4.5 Fewer Bidders

PPP projects are usually complex and expensive, so private developers with limited financial resources and technical skills can't compete for these projects. Experts have stated that a typical PPP project will receive no more than 3 bids, while projects under traditional forms of delivery receive a greater number of bids (LAO, 2012).

2.5 PPP Relationships

In its "Guidelines for successful public-private partnerships", European Commission (2003) identified four main groupings of PPP relationships, each having its own applications, strengths, and weaknesses.

2.5.1 Contracting

A typical PPP contract- sets up an arrangement whereby a private party designs and builds a public facility, while the public sector finances and maintains ownership of the facility. The main reason for this type of PPP is transferring the design and construction risk. It is suited to capital projects where the public sector wishes to retain operating responsibility. The main strength of this type of PPP relationship (aside from the transfer of design and construction risk to the party that can best control it) is the potential to accelerate construction progress. However, this type of contracting does not attract private finance, poses a risk of conflicts between planning and environmental considerations, and adds operational risks to the opposing factors.

2.5.2 Build-Operate-Transfer (BOT)

A Build-Operate-Transfer (BOT) contract involves state or local transportation officials negotiating with a private sector contractor to design, build and operate a public facility for a defined period. Similar to the contracting arrangement in 2.5.1, the public sector which financed the facility, retains ownership of it throughout the project. BOT is suited to projects that involve a significant operating content. It promotes private sector innovation, improved value for money, and improved quality of operation and maintenance. On the other hand, contracts are more complex and tending process can take longer. Contract management and performance monitoring systems are also required.

2.5.3 Design-Build-Finance-Operate (DBFO)

Design-Build-Finance-Operate contracts are set up by a government agency with a private party to design, build, operate and finance a facility for a defined period. The facility is owned by the private sector for the contract period, where it recovers costs through public subvention. It is suited to projects that involve a significant operating

content such as roads, water, and wastewater projects. This type of PPP attracts private sector finance, delivers a more predictable and consistent cost profile, and most importantly increases the potential for risk transfer and, therefore, provides a greater incentive for the private sector contractor to adopt a whole life costing approach to design. This type, however, requires funding guarantees, a change management system, contract management and performance monitoring systems.

2.5.4 Concession

A concession contract which is very similar to a DBFO, except the private party recovers costs from user charges. The main reason for using this type of PPP is the ability to utilize private finance and to transfer design, construction, and operating risk. It is suited to projects that provide an opportunity for introducing user charging. Other strengths of the DBFO includes concession increases in the level of demand risk transfer and encourages generation of third party revenue. On the other hand, it may not be politically acceptable, and it requires effective management of alternatives (European Commission, 2003).

2.6 PPP Arrangements in Transportation Projects

According to the University Transportation Center for Alabama (2010), there are five major types of PPP arrangements for delivering transportation projects.

2.6.1 Private Contract Services Approach

The private contract service approach is considered the most common form of private sector involvement in surface transportation projects. In this type of arrangement, the public sector contracts with a private sector to operate, maintain, and manage the system that provides the service.

2.6.2 Alternative Project Delivery Approach

Project delivery approach methods are used to identify the primary parties taking contractual responsibilities for performing the work. Based on the phases in which the private sector takes responsibility, this approach can combine one or several combinations such as:

- Design-Bid-Build (DBB)
- Construction Manager-at-Risk (CM@R)
- Design-Build (DB)
- Design-Build with a Warranty (DBW)
- Design-Build-Operate-Maintain (DBOM)
- Design-Build-Finance-Operate (DBFO)
- Build-Operate-Transfer (BOT)
- Build-Own-Operate (BOO)

2.6.3 Multimodal Partnerships

Multimodal Partnerships make arrangements to develop, finance, and operate a facility that usually serves more than one mode of transportation such as highway, rail, transit, and airport. Some public and quasi-public agencies are involved with multimodal partnership projects, and their popularity is increasing significantly in the United States.

2.6.4 Joint Development Agreement (JDA)

Joint Development Agreements (JDAs) generally involve transit agencies and private developer's collaboration in planning and delivering a specific project involving the development of an adjacent area to a land owned by an agency for a negotiated payment by a developer. The developer payment to the transit agencies depends on the lease period.

2.6.5 Long-term Lease/Concessions

Long term leases and concessions involve the lease of publicly financed facilities to a private sector concessionaire (PSC) for a specified period of time. The PSC pays an upfront fee to the public sector representative in exchange for the right to collect revenues from users' fees for the duration of the lease which is generally 25 to 99 years. Toll roads and parking garages are the most common examples of this type of project (Cui and Lindy, 2010).

2.7 Financing PPPs

PPP projects will involve financing from different sources with some combination of equity and debt. Negotiations between lenders and stakeholders usually decide the ratios of these different contributions. Some of the financing sources defined by the World Bank (2011) are:

2.7.1 Equity Contributions

Project sponsors provide expertise and some services to the project company such as operation or construction services. Sponsor funding is generally through equity contributions through share capital and stakeholder funds. Other contributors have the right to earn revenues before the equity contributors do. Since equity contributions bear the highest risk in the project, they receive the highest returns.

Equity contributors might include project participants, local investors, host government, other governments, and institutional investors. Equity investors prefer to pay their equity investment later in the construction period in order to save costs, and improve their aggregate equity return.

2.7.2 Debt Contributions

Commercial lenders, institutional investors, export credit agencies, bondholders, bilateral or multilateral organizations, and sometimes the host country government are

the main sources of debt. Those who contribute to the payoff of debt have the highest priority among those who invest funds in the project. Repayment of debt is generally done through a fixed or floating rate of interest, and within a specific period of time.

Compared to bondholders, commercial banks are more desirable as long term debt providers due to the fact that they provide flexibility in renegotiation of loans and in reaction to unforeseen conditions. Equipment suppliers are another source of debt relief when they finance projects in order to sell their equipment.

2.7.3 Bank Guarantees/Performance Guarantees

Bank guarantees allow counter parties to immediately access payments without the cost of looking for cash. Past due payments may be demanded or payable once default on a loan is proven in the court. After obtaining a counter indemnity from the customer, the bank can issue a guarantee, letter of credit or a performance bond. Rules for demand guarantees have been developed by The International Chamber of Commerce, and such rules have been accepted by bankers, traders, and the World Bank.

2.7.4 Bond/ Capital Markets Financing

Instead of using commercial lenders as intermediaries, bond financing allow borrowers to access debt directly from individuals, and institutions. The riskiness of the project is determined by rating agencies that will provide a credit rating to bonds. This helps bond purchasers to know what price they should pay, and the firm parameter of these agreements enhances the attractiveness of the investment. Although, bond financing provides lower interest rates, longer maturity, and more liquidity, this type of financing requires more time and cost, due to extensive disclosure processes. It also provides less flexibility during project implementation.

2.7.5 Mezzanine/ Subordinated Contributions

In terms of priority, mezzanine contributions are located somewhere between equity and debt. Since mezzanine contributors take higher risks, they are compensated by receiving higher interest rates than senior debt contributors, and they are also allowed partial participation in the project profit. The most common form of mezzanine debt is associated with construction cost overruns (World Bank, 2011).

2.8 PPP Risks

As mentioned before, the PPP is a risk-sharing relationship between private and public sectors, where the partner that is most qualified for a certain risk manages that risk. Risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on a project's objectives. Each project will have similar and unique risk components that need to be discussed and assessed in a risk matrix.

Figure 2.1 illustrates the PPP contract and risk sharing options for different types of PPPs in terms of defining the public and private responsibility.

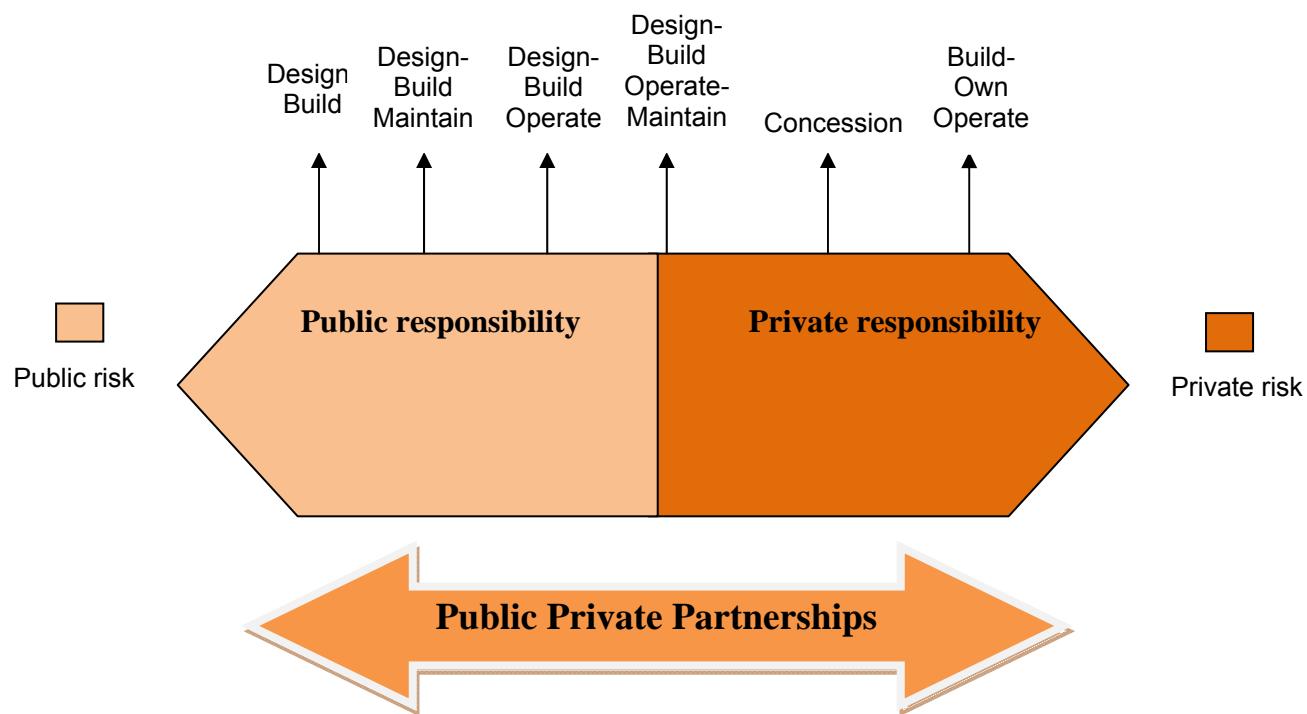


Figure 2.1 - PPP contract and Risk sharing options
Adopted from Source: (ICE, 2008)

Table 2.1 presents a general risk sharing matrix for the public and private sectors in different types of PPP projects.

Table 2.1 - Risk Matrix for Public Private Partnerships
Source: Lewis (2001)

Risks	Type of Risk	Source of Risk	Risk Taken By
Site Risks	Site Condition	Ground conditions and supporting structures	Construction Contractor
	Site Preparation	1) Site redemption, tenure, pollution, obtaining permits and community liaison	Operating company/project manager
		2) Pre-existing liability	Government
Technical Risk	–	Native title and cultural heritage	Government
		1) Fault in tender specifications	Government
		2) Contractor design fault	Design Contractor

Table 2.1—Continued

Risks	Type of Risk	Source of Risk	Risk Taken By
Construction Risk	Cost Overrun	1)Inefficient work practices and wastage of materials	Construction Contractor
		2)Changes in law, delays in approval	Project company/investors
	Delay in Completion	1)Lack of coordination of contractors and failure to obtain standard planning approvals	Construction Contractor
		2)Insured force majeure events	Issuer
	Failure to meet performance criteria	Quality shortfall/ defects in construction/ commissioning test failures	Construction contractor/project company
Operating Risks	Operating cost overrun	1) Project company request or change in practice.	Project company/investors
		2)Industrial relations, repairs, occupational safety, maintenance and other costs	Operator
		3)Government change to outfit specifications	Government
	delays or interruption in operation	1)Operator fault	Operator
		2)Government delays in granting or renewing approvals providing contracted inputs	Government
	shortfall in service quality	1)Operator fault	Operator
		2)Project company fault	Project company/investors
Revenue Risks	Increase in input prices	1)Contractual violations by government-owned supported network	Government
		2)Contractual violations by private supplier	Private Supplier
	Changes in taxes and tariffs	Fall in revenue	Project company/investors
	Demand for Output	Decreased demand	Project company
Financial Risks	Interest Rates	Fluctuations with insufficient hedging	Project company/government
	Inflation	Payments coded by inflation	Project company/government
Force Majeure Risk	—	Floods, earthquakes, riots and strikes	Shared
Regulatory/Political Risks	Change in law	1)Construction Period	Construction contractor
		2)Operating period	Project Company, with government compensation as per contract

Table 2.1—Continued

Risks	Type of Risk	Source of Risk	Risk Taken By
	Political interference	1)Breach/Cancellation of license	Government
		2)Expropriation	Issuer, project company/investor
		3)Failure to renew approvals	Government
	Project Default Risks	1)Combination of risks	Equity investors, followed by banks, bondholders and institutional lenders
		2)Sponsor suitability risk	Government
	Asset Risks	1)Technical obsolescence	Project company
		2)Termination	Project company/operator
		3)Residual transfer value	Government

Risk Management is a structured process that involves identifying, assessing, understanding, responding, and managing risks. It should be conducted on an ethical basis with a strong communication process in place. A sensitivity analysis (SA) performed on cash flows and assumptions, is sometimes needed to test the reliability of results due to changes in assumptions, risk components, and forecasts (FHWA, 2010).

