

American University in Cairo

AUC Knowledge Fountain

Theses and Dissertations

Student Research

6-2017

An integrated framework approach for PPP projects in Egypt

Nada Sherin Mohy El Din

Follow this and additional works at: <https://fount.aucegypt.edu/etds>

Recommended Citation

APA Citation

Mohy El Din, N. S. (2017). *An integrated framework approach for PPP projects in Egypt* [Master's Thesis, the American University in Cairo]. AUC Knowledge Fountain.

<https://fount.aucegypt.edu/etds/1402>

MLA Citation

Mohy El Din, Nada Sherin. *An integrated framework approach for PPP projects in Egypt*. 2017. American University in Cairo, Master's Thesis. *AUC Knowledge Fountain*.

<https://fount.aucegypt.edu/etds/1402>

This Master's Thesis is brought to you for free and open access by the Student Research at AUC Knowledge Fountain. It has been accepted for inclusion in Theses and Dissertations by an authorized administrator of AUC Knowledge Fountain. For more information, please contact thesisadmin@aucegypt.edu.



The American University in Cairo
School of Sciences and Engineering

AN INTEGRATED FRAMEWORK APPROACH FOR PPP PROJECTS IN EGYPT

A Thesis Submitted to
The Department of Construction Engineering

in partial fulfillment of the requirements for the degree of
Master of Science in Construction Engineering

By

Nada Sherin Mohy El Din

B.Sc. in Construction Engineering

Under the supervision of

Dr. Amr Hassanein

Professor, Department of Construction Engineering

The American University in Cairo

And co-supervision of

Eng. Atter Hannoura

Director of the PPP Central Unit in Egypt

May 2017

DEDICATION

I would love to dedicate this thesis to the loving memory of my mother, for her love, endless support and encouragement. She had always stood by me and pushed me forward in my life. I would also like to dedicate this thesis to my father whose endless support is one of the main reasons I have completed my thesis. I can never thank them enough for standing by me every step of the way and owe them any accomplishment I achieve in life.

ACKNOWLEDGEMENTS

I am grateful to Prof. Dr. Amr Hassanein for his patience and guidance. He has been very generous with his knowledge, and his trust in my abilities has made my journey more rewarding. I would like to thank him for giving me the chance to do this research and for his continuous support and valuable feedback. It has been a pleasure working under his supervision.

I would like to thank Eng. Atter Hannoura - Director of the PPP Central Unit in Egypt for his willingness to give me his valuable time to discuss various aspects in my research and for all the information he provided me with to be able to complete my thesis.

I would also like to thank the experts who were involved in the validation survey for this research project: Malak Draz from the International Finance Corporation and Eng. Khaled El Degwy from Orascom Construction. Without their passionate participation and input, the validation survey could not have been successfully conducted.

Finally, I must express my gratitude to my parents, my sister, and my friends for providing me with unfailing support and continuous encouragement throughout my academic career. This accomplishment would not have been possible without them. Thank you

ABSTRACT

Public-Private Partnership (PPP) projects have been growing over the last decade in Egypt, with an increasing popularity and interest in the participation of different entities in similar projects. Since the government is not considered the only provider for public infrastructure systems, the private sector is now contributing to providing such services. However, not all PPP projects have been equally successful or have been utilized in the best way through planning and decision. PPP projects require full consideration of all the factors, adequate structuring and the correct adoption of such factors. Failure in the consideration of all factors that complete the life cycle of PPPs may lead to the failure of the project. An integrated approach within a framework is required in order for the PPP projects to succeed. Limited research has presented an integrated framework approach for the adoption of PPPs. The framework for PPP projects should be conducted both simultaneously and iteratively for the project to succeed.

The objective of this study is to assist the government in the front end process of a PPP project, while contributing to the general understanding and filling some gaps in the research and study of such projects. This can be achieved by depicting an integrated framework approach for government adoption of PPP projects through three steps; the technical structure of the project, developing a financial model and finally, designing the procurement strategy of the PPP project. These three steps are the pillars that indicate the success or failure of a PPP project.