2.9 PPP Underperformance in Toll Roads

Although public-private partnerships have a lot of benefits for both public and private sectors, and they tend to improve business growth, there are some pitfalls that we must be aware of in order to achieve project objectives and maximize benefits. The expectations of PPP projects are high, and the investment is also high; yet results are sometimes disappointing. Causes of these disappointments can be found in the non-goal directed preparation of PPP projects. The fundamental differences in the participants' characteristics are not considered adequately in advance showing the lack of preparation in the project's organization (Reijniers, 1994).

A project is considered underachieving when it does not meet the expected revenue, faces cost overruns, doesn't achieve the expected objectives, and if delayed and not delivered on time. The PPP concept is used to describe a possible relationship

between public and private sectors for the cooperative production or provision of services. This relationship qualifies as a partnership if it involves the joint definition of specific goals and vision, a clear assignment of responsibilities and rights, and a clear communication showing good use of management techniques. However, some PPP projects do not seem to meet this criterion (Reijniers, 1994).

Because of the government need to transfer risks, better manage roads, and provide high quality public services with lower costs, transportation officials tend to partner with private sectors to achieve these objectives. Some toll roads are managed under a Build-Operate-Transfer (BOT) system, where a private company builds, owns, and operates the roads, and then transfers ownership to the government when the lease expires; this allows the government to use the upfront payment paid by the private sector to provide more public services while making sure that the toll road continues to be operated and managed with the highest quality of service by private sectors (Legislative Analyst's Office, 2012).

Although many PPP toll roads are considered successful in meeting budget objectives and risk sharing needs for both public and private sectors, there are some toll roads that have proven disappointing such as SH 130 Segments 5&6, and Indiana Toll Road (ITR). This research will discuss the underperformance of these toll roads showing the factors that led to their underperformance, the impacts, and how to prevent future PPP toll roads from failing.

2.10 Probable Causes of Underperformance

Although PPP representatives from the private sector proved that their projects should be less expensive, more innovative, faster, and more accountable than public service delivery, it has since appeared to cost more. Experts tried to justify these problems by claiming that PPP transferred a huge amount of risk from the public sector to

private sector by using highly questionable "value for money" accounting (Sanger and Crawley, 2009).

Private financing has proven to be more costly and risky than public financing. Moreover, the private sector is worse at managing risk than the public sector, and the risks can never be completely transferred through PPPs, which sometimes have complicated requirements that lengthen the process and cause delays (Sanger and Crawley, 2009). Some of the causes of underperformance are:

2.10.1 Inadequate Feasibility Studies / Unrealistic Revenue Estimations

Feasibility studies are very important as they provide a list of things that should be done in order for the business to work. Also, they identify logistical and other business related problems, develop marketing strategies to convince investors to invest in the project, and serve as a solid foundation for developing a business plan (Wolfe, 2013).

As part of the feasibility study, a strong emphasis should be put on forecasting revenues and costs. Most people underestimate the importance of financial analysis taking place before the beginning of the project. Most PPP toll roads failures can be caused by inadequate feasibility studies that include unrealistic traffic forecasts and undefined public contribution of funds. Experts preparing feasibility studies should consider researching different resources, conducting experiments, and making additional calculations, especially when developing accurate traffic forecasts (Guasch, 2012).

Researching the current state of operation and forecasting the failure based on records which are very obtainable (especially when looking at traffic patterns, density, accidents and types of use) is essential to achieving a successful project. Overestimation of revenues can definitely bankrupt a concession. Financial experts should be able to forecast any future business-related problems that might arise, and which could affect the

project's estimated revenue. Also, they should consider un-expected conditions or problems when preparing financial studies (Guasch, 2012).

2.10.2 Poor Legal Framework

In order to improve the success rate of PPP transportation projects, a solid legal framework is needed at the beginning of the project to specify the "rules of the game" for the private sector and reduce the project risk. By identifying the objectives of the contract, the rights and obligations of the contracting parties, clarity of and adequacy of plans and specifications, and a formal dispute resolution process, there will be less problems in the project and therefore, less delays and cost overruns (Zhang, 2005). In addition, strong institutional arrangements should take place in order to ensure coordination and technical support.

2.10.3 Public Resistance

Consumers (i.e., those who use the highways on a regular basis) are considered a very important part of the public-private partnerships, as they are sometimes asked to pay for services like toll roads access, and their properties might be affected by these partnerships. Therefore, the absence of an assessment of willingness to pay can lead to public dissatisfaction. The public always expect better government decisions in the execution of PPP projects. Violent protests might take place if no action is taken by the government to satisfy public needs (Guasch, 2012).

2.10.4 Uncompetitive Procurement

Another cause of PPP projects underperformance is when a project is awarded to a concession without a competitive bidding for financing, rehabilitating, constructing, tolling, and operating. This gives the private sector a monopoly over the provision of the service. Usually, uncompetitive procurement gives a strong position to the negotiating party and most of the times lead to long delays and excessive cost to the government

(Guasch, 2012). Therefore, it is necessary to counter such provisions with strict price regulations (Pagano, 2009).

2.10.5 Inappropriate Risk Sharing / Risk Management

Risk sharing and risk management are complicated processes that require accurate research and consideration of each sector's strengths and weaknesses. The allocation of risk to the party best able to manage it at the least cost is the main concept behind risk sharing in PPP. Risk management problems can sometimes occur in different stages of the process. Inappropriate identification of the risk, assessment, or response can lead to an ineffective risk management process.

Other causes of delays are the differences in interest between the public sector and the private sector. The public sector's main interests are concerned with regulations, political influence, democratic decision-making processes, minimization of risks, and realization of social goals. Therefore, the public sector has its own objectives and own political responsibilities. On the other hand, the private sector's interests are aimed at achieving returns on invested funds, daring to take business risks, and realizing a corporate goal. In addition, there is a lot more to consider when assessing feasibility than a difference in interests (Bain, 2009).

For example, differences in management approach, differences in the perception of risk, differences in the decision-making process, and differences in opinion about the time factor. These differences may create problems during the preparation and implementation of PPP projects (Bain, 2009).

2.10.6 Length of the Contractual Period

Private companies prefer a longer payback period for two reasons. One is that the company will have more time to collect revenues from users. Second, since the IRS treats such a long term as ownership of the facility, the company can depreciate

investment as if they own the facility, pay less tax, and their risk is reduced. Moreover, for public sectors, usually the longer the contract period, the more likely the facility will generate a higher upfront payment. However, societal, technological, and developmental changes will increase over longer periods, thereby increasing the project risk for both sectors especially in the later years of the lease (Pagano, 2009)

On the other hand, for private companies, the present value of earnings far in the future will be less than near term earnings. For very long contract periods, the profitability curve will flatten. A statistical analysis was done to show the present value of future private sector profits from leasing.

By assuming an initial lease payment with constant revenues and operations costs each year, then letting:

L = the lease payment (\$)

R = yearly revenues from the lease (\$)

C_f = yearly costs of operating the facility (\$)

n = length of the contract period (years)

r = appropriate private sector discount factor

t = time

TP_n = Present value of profits stream to be derived from operating the lease over n years

MP_t = Marginal profits (\$)

Then:

$$TP_n = \sum_{t=1}^n \left(R - \left[\frac{C_f}{(1+r)^t} \right] - L \right)$$

A reasonable approximation of the marginal profits accruing to the firm after leasing the facility for one more year is:

$$MP_t = R - C_f / [(1+r)^t]$$

Figure 2.2 illustrates how the present value of the total profits to be derived from leasing the facility increases at a decreasing rate, reflecting the declining present value of profits over time. Point B in the figure is the breakeven number of years of the lease.

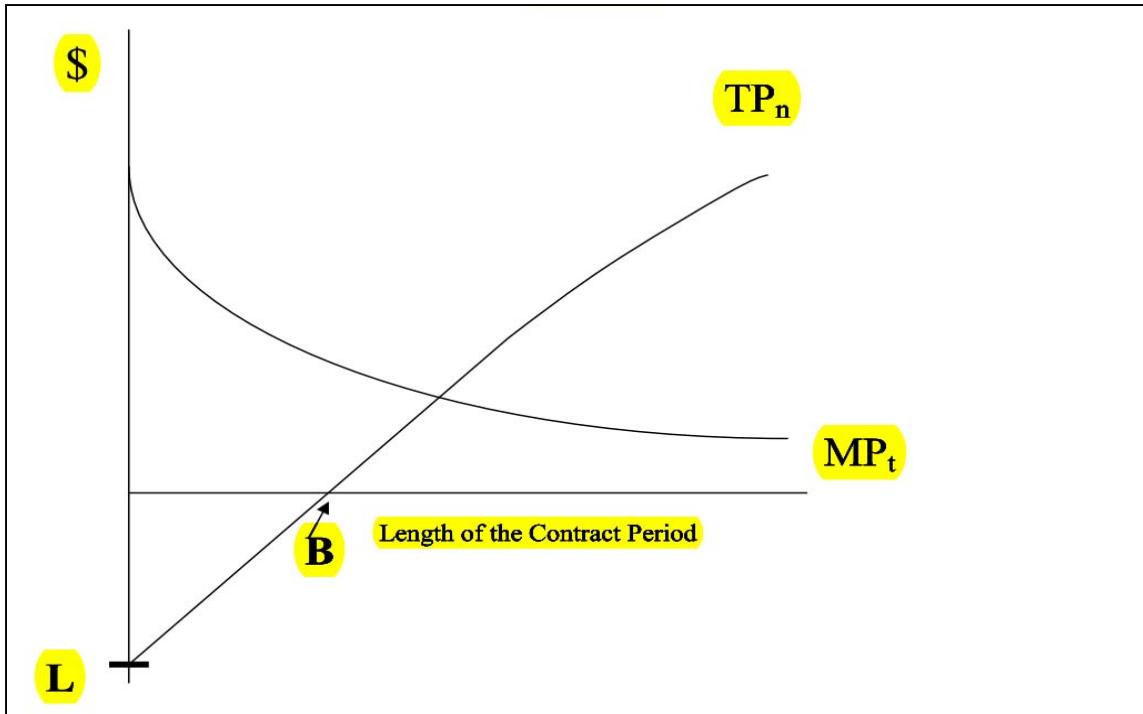


Figure 2.2 - Present Value of Future Private Sector Profits from Lease
Source: (Pagano, 2009)

The marginal social cost of leasing the facility declines over time. It is given by:

$$MSC_t = R/(1+r)^t$$

The marginal social benefits of leasing the facility are given by:

$$MSB_t = AE / (1+r+U)^t, \text{ where:}$$

AE = Allocative efficiency gains from the use of the facility

U = Public sector risk factor

Marginal social benefits and costs are shown in Figure 2.3. The intersection of these two lines shows the optimal length of the contract. If the length of the contract is

less than this, it would be better to expand the project length. Contract periods more than L would involve a potential social loss. Using the public risk factor, contract periods of 75-99 years may not be socially desirable as it allows for many economic ups and downs (Pagano, 2009).

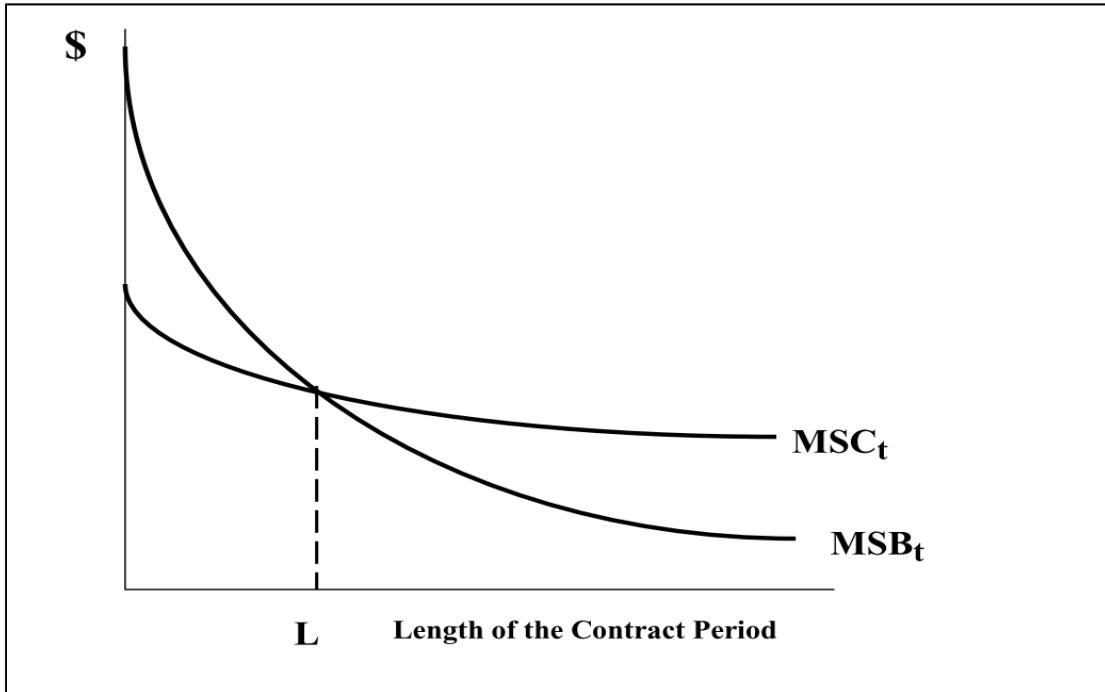


Figure 2.3 - Socially Optimal Contract Period
Source: (Pagano, 2009)

2.11 Critical Success Factors

Public agencies and private organizations can achieve mutual advantages in developing a PPP, especially when the partnership is characterized by trust, fairness, openness and mutual respect. The main rewards from partnering for the public sector are improving program performance, cost-efficiencies, better provision of services, and effective allocation of risks and responsibilities. The private sector, on the other hand is worried more about having a better investment potential, making a reasonable profit, and finding more opportunities to expand its business interests (Tiong, 1996).