These three pillars are then subdivided into a series of steps that form the integrated framework approach. Each pillar has a methodology that is followed by an application on a case study, and a validation exercise. The first pillar is the first step in the initial assessment of a PPP project. The technical structuring of the project includes structuring of the contractual terms and managing of risks. It is concluded that the termination term is one of the most important clauses in a PPP contract. In addition, financing risk is a risk that affects the affordability and the bankability of a PPP project, and it is allocated to the government. The second step in the initial assessment of a PPP project is the development of the public sector comparator.

The second pillar is the financial modeling of a PPP project. A financial model template is developed, applied, and validated on a case study. The results reveal that the template is running properly and all financial formulas and equations are correct. Following the financial model development, a value for money assessment process is conducted on a case study both quantitatively and qualitatively. The risk-adjusted net present costs are calculated at different discount rates (10%, 11%, 12%, 13%, and 14%) for the public sector comparator and PPP option.

The final pillar is a qualitative assessment of the procurement activities of PPP projects. According to law 67 that regulates PPP activities, the results show that single bid may be accepted if other qualified bidders have failed technically and it appears that the bid was made in the bidder's belief under competition. Due to the complexity and long concession periods of PPP projects, technical offers shall have higher weight than financial offers. According to common practice, technical offers usually weigh 70% while financial offers weigh 30%. The concept of structuring a procurement process is further examined and validated by a case study.

KEYWORDS: (PPP projects, Egypt, integrated framework, financial model, public sector comparator, value for money, technical structure, procurement process)

TABLE OF CONTENTS

LIST OF FIGURES	ix
LIST OF TABLES	x
Chapter 1 : INTRODUCTION.....	11
1.1 Background.....	11
1.2 History of PPPs.....	13
1.3 The Idea behind PPP in Egypt.....	13
1.4 Problem Statement	14
1.5 Research Objective	15
1.6 Scope of Work	15
Chapter 2 : LITERATURE REVIEW.....	17
2.1 What is PPP	17
2.1.1 PPP Definition	18
2.1.2 Different Models of PPP	19
2.1.3 Advantages and Disadvantages of PPP	21
2.1.4 Why Should Governments Consider PPP?	22
2.1.4.1 Successful Sectors of PPP.....	23
2.1.5 PPP Success Factors	24
2.2 PPP in Egypt.....	25
2.2.1 PPP Central Unit.....	25
2.2.2 The Start of a PPP Project Starting from the Line Ministry until the Tendering Process	26
2.2.3 PPP Project Life Cycle.....	28
2.2.3.1 Phase 1: Project Initiation & Screening.....	28
2.2.3.2 Phase 2: Business Case	28
2.2.3.3 Phase 3: Risk Assessment, VFM Analysis and PSC	28
2.2.3.4 Phase 4: Tendering and Procurement	29
2.2.3.5 Phase 5: Bidders Selection.....	29
2.2.3.6 Phase 6: Contract Signature and Financial Closure.....	29
2.2.3.7 Phase 7: Post Award PPP Performance Monitoring & Contract Compliance.....	29
2.3 The Criteria of a Project to undergo a PPP Participation	29

2.3.1 Project Affordability	29
2.3.2 Risk Analysis	30
2.3.3 Bankability of the Project	36
2.3.4 Value for Money (VFM).....	37
2.3.4.1 VFM Tests	38
2.3.4.2 VFM Evaluation Criteria	39
2.4 PPP Project Viability “Private Sector Point of View”	40
2.5 Financial Models of PPP projects.....	41
2.5.1 Financial Model Usages.....	41
2.5.2 Data Collection	42
2.5.4 Design of the Model.....	43
2.5.4.1 Design Approaches	44
2.5.4.2 Model Inputs and Outputs.....	44
2.5.4.3 Sensitivities.....	45
2.5.5 Stakeholders’ Preference on Financial Indicators.....	45
2.6 Public Sector Comparator (PSC)	46
2.6.1 Purpose of PSC	47
2.6.2 Components of PSC.....	47
2.6.3 PSC and the Procurement Process	48
2.6.4 PSC and Bid Evaluation.....	49
2.7 Hypotheses.....	49
Chapter 3 : RESEARCH METHODOLOGY.....	51
3.1 Introduction.....	51
3.2 Technical Structuring of a PPP Project.....	55
3.2.1 Quantification of Risk.....	55
3.3 Public Sector Comparator (PSC) Model.....	57
3.3.1 Raw PSC	57
3.3.2 Retained and Transferable Risks	59
3.3.2.1 Calculating Transferable Risk.....	59
3.3.2.2 Calculating Retained Risk.....	60
3.3.3 Discount Rate.....	60

3.4 Financial Model	61
3.4.1 Model Design.....	61
3.4.2 Model Calculations	65
3.4.3 Model Sensitivities.....	69
3.4.4 Shadow Bid Model	69
3.5 Value for Money (VFM) Assessment.....	69
3.6 Structuring of the Procurement Process.....	71
3.6.1 Bidding Steps	71
3.6.2 Weighing Criteria.....	72
Chapter 4 : APPLICATION.....	73
4.1 Technical Structuring of the Project	73
4.1.1 Managing Risks	74
4.1.2 Structuring of the Contractual Terms.....	74
4.1.3 Case Study (1) – PPP Schools Project	75
4.1.4 Case Study (2) – Nile River Bus Ferry in Cairo	76
4.2 Financial Model Validation	77
4.2.1 Model Application on the Salam to 10th of Ramadan LRT Project.....	77
4.2.1.1 Model Calculations	81
4.2.1.2 Model Outputs	86
4.2.1.3 Sensitivity Analysis	89
4.2.2 Case Studies Comparison.....	91
4.3 Value for Money Analysis	93
4.3.1 Public Sector Comparator (PSC) for WWTP Project	93
4.3.1.1 Raw PSC	93
4.3.1.2 Financing Costs.....	94
4.3.1.3 Risk Analysis	94
4.3.1.4 Discounted PSC	100
4.3.2 Shadow Bid Model for WWTP Project	101
4.3.2.1 Assumptions.....	102
4.3.2.2 Costs.....	102
4.3.2.3 Adjustments	104

4.3.2.4 Risk Analysis	104
4.3.2.5 Discounted Shadow Bid Model (PPP Price).....	104
4.3.3 Value for Money (VFM) Assessment.....	105
4.3.3.1 Quantitative Assessment.....	105
4.3.3.2 Qualitative Assessment.....	107
4.4 Structuring of the Procurement Process.....	108
4.4.1 Case Study – New Cairo Wastewater Treatment Plant	108
Chapter 5 : CONCLUSIONS.....	110
5.1 Conclusions.....	110
References.....	113

LIST OF FIGURES

Figure 2.1: Existing Services and Facilities (Laing, et al. 2011).....	17
Figure 2.2: Project Procurement Options (Kong, 2007).....	20
Figure 2.3: The Scale of PPPs (United Nations Economic Commission, 2008)	21
Figure 2.4: PPPCU Role (PPP Central Unit, 2009).....	26
Figure 2.5: The start of a PPP project – Step 1 (PPP Central Unit, 2009).....	27
Figure 2.6: Approval of PPP project - Step 2 (PPP Central Unit, 2009)	27
Figure 2.7: The Overall PPP Project Lifecycle (PPP Central Unit, 2009)	28
Figure 2.8: Illustration of Risk Management Process (Chinyio and Fergusson, 2008).....	31
Figure 2.9: Risk Allocation vs project efficiency and total cost (Zou, et al. 2008).....	33
Figure 2.10: Risk Analysis Process (Zou, et al. 2008).....	35
Figure 2.11: Architecture of a financial model (Khan and Parra, 2003)	43
Figure 2.12: Bid Evaluation (Melbourne Partnerships Victoria, 2001).....	49
Figure 3.1: Research Methodology Flowchart.....	52
Figure 3.2: The integrated framework approach flowchart	53
Figure 3.3: Application and Validation Exercises	54
Figure 3.4: PSC Methodology	57
Figure 3.5: Raw PSC Components	58
Figure 3.6: Model Design	65
Figure 3.7: Net Profit Calculation.....	67
Figure 3.8: Balance Sheet Calculations	67
Figure 3.9: Cash Flow Activities	68
Figure 3.10: VFM Quantitative Assessment.....	70
Figure 3.11: Procurement Options (Burger and Hawkesworth, 2011)	70
Figure 4.1: OPEX Calculations.....	85
Figure 4.2: Sensitivity Chart	90
Figure 4.3: FX Rate Sensitivity Chart.....	91
Figure 4.5: PSC Components.....	101
Figure 4.6: Value for Money Analysis	106