For a public-private partnership project to meet its objectives, both the public and private sectors should ensure that all success factors responsible for successful implementation of PPP are well structured in a way that its optimum performance can be guaranteed. Identification of the critical success factors for any project would help it obtain its goals in the most cost-effective way and with the highest quality of service possible (Oyedele, 2013). According to Zhang (2005), the five main critical success factors (CSFs) are:

2.11.1 Economic Viability

Traditionally, there are four main methods used for economic viability evaluation: payback period, net present value, discounted payback period, and internal rate of return methods. However, new probabilistic and statistical methods were developed because of PPP projects' long lead time and long operation period with various uncertainties, which bring risk into capital investment evaluation decisions. Economic viability depends on different factors, such as:

1. Long term demand for the service offered by the project
2. Sufficient profitability of the project to attract lenders
3. Limited competition from other projects

2.11.2 Appropriate Risk Allocation

As mentioned before, a workable legal framework with an effective legal input should be established at the beginning of the project cycle and updated with experience and lessons learned over time. By defining the strengths and weaknesses of each sector, Risks can be effectively managed by allocating them to the personnel best able to deal with them.

2.11.3 Reliable Concessionaire Consortium

Selection of the right concessionaire is critical to the success of the project as it undertakes much broader risks than a mere contractor. The main factors of achieving strong financial and technical strengths are:

1. Capable project team
2. Good relationship with host government authorities
3. Effective project organizational structure
4. Sound technical solution
5. Low environmental impact
6. Partnering skills
7. Public safety and health and consideration
8. Innovative technical solution
9. Rich experience with PPP project management

2.11.4 Sound Financial Package

A sound financial package includes the following features:

1. Sound financial analysis
2. Long-term debt financing that minimizes refinancing risk
3. Investment, payment, and drawdown schedules
4. Fixed and low interest rate financing
5. Low financial charges
6. High equity / debt ratio

2.11.5 Favorable Investment Environment

In order to develop a public infrastructure project, there must be willingness from private sector investors and lenders who depend on the environment where these projects operate. A favorable investment environment includes the following features:

1. Government support
2. Reasonable legal framework
3. Stable political system
4. Favorable economic system
5. Supportive and understanding community
6. Promising economic growth
7. Adequate local financial market (Zhang, 2005)

2.12 Failure Prevention Techniques

A solid legal framework for PPP is needed to specify the rights and responsibilities for each sector and reduce the project risk, thus improving the success rate of PPP projects. After knowing the possible causes of underperformance for PPP toll roads, the question that comes to mind is how to prevent PPP projects from failing.

The first step is to assure that a PPP won't fail by choosing a PPP for the right reasons, and using the right PPP contract. This means that PPPs should be well-defined projects that are awarded in transparent and efficient competitive auctions and not through bilateral negotiations. In addition, projects should be treated by the government partner as if they were public investment to reduce the temptation to overspend. Government overseers should ensure that PPPs will be chosen for the right reason. For a PPP project to be successful, the public participant should act as a private company in terms of management and focus on making sure funds are available when needed. PPP leaders must also have a solid grasp of the democratic decision-making process and be aware of public laws and regulations (GAO, 2008).

According to Jacques Reijniers (1994), a prevention plan that will help achieve better PPP projects and prevent different types of pitfalls from happening, should

consider the project's objectives, planning process, organization, control, and management.

2.12.1 Assignment and Objectives

This step in the failure prevention plan includes the following features:

1. A clearly defined project scope
2. Risk analysis and feasibility studies
3. Clarity about the clients
4. Unambiguous clearly described final objectives
5. Availability of adequate decision documents available

2.12.2 Planning

There should be two planning levels: 1) a milestone plan that defines what must be achieved and 2) an activity plan that shows how to achieve it. This step includes the following features:

1. Creativity in preparing the plans
2. Realistic planning
3. Risk management embedded in planning
4. Phased approach

2.12.3 Organization and Coordination

The project should be organized conveniently, and a responsibility chart showing all participant responsibilities should be prepared. The organization plan includes the following features:

1. Project goals that are clearly laid down
2. Kick-off meeting between all project participants
3. Project manual compiled for all projects participants

2.12.4 Control

The next steps of the prevention plan are preparing progress reports and evaluate each phase to monitor any changes in the original plan. This will help identify problems at an early stage of the project, and it will help the planning committee find solutions at lower costs and effort.

2.12.5 Management

Last but not least, management should be considered when thinking about a failure prevention plan for PPP projects. For instance, the project manager should have balanced responsibilities and authorities, and be selected based on his leadership skills (Reijniers, 1994).

In addition, there is a need to discuss and analyze the application of travel demand forecast models. The models that are used to project revenues as a function of the demand estimates should be applied accurately and use the most innovative methods ranging from simple sketch-planning tools to investment grade studies. Also, comparing the effectiveness of various toll facility demands and revenue forecasting methods will help improve the methods used for estimating the value of time and for developing innovative techniques to improve the quality and transparency of the forecasts, thereby, achieving reliable revenue estimates (NCHRP, 2006).

2.13 Chapter Summary

In this chapter, a comprehensive review of information gathered from the literature research including PPP history, definition, types, risks, benefits, and limitations is conducted. A review of PPP failure in toll roads, causes of failure, critical success factors, and failure prevention techniques was also studied. Sources of literature include journal articles, conference reports, seminar presentation, and reports from other resources.

Chapter 3

Methodology

Chapter 2 provided a comprehensive overview of PPP project underperformance in terms of causes, prevention techniques, and how to achieve a successful project. This chapter provides an overview of the methodology process. Each section of this process is explained in detail in subsequent chapters.

3.1 Introduction

The methodology consists of five stages. The first stage will be identifying research objectives and research needs, and will include a comprehensive literature review and background discussion of the topic to help define the methodology and final results.

The second stage basically discusses two case studies (Indiana Toll Road and Texas SH 130 Segments 5 & 6) where the PPP failed to meet its expected outcomes. Causes of underperformance, impacts, prevention techniques, and a conclusion will be the main topics to discuss and analyze for each case study.

The third stage will focus on data acquisition. This will be conducted by gathering information and responses from a survey. The fourth stage will be interpretation and analysis of the responses statistically, and a discussion of the responses with a summary in final results. The final stage will represent conclusions and recommendations. Moreover, the thesis will provide some recommendations for future research.

3.2 Case Studies

Case studies represent research that gathers information about a specific person, group, or event. Case studies provide a clear understanding of a complex issue, and emphasize detailed analysis of a limited number of events or conditions and their relationships. Case studies can provide very detailed information about a particular

subject that it would not be possible to acquire through any other type of experimentation. On the other hand, the main issue with case studies is their lack of being applicable to all projects, as the results of a particular case study may not apply to the general idea behind it (Maheshawri, 2011).

In order to describe the pitfalls and problems that usually take place in PPP toll roads, an analysis of two state toll roads is offered. The public-private partnership of Indiana Toll Road and State Highway 130 Segments 5&6 was discussed in terms of the project history, the nature of the partnership, the underperformance that took place, and the causes of underperformance.

3.2.1 Indiana Toll Road

3.2.1.1 Overview

The Indiana Toll Road (ITR) is part of the U.S. Interstate Highway System which runs about 156 miles through Indiana connecting the Chicago Skyway to the Ohio Turnpike. It was publicly financed and constructed during the 1950s. The state of Indiana created the Toll Road Commission in 1951 to finance the Indiana Toll Road. Construction was completed in 1956; it opened in stages from east to west. Money collected from tolls was used to maintain the road and keep up with debt service (Cui and Lindly, 2010).

By mid 1980s, the toll road was producing enough revenue to finance other transportation smaller projects. As it started getting older, the cost maintenance started increasing; hence, revenue began to decline. Since 1999, the road has been earning less than \$7 million, barely enough to cover its own maintenance, operations, and management expenses (Cui and Lindly, 2010).

Mitch Daniels, the Governor of Indiana, realized the importance of transferring the ITR to a private partner to better manage it and increase the profits while allowing the state to keep ownership of the toll road. Public-private partnership was his decision, when

he transferred the ITR in 2006 to a private consortium known as Statewide Mobility Partners (SMP) consisting of en Cintra Concessions de Infrastructures de Transporte SA (Cintra) of Mexico and Macquarie Infrastructure Group (MIG) of Australia (Cui and Lindly, 2010).

The ITR Concession Company made up of the Spanish operator Cintra, and the Australian bank Macquarie paid \$3.8 billion for a 75-year lease of the Indiana Toll Road. The bid was an example of a real PPP highway investment in America, and it exceeded that of the nearest competitor by about a billion dollars. The consortium agreed to perform maintenance and operations while retaining revenue gained from tolling during the 75 year lease (Cui and Lindly, 2010).

3.2.1.2 The Partnership

The Governor's decision was met with two conflicting opinions. Opponents believed the state would lose revenue by leasing the toll road since the traffic had increased, and they were concerned about state employees which would obviously lose their jobs. Furthermore, they expressed refusal to transfer the operations to non-American companies which created a different kind of risk. On the other hand, proponents asserted that the road would never be worth that amount in public hands, and they pointed out that money saved from this deal would allow funding of many road projects that would benefit the public (Engel, 2011).

The state's main reason behind leasing the ITR was to reduce their risk by transferring part of it to the private sector. According to the instability of the economy, it was hard for state officials to predict when the ITR would produce capital gain for the state. Moreover, the state would invest the upfront revenue in many other necessary Indiana road projects, which would create more revenue in the future. One year later, some evidence of the Indiana toll road concession company's success was reported.

Under the consortium's operation, tolls were lower, roads were adequately maintained, and management was outstanding (Engel, 2011).

3.2.1.3 The Underperformance

On the five year anniversary of the lease, the economy instability, low revenue and traffic being below the company's projections, caused Debtwire, a subscription-only wire services to announce that the Indiana Toll Road Concession Company was in danger of defaulting on its debt--possibly as soon as the next year (Lindenberger, 2011).

Even though the state got a great deal, as the lease agreement contained huge protections for taxpayers and travelers, and the road operation was considered successful, the private investors did not do as well. In fact, they had not been able to get past the debt they incurred from winning the bid. Disclosure documents from Macquarie Atlas Roads shows that revenues from the highway were expected to remain insufficient to cover debt service obligations over the medium term. The documents proved that governor Daniels was right when he stated that the consortium didn't make the best decision when they bid for the lease. "They overpaid, that's why you hold an auction. Sometimes you hit the jackpot," he said (Deelinger, 2011). He even told Barron's that the arrangement was the "best deal since Manhattan was sold for beads" (Holeywell, 2011).

Macquarie spokeswoman Paula Chirhart and Cintra spokesman Patrick Rhode stated that more vehicles were using the ITR as the economy recovered, and that the consortium was not expecting a default insisting that the ITR would continue to meet its debt service payments as they fell due (Deelinger, 2011).

On the other hand, recent studies showed that the ITR lease was a bad deal for the state. According to a study conducted by John Gilmour (2012), a government professor at the College of William and Mary in Williamsburg, VA, the PPP was not the best decision made by the state when they leased the ITR. He also stated that the state

could simply have raised tolls on its own; generating more profit than it is now (Gilmour, 2012).

3.2.1.4 Causes of Underperformance

A. Length of the Contract Period

According to Gilmour (2012), the length of the lease plays a very important role in the success of any PPP project. A 75-year lease which is considered a long lease, can lead to problems like roads life depreciation. The roadway system's life which is usually runs between 25 and 30 years, and the financial viability of the system would have been depreciated by the end of the 75-year lease. However, the length of a short lease would be very similar to the length of revenue bonds and, therefore, can generate additional revenue, and reduce the amount of inter-generational cost shifting (Gilmour, 2012).

B. Overestimation of Traffic and Revenue

In order for a PPP toll road to attract potential investors in the future, it must appear capable of generating enough revenue to cover debt cost and maintenance costs over the lifetime of the facility. This requires a reliable forecast of expected revenues, which directly depends on estimated traffic demand and toll rates of the facility (NCHRP, 2006). The problem for ITR's investors was miscalculation of traffic projections which were notoriously unreliable and more an art from than a science (Holeywell, 2011).

According to the Fitch Rating, a global rating agency, the ITR consortium made a fundamental financial miscalculation in using a gimmicky hedge known as an "accreting swap." It was an early victim of sustained low interest rates, which because of the swaps have caused a big problem in debt service. As a result, the risk profile of the ITR concession company was increased rather than decreased (Samuel, 2013).

In addition, the ITR deal was a case of bad timing, since it is impossible for Macquaire and Cintra to predict that the worst economic downturn since the Great Depression would strike so soon after the contract was signed (Holeywell, 2011).

3.2.2 Texas State Highway 130

3.2.2.1 Overview

State Highway 130 (SH 130) is part of the Central Texas Turnpike System (CTTS). The system which consists of SH 130, SH 45N, and Loop 1 Extension were built under a Public Private Partnership agreement. SH 130 Segments 5 and 6 were part of the first PPP project to be developed in Texas under a Comprehensive Development Agreement (CDA). With a \$1.3 billion private investment, Texas's first concession agreement was approved in 2006 by the Texas Transportation Commission for the construction of the southern area of SH 130 (representing 40 miles). This money came from Senior Bank Loans, TIFIA Loan, and equity contributions (Cui and Lindly, 2010).

One month ahead of the start of operations per the facility agreement, the road opened to traffic in October 2012. The road began charging tolls in November of the same year. Representatives of the 50-year contract with TxDOT predicted that future developments in some small towns along the toll road's route would lead to increased traffic in future, and TxDOT hoped that building this toll road would be the best solution for congested Interstate 35 for those driving throughout central Texas (Batheja, 2013).

3.2.2.2 The Partnership

The agreement with the SH 130 Concession Company, LLC (which is the Spanish-American company formed by Cintra (with 65% ownership) and Zachry American infrastructure (35% ownership) was to design, build, finance, operate, and maintain the road for 50 years. Cintra-Zachry paid the state \$25 million upfront, and shared future toll revenues for the right to collect a portion of the tolls. TxDOT estimated

that the state would receive approximately \$1.7 billion over the next 50 years in toll revenue. SH 130 continued to be a state-owned toll road and any property purchased was held by the state. Since the SH 130 Concession Company was responsible for designing, financing, constructing, operating, and maintaining the project, the state was only responsible for customer service and the business operation of toll collections (Cui and Lindly, 2010).

3.2.2.3 The Underperformance

SH 130 has not been the immediate success story everybody was hoping for. In October 2013, Moody's Investors service downgraded the credit rating of SH 130 Concession Company LLC for the second time, based on what it said was inadequate traffic growth.

Moody's warned that a default may not be far off as it downgraded \$1.1 billion of debt tied to the project by five notches, from B1 (rated as a high credit risk) to Caa3 (rated as poor quality and very high credit risk), including the Senior Bank Facility with \$686 million outstanding and the Subordinate Transportation Infrastructure Finance and Innovation Act (TIFIA) loan with \$493 million outstanding (Moody's, 2013).

Table 3.1 shows some of the credit ratings and the chance of default associated with each rating.

Table 3.1 - Moody's, S&P, and Fitch's rating
 Source: Garniero (2009)

Chance of default	Moody's	S&P	Fitch
		Investment grade	
Lowest risk	Aaa	AAA	AAA
	Aa1	AA +	AA +
	Aa2	AA	AA
Very low risk	Aa3	AA -	AA -
	A1	A +	A
	A2	A	A +
Low risk	A3	A -	A -
	Baa1	BBB +	BBB +
	Baa2	BBB	BBB
	Baa3	BBB -	BBB -
		Speculative grade	
Probable	Ba1	BB +	BB +
	Ba2	BB	BB
	Ba3	BB -	BB -
High risk	B1	B +	B +
	B2	B	B
	B3	B -	B -
Default	Caa1	CCC +	CCC +
	Caa2	CCC	CCC
	Caa3	CCC -	CCC -
	Ca	CC	CC
	C	C	C
		D	DDD
			DDD
			DDD

The negative outlook of the rating shows Moody's view that traffic and revenue will continue to grow at a very slow pace; it also reflects the difficulty in getting additional sponsors support. All available liquidity facilities, contingent equity, and excess revenue on hand will be fully utilized when the June 30, 2014 payment is due. The threat of default will definitely push the company to refinance its debt next year, and that will be a good reason for TxDOT to terminate its toll contract with the company many years ahead of schedule (Moody's, 2013). Figure 3.1 shows the SH 130 segments 5&6 being parallel to the busy I-35.

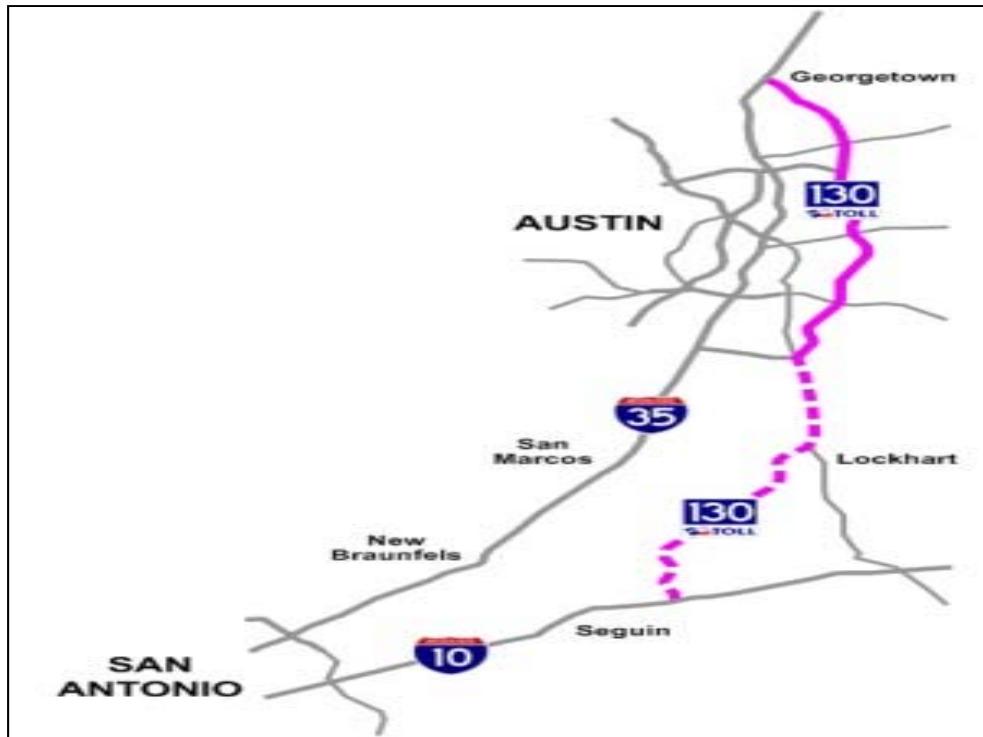


Figure 3.1 – Texas State Highway 130 Map
Source: Batheja (2012)

Even though the location of the toll road has been expected to draw traffic from one of the most congested highways in Texas, I-35, and may be a good choice for truckers, TxDOT has already spent public funds trying to increase traffic on SH 130 by advertising the road when they put nearly 400 signs along the I-35 corridor promoting SH 130 as an alternative route, and subsidizing trucks to use the road at a discount rate. Also, as mentioned before, if the SH 130 concession company does default, TxDOT's first option will be to take it over and operate it as a freeway instead of charging tolls (Batheja, 2013).

The rate of traffic and revenue growth will not be enough to meet debt obligations that will continue to grow when TIFIA's interest payments begin in 2017. Therefore, the only feasible options are sponsor equity support and debt restructuring. Moody's

discounted cash flow analysis is showing that the project may be unable to fully support the current debt quantum in the long term (Moody's, 2013).

3.2.2.4 Causes of Underperformance

A. The Project Location

Located 30 miles east of the most congested part of Central Texas, the road location was considered a challenge from the start. Capital Area Metropolitan Planning Organization Chairman Will Conley said that the project's location distinguishes it from SH 130. It is very difficult to get people to change habits and take an alternative route very far out of their way. Many people predict that if SH 130 was a free highway, it would attract significant levels of traffic from the heavily congested Interstate 35, but it is obvious that travelers who can't afford toll fees will not plan to take SH 130, not only because of the high cost of tolls, but also because of the road's extra distance and highest in the nation speed limit of 85 miles per hour, which also can affect gas consumption (Hall, 2013).

Therefore, it is very important to choose a PPP for the right reasons. The road's disappointing outcomes caused a lot of people to start questioning the need for Public Private Partnerships in transportation projects, and if the disadvantages can sometimes outweigh the advantages. However, in this case, experts blamed the need for the roadway in the first place, before blaming the state's decision to partner with private sectors.

B. Unrealistic Estimation of Toll Road Demand and Revenue

It is very important that the forecasted toll revenue targets be accurate and reliable, reflecting the ability of the toll road to achieve its forecasted traffic forecasts. Since the feasibility of new toll road projects is based on models that forecasts traffic demand, the effectiveness of these forecasts are very critical in determining the credit

quality of the projects. Therefore, it is very important to understand the models that are used to forecast travel demand and analyze the strengths and weaknesses of each model in order to improve the forecast results (NCRHP, 2006).

In April 2013, Moody's downgraded SH 130 to B1 to show the weak traffic and revenue performance during the initial ramp up phase of the toll road. Six months later, when it was downgraded for the second time, it showed a monthly growth of traffic and revenue, but the growth was still insufficient to meet operating and debt obligations (Moody's, 2013).

As the traffic projections and expected revenues for the road failed to meet its expectation, that caused TxDOT had to reduce the toll rates and give the road the country's highest speed limit of 85 miles per hour, which is described by some traffic experts as unsafe (Batheja, 2013).

Inaccurate traffic and revenue studies and calculations caused the Transportation Infrastructure Finance and Innovation Act (TIFIA) program to require a new traffic and revenue study to be completed in 2014. The new study will help sponsors decide whether it is profitable or not to provide additional equity support for the project (Moody's, 2013).

3.3 Use of Survey

Another important part of the research is conducting a survey. Based on their experience in PPP projects, professionals and experts from public and private sectors were asked to answer some questions regarding the PPP pitfalls in toll roads. Professionals can be engineers, contractors, subcontractors, suppliers, and project managers.

The survey methodology consisted of four stages. The first stage was developing a list of initial contacts that are familiar with PPP transportation projects and worked at least in one public or private project. The second stage was developing survey questions that ensure that basic consistent information was being collected from each survey participant. The third stage was calling and e-mailing contacts to make sure they answer all the questions on the survey. The last stage was discussing and analyzing the responses statistically and graphically in order to come up with a clear understanding of the results.

3.3.1 Survey Questions

Respondents were asked to share their ideas based on their experience and knowledge of key success factors for PPP projects. They were also asked how to achieve a successful agreement by preventing the main causes of PPP failures in general and most specifically for PPP toll roads. Using the survey, many objectives were achieved. For instance, the success, difficulties, benefits, and risks of PPP were analyzed along with the other related responses received, and compared to information gathered in the literature research.

The survey aimed to provide a better understanding of how PPPs are affected by various factors that usually lead to underperformance of projects and not achieving the expected objectives and outcomes. Questions on how to achieve accurate and reliable

traffic estimates and revenue forecasts were asked in order to provide a solution for underachieving projects due to lack of demand estimations.

3.3.2 Collection of Responses

An online survey service called Survey Monkey was used to design the survey. It was distributed through emailing or customized website links. Telephone follow up calls and e-mails were used to ensure the maximum number of responses possible. Besides providing all the response information, the service also created an ease for analyzing responses received.

3.3.3 Survey Respondents

Survey analysis was based solely on the responses received from survey recipients. The recipients were selected based on adequate knowledge of PPP projects. Most respondents had more than 15 years of experience with the public sector.

3.4 Mean Score Ranking Technique

Table ranking questions are the types of questions which ask the respondents to rank a list of choices according to importance, likeliness of happening, level of satisfaction, etc. In order to analyze this specific type of questions, the mean score ranking technique was used. Options were given rating scale numbers from 1 to 5 for use in calculations and statistical analysis. For example, for the level of importance ranking questions, *not important* was given a score of 1, and *critically important* was given a score of 5. The mean score of each option in the question is then calculated by using the following formula:

$$MS = \sum (f \times s) / N \quad \text{where } 1 \leq MS \leq 5$$

where s = score given to each factor by respondents, ranking from 1 - 5

f = Frequency of each rating for each option

N = Total number of responses for that option

3.5 Percent Calculations

For multiple choice questions, the data were analyzed using pie and bar charts.