LIST OF TABLES

Table 2-1 Comparison of the top rank preferred input assumptions (Kurniawan et al. 2015).	46
Table 3-1: Macroeconomic Assumptions	62
Table 3-2: Funding Assumptions.....	62
Table 3-3: Working Capital Assumptions	63
Table 3-4: Law 89 Procurement vs. Law 67/2010 PPP Procurement.....	72
Table 4-1: Macroeconomic Assumptions	78
Table 4-2: Direct Operating Costs Assumptions	79
Table 4-3: Revenue Assumptions	80
Table 4-4: Funding Assumptions.....	80
Table 4-5: Working Capital Assumptions	81
Table 4-6: Revenue Calculations	82
Table 4-7: Model Outputs.....	88
Table 4-8: Change in Variables	89
Table 4-9: Sensitivity Results	89
Table 4-10: FX Rate Sensitivity	90
Table 4-11: Financial Models Comparison.....	91
Table 4-12: Major Maintenance Percentages	93
Table 4-13: Inflation Rates	94
Table 4-14: Risk Analysis.....	96
Table 4-15: Risk Adjusted PSC	100
Table 4-16: CAPEX Assumptions	102
Table 4-17: PPP Price (Risk Adjusted).....	104
Table 4-18: Cost to Government under Public Procurement - PSC	105
Table 4-19: Cost to Government under PPP Procurement - Shadow Bid Model (PPP Price) ...	106
Table 4-20: Value for Money to Government - VFM (EGP mln).....	106

CHAPTER 1 : INTRODUCTION

1.1 Background

Recently the concept of the private financing of infrastructure projects has evolved worldwide. The government nowadays is not considered the only provider for the public works or services in the society. The concept of the Public-Private Partnership (PPP) has been recently recognized as an important contribution for governments in providing infrastructure systems. These schemes are sometimes referred to as PPP, P3 or P³.

This type of participation offers better quality for the infrastructure projects due to the efficient management and skills of the private sector, distributing cost over time to the government, in addition to fair profit of the private sector during the concession period. The private sector's expertise, innovation and skills optimize the cost of the project thus provide value for money to the government. Throughout the concession period, the government retains control over the delivery of the specified level of service. Thus, the role of the government in this case becomes only coordination along with the private sector. As a result, managerial and financial efficiencies are brought into the process (Chan and Cheung, 2014). Various terminologies are used to describe such private participation, such as Private Finance Initiative (PFI) and Concession models (i.e. Build-Operate-Transfer (BOT)); however PPP is a more generic term for such long term public private cooperation.

In the Build–Operate–Transfer (BOT) participation, the private sponsor finances, designs, and builds the project and then operates it for a specified concession period. During this concession period, the sponsor collects revenues from operating the project to recover its investment and earn a profit. At the end of the concession period, the ownership of the project is transferred to the granting authority. However, Private-Finance-Initiative (PFI) is slightly different from BOT in the sense that the private sponsor collects revenues through periodic payments by the government over the life of the project. The private sponsor of these kinds of projects usually consists of a consortium or a joint venture of engineering, construction, and venture capital firms, where the investment capital may come from commercial banks, insurance companies or the sale of bonds (Yun, et al. 2009).

The most important reason for adopting PPP participations is the government need. In many countries, PPP scheme was originally initiated due to financial shortages to deliver public

infrastructure and services. In addition to the government need, private sector's efficiency and expertise is considered another reason for adopting PPP projects (Chan and Cheung, 2014). Many researchers and practitioners described the advantages of PPP projects as opposed to normal procurement methods that lead to the importance of such participations. Some of these advantages are the transfer of risk, better value for money, more appropriate financial analysis, and enhanced partnership between the public sector and the private sector (Tang, et al. 2010).

On the other hand, PPP projects are considered somehow complicated due to the long concession period, inaccurate forecasting of investments and market demands, uncertain operation ability of the facility and the different stakeholders involved in the process. All these factors create a lot of risks that should be considered while dealing with these projects (Yun, et al. 2009). In addition, there are also political risks involved in the PPP participation that results from the communication with the government. Therefore, proper risk allocation in PPP projects is considered very essential so that each party can develop a strategy to manage these kinds of risks to ensure project success.