The percentage representation of each response was calculated using this formula:

$$\text{Percentage (\%)} = \frac{n}{N} \times 100$$

where n = number of responses for a specific option

N = Total number of responses for that question

3.6 Chapter Summary

Two case studies were discussed to highlight the underperformance of PPP that took place in two U.S. toll roads. Moreover, a survey was conducted to obtain information from experts with previous involvement and knowledge of PPP transportation projects. The statistical representation of the survey responses will help in evaluating and analyzing the various responses received.

Chapter 4

Results

Chapter 3 provided an analysis of two case studies and an overview of how the survey responses were used. This chapter presents the responses and analysis conducted for this research. The results are presented with statistical and graphical representations. The responses were gathered from professionals and experts involved with Public-Private Partnership transportation projects in the United States.

4.1 Analysis of Survey Results

A comprehensive analysis of survey responses is provided in this section.

4.1.1 General Experience of Respondents in PPP Projects

Seventeen survey respondents were asked a few questions to identify their involvement with PPP transportation projects in the United States. Even though the survey was sent to professionals in different states, all respondents turned out to be from Texas. This might show that PPP experts in Texas are much more worried about the pitfalls of PPP toll roads, especially after the recent underperformance of segments 5&6 of SH 130.

First, respondents were asked about their job position and what best identifies their experience with PPP transportation projects. Figure 4.1 shows that more than half of the respondents are engineers. Consultants and contractors also participated in the survey giving the responses more accuracy and reliability.

Respondents were also asked how many years of experience they had in the construction industry. As shown in Figure 4.2, about 80% of the respondents had over 6 years of experience. Obviously, the more experience respondents have, the more reliable their results are because professionals with more experience have been involved in more

transportation projects and are more knowledgeable about what causes the project to underperform or succeed.

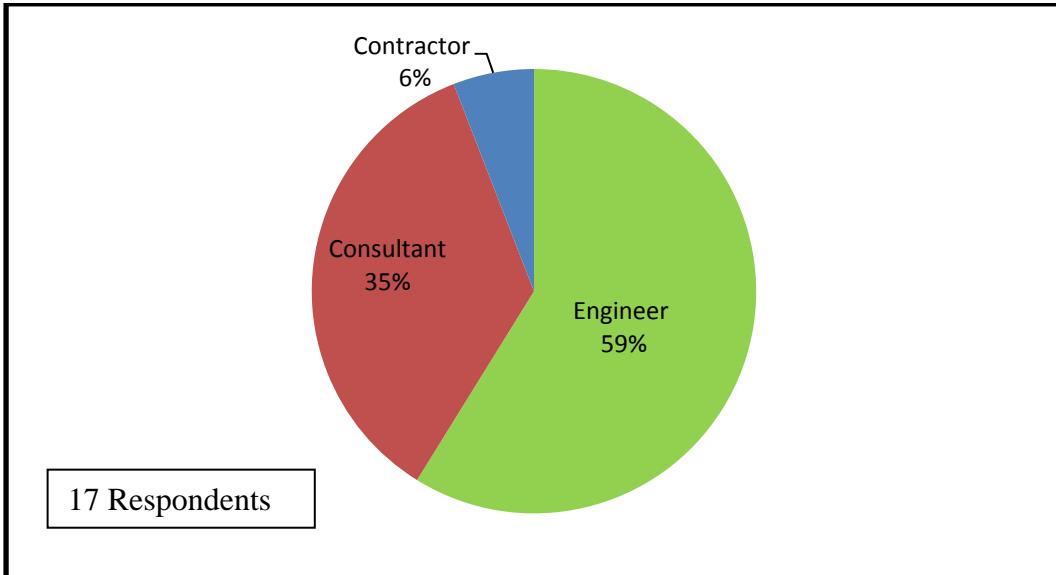


Figure 4.1 – Distribution of Survey Respondents by Position

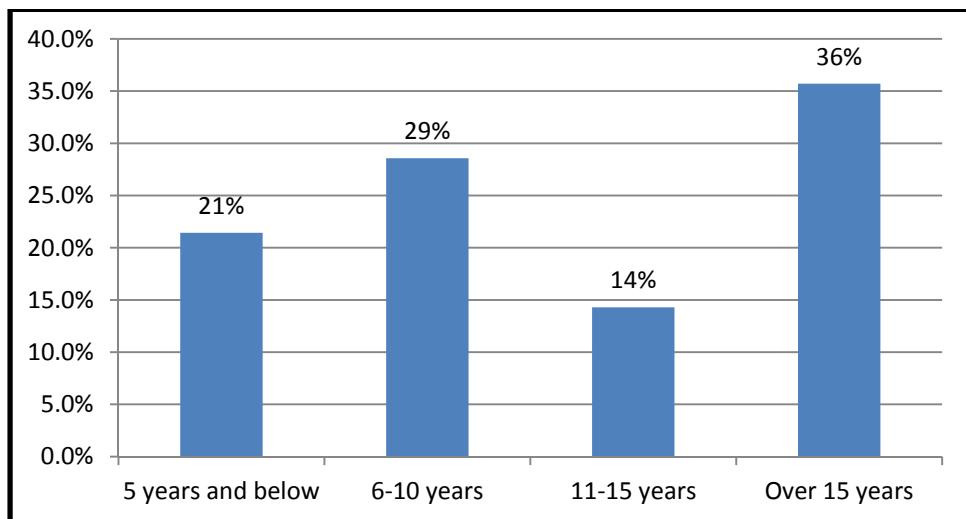


Figure 4.2 – Years of Experience of Respondents

Most of the respondents had experience with public sector or both sectors. About 30% of the respondents had experience with the private sector in implementing PPP

transportation projects. Figure 4.3 illustrates the distribution of survey respondents by sector.

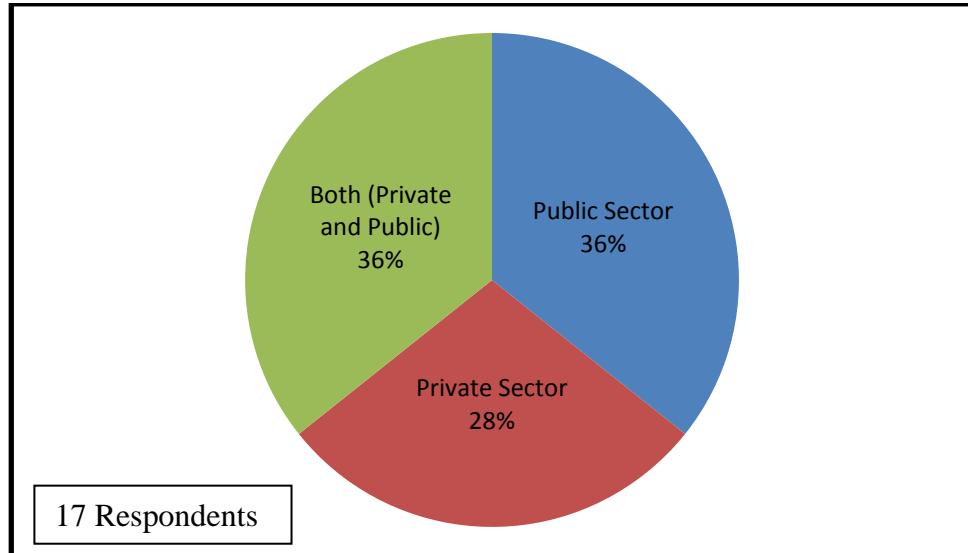


Figure 4.3 – Distribution of Survey Respondents by Sector

4.1.2 Comparing PPP to Traditional Procurement Method

Respondents were asked if they thought that PPP was a more effective method in delivering transportation projects compared to traditional procurement methods. As shown in Figure 4.4, over 85% of the professionals voted for PPP to be a better method in delivering transportation projects.

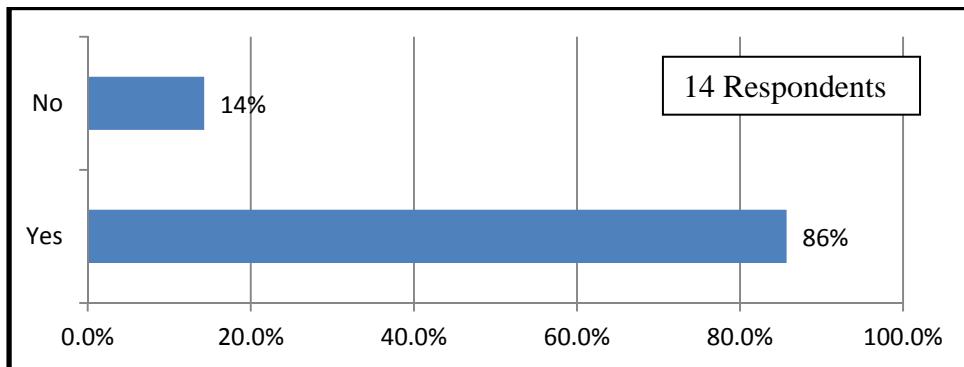


Figure 4.4 – PPP Effectiveness in Delivering Transportation Projects

4.1.3 Reasons for Choosing PPP

Based on their experience, the survey respondents were asked about the main reasons PPPs are adopted. The choices were risk transfer, source of finance, better quality of service, reduced time on project delivery, enabling major innovations, value for money, and political reasons. About 80% of the respondents voted for source of finance to be one of the main reasons of implementing PPP. This shows the importance private sectors place on financial resources in delivering transportation projects that are needed for public, which are often over the government's budget. Moreover, about 65% of the respondents believed that PPP projects are adopted to reduce time on project delivery.

Less than 25% of the respondents chose better quality of service as a reason for choosing PPP over traditional delivery methods, which mean that the private sectors care more about gaining profits than delivering best quality services and facilities. Based on the answers of most respondents, enabling major innovations wasn't a main reason for adopting PPP projects.

The responses for this question were statistically demonstrated in Figure 4.5.

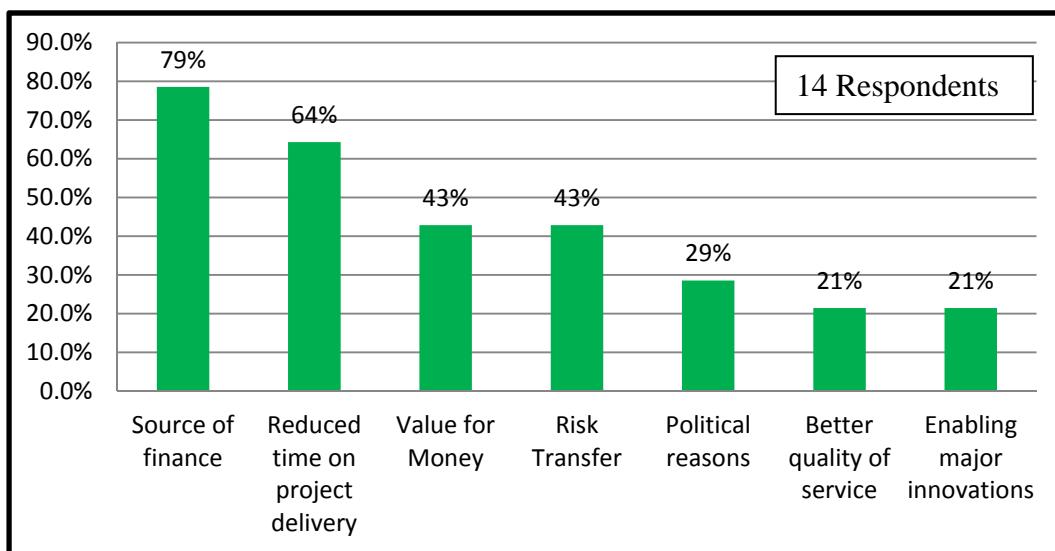


Figure 4.5 – Reasons for Choosing PPP

4.1.4 PPPs Limitations

When asked about PPP limitations, most of the respondents agreed that limiting the government's flexibility in terms of changing funding allocation to reflect new government's priorities was a drawback. Most of the respondents disagreed with the statement that legal issues were one of the main limitations of PPPs.

Figure 4.6 shows the main limitations of adopting PPP in transportation projects.

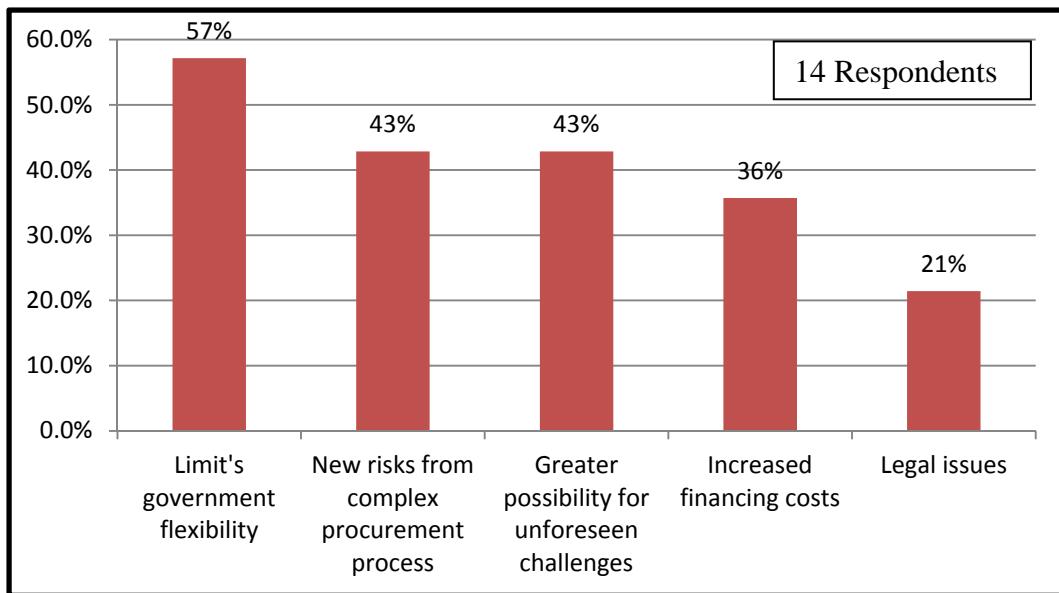


Figure 4.6 – PPPs Main Limitations

4.1.5 Risks Associated with PPP Transportation Projects

About 65% of the respondents chose financial risk as the most likely risk associated with PPP transportation projects, while more than half of them voted for technical risk and operating risk caused by human errors and organizational internal activities. On the other hand, political and environmental risks were believed to be unlikely to happen. Figure 4.7 shows the responses for each risk factor.

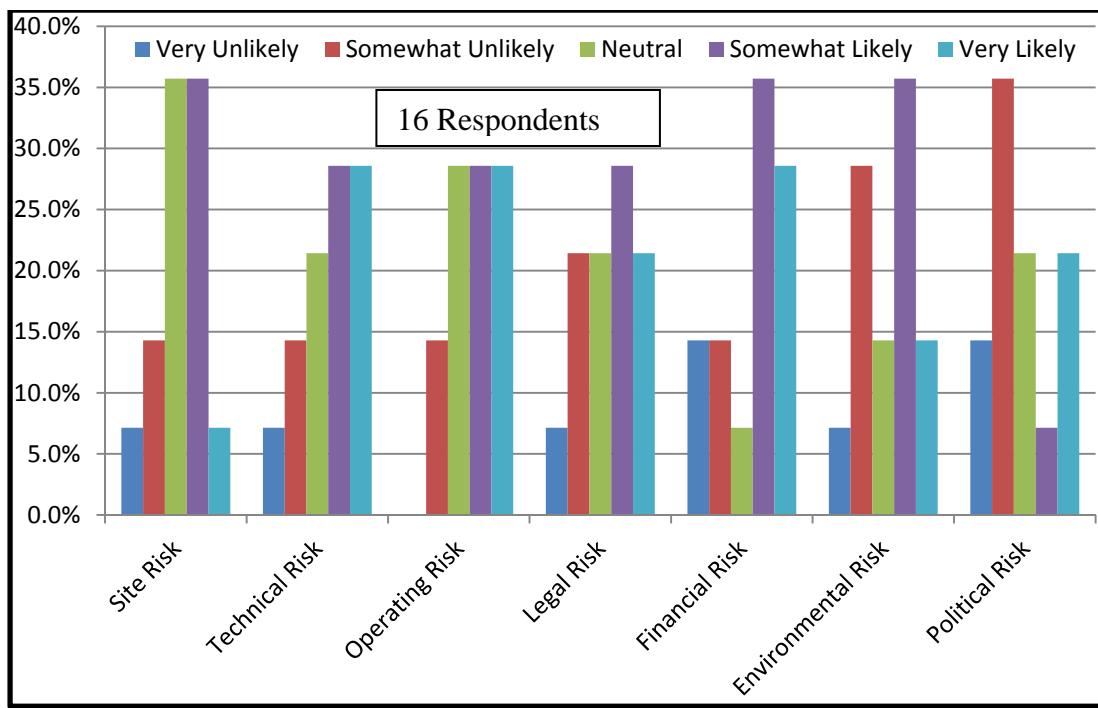


Figure 4.7 – Risks Associated with PPP Transportation Project

4.1.6 Public Support for PPP Transportation Projects

Although the results were very close, more respondents agreed that there is strong public support for PPP transportation projects. However, some of the public are always concerned about private sectors profiting excessively on PPP transportation projects. Figure 4.8 illustrates the responses received.

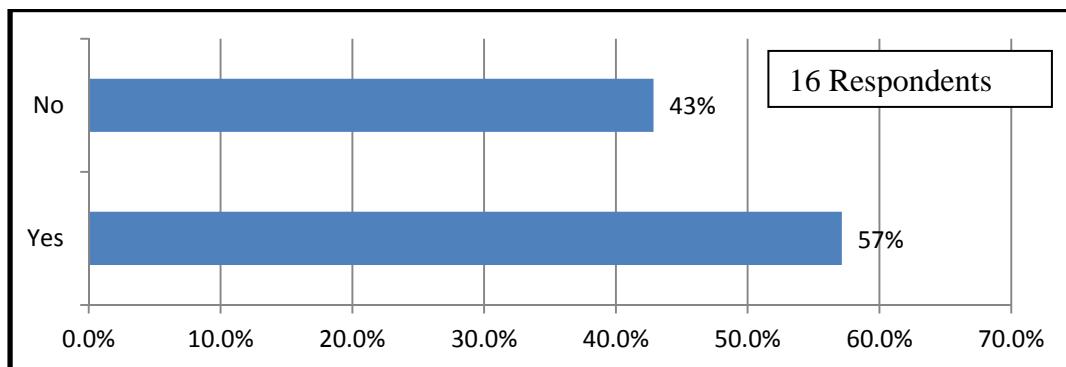


Figure 4.8 – Public Support for PPP Transportation Projects

4.1.7 Transportation Projects Best Suited for PPP

The survey respondents, when asked about the type of transportation project best suited for PPP, voted for economically viable meaning revenue generated after the project would be sufficient to fund cost of materials and overhead. As shown in Figure 4.9, Value for Money to ensure the maximum benefit possible was the second best option. High scope of innovation and high risk projects were not seen to be best suited for PPP.

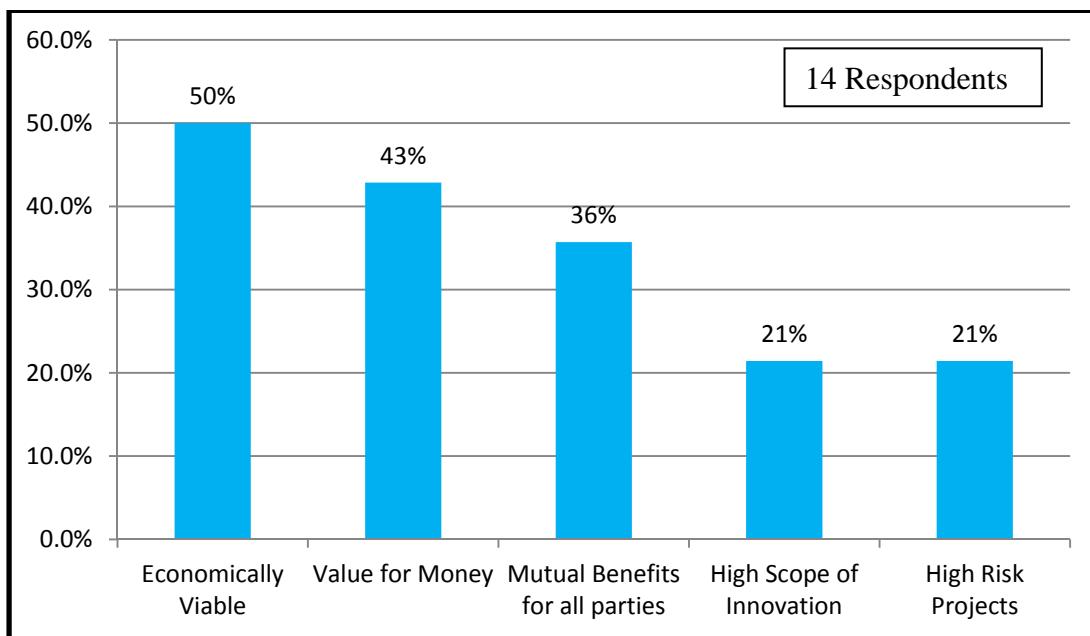


Figure 4.9 – Transportation Projects Best Suited for PPP

4.1.8 Causes of PPP Projects Failure

Respondents were asked to rate some common factors that caused PPP projects to underperform and sometimes fail. Although none of the respondents had experienced failure in the PPP projects they had been involved in, they agreed that some of the failure causes were critically important in causing underperformance of PPP projects. Figure 4.10 illustrates the responses received.

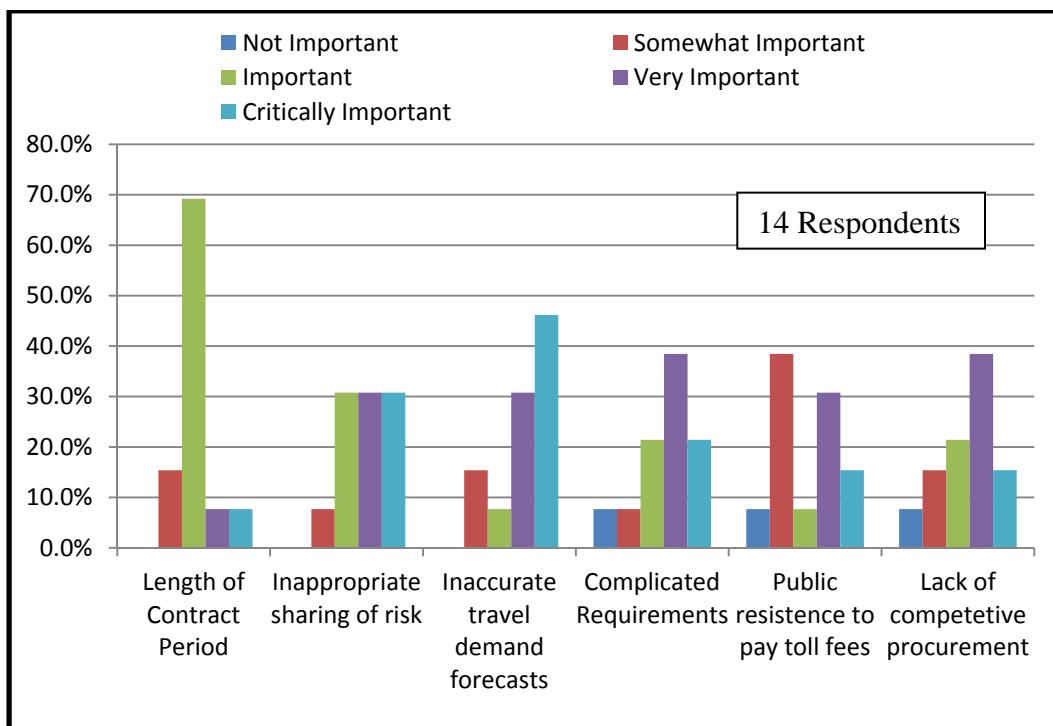


Figure 4.10 – Causes of PPP Failures

4.1.9 Factors Leading to a Successful PPP

Respondents were also asked to rate different factors that lead to a successful PPP. For each of the factors, the respondents were asked if they agreed or disagreed with the cause cited as leading to a successful PPP. As shown in Figure 4.11, about 60% of the respondents strongly agreed that a well-organized public agency is a leading factor to a successful PPP.

Most of the respondents agreed that appropriate risk allocation, strong private organization, project technical feasibility, good governance, and favorable legal framework were leading factors to a successful PPP. However, some of the respondents disagreed with social and political support being an important factor that leads to successful PPP projects.

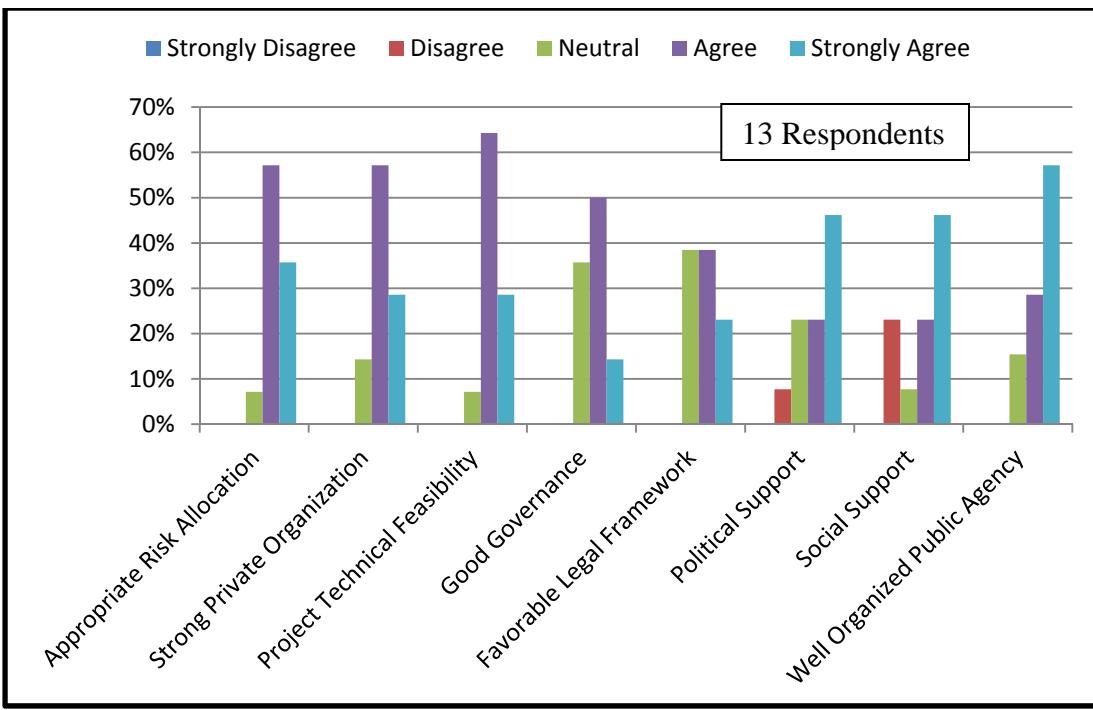


Figure 4.11 – Factors Leading to a Successful PPP

4.1.10 Demand Forecasts for Estimating Toll Revenues

The survey respondents were asked about any recommendations they had to improve the accuracy of travel demand forecasts for estimating toll revenues. The responses were equally distributed between improving methods for travel demand forecasting models and collecting better or more data. Also, about 40% of the respondents recommended providing better training for modeling and planning staff and conducting more risk assessment in forecasts.

Other ideas and recommendations from respondents included allowing PPP proposers to conduct their own traffic & revenue study and having the state baseline year traffic counts and revenue forecasts conducted during procurement.

Moreover, one of the respondents indicated the study should be provided only to shortlisted proposers and suggested that all revenue risks should be borne by the developer. Responses are illustrated in Figure 4.12.

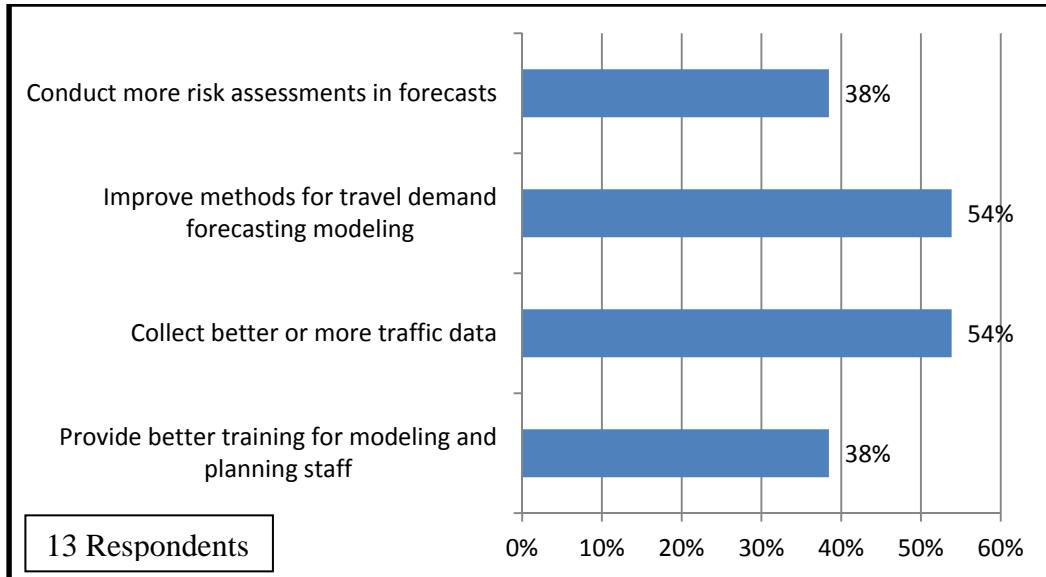


Figure 4.12 – Recommendations for Improving Toll Revenues Estimates

4.1.11 Shared Experience with PPP Projects

Finally, respondents were asked if they had any experience with PPP transportation projects that they would like to share. One of the respondents stated that due to the magnitude of the financial obligations required upfront at the time of the financial close, PPP projects could not attract competitive bidders. As a result, this will be even more challenging going forward due to the liquidity constraints in the financial sector.

4.2 Discussion of Results

After obtaining and analyzing the survey results, they were compared to the results of the case studies in order to obtain final results and a summarizing conclusion of the thesis. Mean score ranking technique was used to analyze the survey results.

4.2.1 Risks in Transportation Projects

4.2.1.1 Output of Survey Results

It is shown in Figure 4.13 that according to the respondents, the three most likely risks were the operational, technical, and financial risks. The most unlikely risk was cited as political risk associated with political changes.

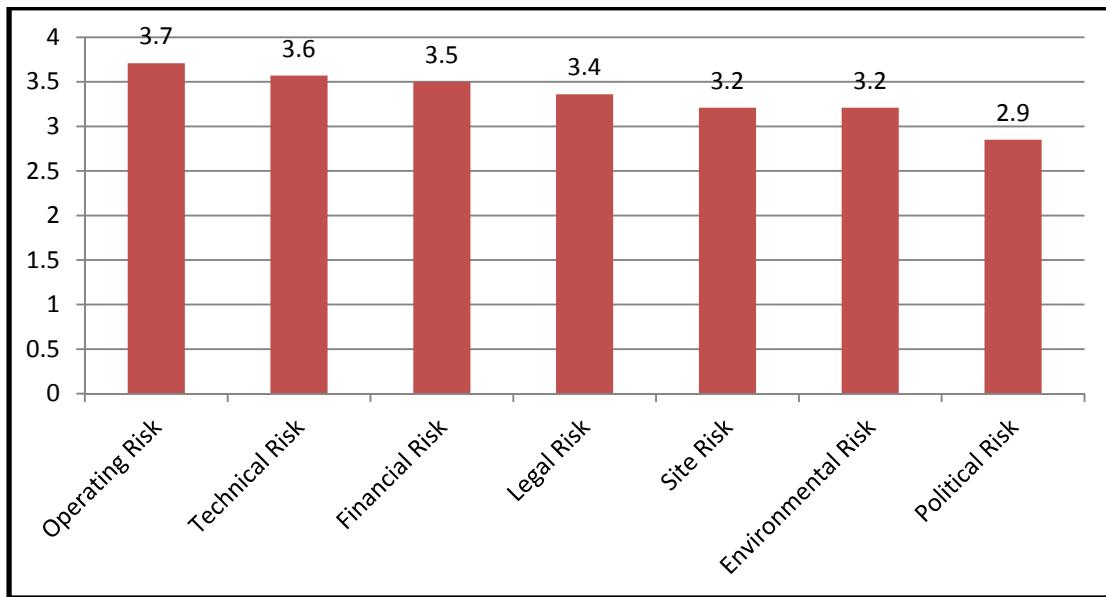


Figure 4.13 – Output of Risks in PPP Transportation Projects

4.2.1.2 Output of Case Studies

The financial risk which means not having enough cash flow to meet monetary obligations for the entire project was the main risk that faced by the private sector in both SH 130 segments 5&6 and ITR case studies. The inappropriate allocation and management of financial risk caused the private sector in both cases to think about debt restructuring or terminating the contract due to not meeting financial obligations.

As a result, the financial risk, which was not appropriately shared or managed in both case studies, was chosen by the survey respondents as one of the most likely risks to happen in transportation projects causing negative impact on all the parties.

4.2.2 Causes of PPP Failures

4.2.2.1 Output of Survey Results

As can be seen in Figure 4.14, respondents rated inaccurate travel demand forecasts as the most critical factor that caused PPP projects to fail or underperform. Moreover, they ranked the inappropriate allocation of risks and length of the contractual period as two of the most dangerous factors causing PPP projects to underachieve.

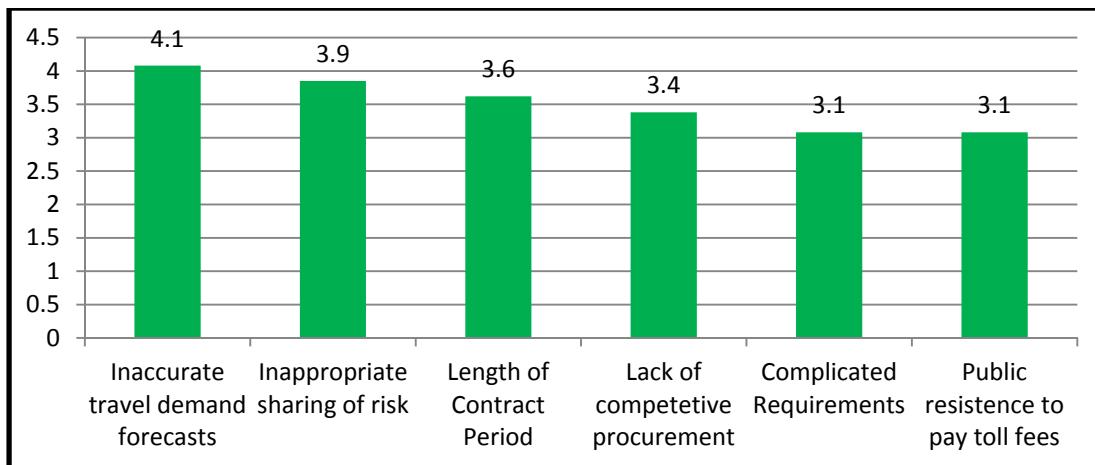


Figure 4.14 – Output of Causes for PPP Failures

4.2.2.2 Output of Case Studies

In both case studies discussed, overestimation of traffic and revenue was expected to be the main cause of underperformance, as the private sector errors in miscalculation of traffic demand or in preparing revenue studies will always lead to financial problems with debt services. Plus, the 75-year lease in ITR was expected to be the main cause of underperformance, because of the developmental challenges and economic ups and downs associated with this long lease period.

As a result, it is obvious that the survey response to this question was consistent with the results obtained from analyzing case studies. This shows the importance of accurately estimating demand and revenue before beginning a project.

4.2.3 Factors That Lead to a Successful PPP

4.2.3.1 Output of Survey Results

As shown in Figure 4.15, it is clear that most of the respondents believed that a well-organized public agency with specified objectives, rights and responsibilities is the most important factor that needs to be considered in order to achieve success in PPP projects. Also, appropriate risk allocation, project technical feasibility, and a strong private organization were chosen to be the most critical success factors in PPP projects.

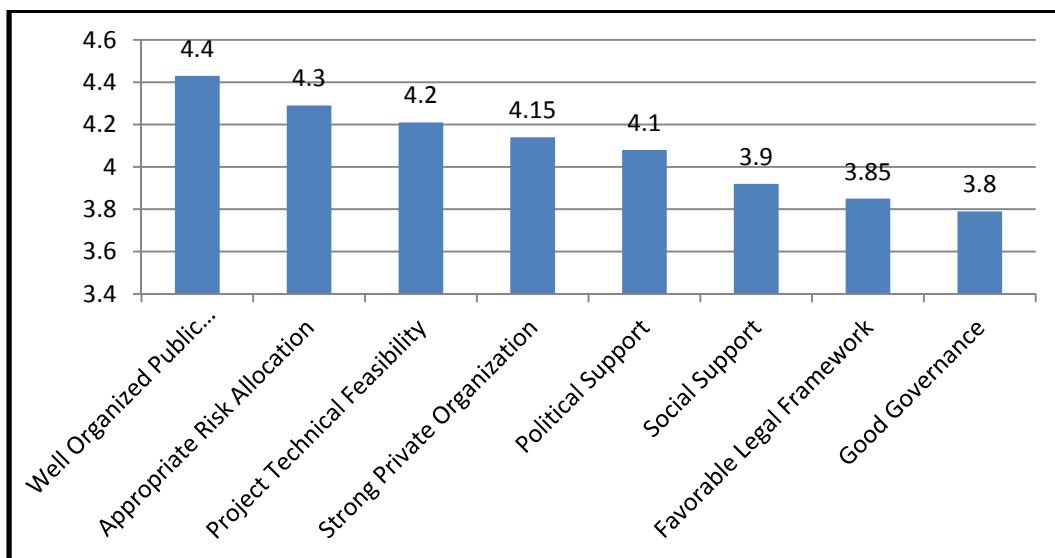


Figure 4.15 – Output of Factors that Lead to a Successful PPP

4.2.3.2 Output of Survey Results

In the Indiana Toll Road, the private sector was not financially stable enough to pay the huge upfront payment of \$3.8 billion. In addition, the financial risk was not accurately managed, which caused the concession to look for additional equity support to cover debts. Also, feasibility studies prepared in both case studies were not adequate.

As a result, the main survey factors cited as causing success in PPP projects were not appropriately implemented in both case studies, causing the private sector to deal with financial problems that caused the projects to underperform.

Moreover, similar to what should have been done to prevent underperformance in the case studies discussed, the survey respondents recommended improving the accuracy of travel demand forecasts for estimating toll revenues with solutions alternating between providing better training for modeling and planning staff, collecting more data, improving methods for travel demand forecasting models, and conducting more risk assessment in forecasts.

4.3 Chapter Summary

Results of the survey were analyzed, and compared with the two case studies. In the two case studies that were discussed, it was determined that if risk assessments are conducted in demand forecasts, more accurate and conservative traffic and revenue forecasts could be achieved thereby decreasing the level of underperformance in both projects.

Chapter 5

Conclusions and Recommendations for Future Research

Previous chapters provided a comprehensive literature research, two case studies analyses, a survey, and a comparison of results. This chapter presents several conclusions and observations derived from the study. The chapter closes with suggestions and recommendations for future research.

5.1 Conclusions

The following conclusions and observations were derived from this thesis.

- From the survey conducted, the public private partnership was considered much more effective than traditional procurement methods in delivering transportation projects. PPPs were adopted in transportation projects because the private sector tends to take the responsibility of financing needed transportation projects that otherwise would not be built. Reduced time on project delivery and Value for Money (VFM) were other important reasons given explaining why PPPs are adopted.
- PPP projects are believed to limit government's flexibility, as it would be very hard for the government to change their funding allocation to reflect new priorities after a contract is signed.
- Operating, technical, and financial risks had the highest probability of occurrence in PPP transportation projects. In ITR and SH 130, the financial risk, which wasn't managed properly, had the highest impact in causing underperformance. Revenues were not enough to meet project obligations.
- PPP is preferred when it provides mutual benefits for all parties, high scope of innovation, and when the revenue generated after high risk projects are sufficient to fund the cost of materials and overhead.

- The length of the contract period is considered one of the main factors that affect the success of PPP toll roads. It is concluded that contract periods over 75 years will lead to problems like roads life depreciation, causing underperformance in PPP toll roads.
- Inappropriate sharing of risk could lead to serious problems in PPP toll roads. Therefore, much emphasis is placed on having a solid legal framework at the beginning of the project. Allocating the risks to the party best able to deal with them is the main concept behind managing high risk projects.
- Although the public are considered an important part of PPP, it is concluded that public resistance to pay toll fees is not an important reason for PPP toll roads underperformance.
- The most critical success factors in PPP transportation projects are having a well-organized public agency, a project technical feasibility, a strong private organization, and political support.
- Inadequate or non-existent feasibility studies that include unrealistic traffic and revenue forecasts are the main causes of underperformance in PPP toll roads. Overestimation of revenues was related to the applications of forecasting models and methods.
- In order to improve the accuracy and reliability of travel demand forecasts for estimating toll revenues, more risk assessments in forecasts should be conducted. Moreover, it is necessary to provide better training for modeling and planning staff, collect more traffic data, and improve methods for travel demand forecasting models.

5.2 Recommendations for Future Research

The research literature cited in this thesis largely focused on the underperformance of PPP toll roads in terms of causes, prevention techniques, and how to achieve a successful PPP project. The following topics are recommended for future research.

- Although probable causes of underperformance were discussed in two of the U.S. PPP toll roads, more research can be conducted on successful PPP toll roads in order to compare between successful and underperforming projects in terms of accuracy of feasibility studies, length of contract period, and allocation of risks.
- Research should be conducted on improving the understanding of factors and assumptions used to develop travel demand forecasts.
- Further research is needed to enable understanding and improvement of the risk management process in PPP projects and how it impacts the project objectives.
- This research could be further expanded to improve the understanding of and methods used in estimating revenue for PPP toll roads. This could increase the reliability of feasibility and financial studies and increase the success rate of future projects.

Appendix A
Survey Questionnaire

See Supplemental File.

List of Abbreviations

The following table describes the significance of various abbreviations and acronyms used throughout the thesis.

Abbreviation	Meaning
PPP	Public-Private Partnership
FHWA	Federal Highway Administration
ROI	Return of Investment
SA	Sensitivity Analysis
BOT	Build-Operate-Transfer
ITR	Indiana Toll Road
SH 130	State Highway 130
ASCE	American Society of Civil Engineers
UTA	University of Texas at Arlington
DBB	Design-Bid-Build
CM@R	Construction Manager-at-Risk
DB	Design Build
DBW	Design -Build with a warranty
DBOM	Design-Build-Operate-Maintain
DBFO	Design-Build-Finance-Operate
BOT	Build-Operate-Transfer
BOO	Build-Own-Operate
JDA	Joint Development Agreement
PSC	Private Sector Concessionaire
CTTS	Central Texas Turnpike System
TxDOT	Texas Department of Transportation

References

- Agyemang, P. (2011). "Effectiveness of Public Private Partnership in Infrastructure Projects." M.S. Thesis, University of Texas, Arlington, TX.
- Bain, R. (2009). "Review of lessons from completed PPP projects financed by the EIB". European Investment Bank. <http://www.robbain.com/Review%20of%20Lessons%20from%20Completed%20PPP%20Projects%20Financed%20by%20the%20EIB.pdf>, accessed on January, 2014
- Batheja A. (2013). "Debt Issues Tied to SH 130 Could Impact Toll Projects". The Texas Tribune. <http://www.texastribune.org/2013/10/23/threat-toll-road-default-could-hurt-future-project/>, accessed on February, 2014.
- Bosso, D. (2008). "The Effectiveness of Contemporary Public-Private Partnerships for Large Scale Infrastructure Projects in the United States." M.S. in Civil Engineering Thesis, Virginia Polytechnic Institute and State University, Blacksburg, Virginia.
- Button, K. (2010). Transport Economics, Third Edition. Edward Elgar Publishing. Northampton, California.
- Cui Q. and Lindy J. K. (2010). Evaluation of Public Private Partnerships Proposals. University Transportation Center for Alabama, Department of Civil and Environmental Engineering, Huntsville Alabama.
- Dillenger M. (2011). "Is the Indiana Toll Road Operator in Danger of Default". Transportation Nation. WNYC. <http://www.wnyc.org/story/283746-is-the-indiana-toll-road-operator-in-danger-of-default/>, accessed on February, 2014.
- Engel E., Fischer R., and Galetovic A. (2011). " Public-Private Partnerships to Revamp U.S. Infrastructure." <http://www.ncppp.org/wp-content/uploads/2013/03/PS-Feb2011-HamiltonProject.pdf>, accessed on January, 2014.
- European Commission. (2003). "Regional Policy Guidelines for Successful Public Private Partnership." Brussels, http://ec.europa.eu/regional_policy/sources/docgener/guides/PPP_en.pdf, accessed on January, 2014.
- Feigenbaum, B. (2011). "Risks and Rewards of Public Private Partnerships for Highways". Reason Foundation. http://reason.org/files/public_private_partnerships_for_highways.pdf, accessed on February, 2014.
- FHWA. (2004). United States Department of Transportation - Federal Highway Administration, <http://international.fhwa.dot.gov/contractadmin/04.cfm>. "Report to Congress on Public-Private Partnership, accessed on February, 2014.
- FHWA. (2008). "An update on the Burgeoning Private Sector Role in U.S. Highway and Transit Infrastructure." http://www.fhwa.dot.gov/reports/pppwave/ppp_innovation_wave.pdf, accessed on January, 2014).

- FHWA. (2010). U.S Department of Transportation. Sensitivity Analysis.
<https://www.fhwa.dot.gov/policy/2010cpr/chap10.htm>, accessed on February, 2014.
- Guasch J. L. (2012). "PPP: International Experience and Lessons for Poland."
http://www.ppp.gov.pl/Konferencjeseminaria/Documents/ZS4_WB_POLAND.pdf,
accessed on February, 2014.
- Hall T. (2013). "First foreign-owned toll road in Texas downgraded to junk bond status".
<http://www.examiner.com/article/first-foreign-owned-toll-road-texas-downgraded-to-junk-bond-status>, accessed on February, 2014.
- Holeywell R. (2011). "The Indiana Toll Road: A Model for Privatization". "[www.governing.com](http://www.governing.com/templates/gov_print_article?id=130798598)"
http://www.governing.com/templates/gov_print_article?id=130798598, accessed on
February, 2014.
- ICE. (2008). "Financing and anti-corruption". Institution of Civil Engineers.
<http://www.ice.org.uk/topics/International-development/civil-engineers-toolkit-for-development/Policy/financing-and-anti-corruption>, accessed on February, 2014.
- Ke Y, Wang S, and Chan A. (2010). "Risk Allocation in PPP Infrastructure Projects: Comparative Study". Journal of Infrastructure System at ASCE. <http://www.keyongjian.com/wordpress/wp-content/uploads/2013/10/2010-5.pdf>, accessed on March, 2014.
- Kulakrni, N. (2009). "A survey of payment mechanisms for public-private partnership transportation projects: Comparisons of the US, India, and Mexico. <http://webdocs.stern.nyu.edu/glucksman/docs/Kulkarni2009.pdf>, accessed on February, 2014.
- Legislative's Analysts' Office (LAO). (2012)."Maximizing state benefits from Public-Private Partnerships". http://www.lao.ca.gov/reports/2012/trns/partnerships/P3_110712.aspx,
accessed on January, 2014.
- Lewis, M. K. (2001). "Risk Management in Public-Private-Partnership." <http://www.uni-geottingen.de/en/60920.html>, accessed on January, 2014.
- Lindenberger M. (2011). "Report: Cintra team near default on Indiana Toll Road". Dallas News.
<http://transportationblog.dallasnews.com/2011/06/report-cintra-team-near-default.html>,
accessed on February, 2014.
- Maheshwari V. K. (2011). " The case study - Research method in education".
<http://www.vkmaheshwari.com/WP/?p=187>, accessed on March, 2014.
- Moody's Investors Service. (2013). "Moody's downgrades SH 130 Concession Company to Caaa3 from B1; Outlook negative. https://www.moodys.com/research/Moodys-downgrades-SH-130-Concession-Company-to-Caa3-from-B1--PR_284463, accessed on February, 2014.
- National Cooperative Highway Research Program (NCRHP). (2006). "Estimating Toll Road Demand and Revenue". Transportation Research Board of the National Academies.
http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_364.pdf, accessed on March, 2014.

- Oyedele, L. (2013). " Avoiding Performance Failure Payment Deductions in PFI/PPP". Model of Critical Success Factors, American Society of Civil Engineers.
- Pagano A. M. (2009) "Public-Private Partnerships (PPP) in Transportation: An Analysis of Alternatives" The Transportation Research Forum. http://www.trforum.org/forum/downloads/20_09_51_AnalysisofAlternatives_paper.pdf, accessed on January, 2014.
- PPP Canada. (2007). " Improving the delivery of public infrastructure through public private partnerships". P3 Business Case Development Guide. http://www.p3canada.ca/_files/P3%20Business%20Case%20Development%20Guide.pdf, accessed on January, 2014.
- Reijniers J. (1994). "Organization of public-private partnership projects." International Journal of Project Management, 19(5). 137-142
- Samuel, P. (2013). "Weak Economic Fundamentals, over optimism, on T&R main cause of P3s failure – Fitch Rating report." Toll Roads News. <http://tollroadsnews.com/news/weak-economic-fundamentals-over-optimism-on-tr-main-cause-of-p3s-failure---fitch-rating-report>, accessed on February, 2014.
- Sanger, T, and Crawley C. (2009). "Economic Crisis exposes the high costs and risks of P3s." Canadian Center for Policy Alternatives. <http://www.policyalternatives.ca/publications/monitor/problem-public-private-partnerships>, accessed on January, 2014.
- Spiering M and Dewulf G. (2006). "Strategic Issues in Public-Private Partnership". Blackwell Publishing. <http://upcen.edu.pe/ebooks/Derecho/Comercial/Asociaciones%20P%C3%BAblico%20Privadas/Biblioteca%20especializada/Strategic%20Issues%20in%20Public-Private%20Partnerships.%20Mirjam%20Bult Spiering%20and%20 Geert%20Dewulf.PDF>, accessed on January, 2014.
- Standard &Poor's (2005). "A Global Survey of PPPs: New Legislation Sets Context for Growth". Public Private Partnerships Global Credit Survey 2005. http://www.foroinfra.com/nuevos_pdf/SP.pdf, accessed on January, 2014.
- The National Council for Public Private Partnership (NCPPP). (2012) http://www.ncppp.org/wp-content/uploads/2013/03/WhitePaper2012_FinalWeb.pdf, accessed on February, 2014.
- Tiong, R.L.K. (1996) CSFs in Competitive Tendering and Negotiation Model for BOT Projects. ASCE Journal of Construction Engineering and Management, USA. 122 (3). 205-211.
- United States Government Accountability Office (GAO). (2008). Highway Public-Private Partnerships. Report to Congressional Requesters. <http://www.gao.gov/new.items/d0844.pdf>, accessed on January, 2014
- World Bank. (2011). "Sources of Financing". PPP in Infrastructure Resource Center. <http://ppp.worldbank.org/public-private-partnership/financing/sources>, accessed on February, 2014.
- Zhang, X. (2005). "Criteria for selecting the Private-Sector Partner in Public-Private Partnerships." Journal of Construction Engineering and Management, 4(11) 631-644

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