In addition to risks, financial evaluation of PPP projects is considered another key factor for the success of such projects. Therefore, for the success of privately funded infrastructure, a high level of financing skill is required in order to produce a convincing plan that satisfies the stakeholders involved. Many researchers have attempted to reach an optimal capital structure for PPP projects in order to decrease the financial risks as much as possible. However, the financial evaluation of such projects is considered complex and challenging due to the variety of risks and uncertainties involved; which makes the forecasting of cash flows quite difficult. In PPP projects, the concessionaire (private sector) undertakes many more risks than any contractor in any other type of project. PPP projects are generally financed through varying proportions of debt and equity. Generally operators (private sector) will try to reduce the amount of equity and increase the amount of debt finance in order to minimize the level of risk exposure. On the other hand, creditors or lenders will try to raise the amount of equity finance to a secure and decent level of financial responsibility from the operators. Equity financing typically covers only 10–30% of total project costs, while debt financing is obtained for the remaining 70–90%. The debt/equity (D/E) ratios of different projects vary depending on the nature of the project. The common strategy is to utilize as much debt but only as much as the project cash flows can justify

to provide an attractive rate of return to the equity investors. Thus, an appropriate balance between equity and debt is needed (Schaufelberger and Wipadapisut, 2003).

In addition to the risk allocation and financial evaluation of PPP projects, there are other factors that contribute to the success of such participations. These factors were not tackled by many researchers, yet they are considered crucial to the whole PPP process. This study will focus on these missing parts in literature in order to ensure PPP project success.

1.2 History of PPPs

The concept of PPP started in the 18th century as the private sector began to invest in the public infrastructure in the European countries such as supplying drinking water to Paris. Later in the 19th century, there were similar cases such as the Suez Canal in Egypt and the Trans-Siberian Railway, in addition to canals, turnpikes, and railroads in Europe. However, the approach of the PPP was widely implemented in the late 90's (Tang, et al. 2010). In 1997, the concept of PPP was heavily utilized in England; the private companies have been involved in the development of facilities including designing, financing, construction, ownership, and/or operation of a public sector utility or service. However in China, international financial institutions and foreign firms rather than domestic firms have been involved in the PPP projects. The most successful PPP project in China was the Laibin B power station in Guangxi in 1997 (Tang, et al. 2010). At the early 2000s, there has been a significant increase in the use of PPPs by countries such as Australia, France, Germany, Korea and the United Kingdom. In the last decade, PPPs in the UK constituted approximately 12% of total annual capital expenditure (Burger and Hawkesworth, 2011). Although governments increasingly use PPPs, these arrangements still have relatively small component of total public sector investment.

1.3 The Idea behind PPP in Egypt

Governments in both developed and developing countries are turning to private investments as an alternative source of funding to cover the funding shortages. In Egypt, the private sector involvement in infrastructure projects provides a new source of investment capital in addition to the high quality of service to Egyptian citizens. PPPs create a new private sector facility management market, expand the economy, drive the creation of local long term funding markets, and stimulate job creation (PPP Central Unit, 2009).

The idea behind the PPP participation schemes in Egypt has been introduced since 2004 in order to sustain Egypt's growth in the field of infrastructure projects. The private sector's investment is required, as discussed earlier, to cover the government needs. International experience shows that 10-30% of infrastructure capital needs could come from the private sector through PPPs if an appropriate and regulatory framework is established. It is estimated that Egypt can target 10-15% of its infrastructure needs through PPPs (PPP Central Unit, 2009). Accordingly later in 2006, the government of Egypt has established the PPP Central Unit within the Ministry of Finance. The role of the PPP Central Unit is to offer support and expertise, identify pilot projects together with the line ministry involved, set national guidelines for implementation, standardize PPP contracts, provide technical/advisory support to the responsible line ministry and monitor the implementation of PPP projects (PPP Central Unit, 2009).

1.4 Problem Statement

PPP projects have been envisaged as an attraction for investments from both local and international firms. However, not all PPP projects have been equally successful or have been utilized in the best way through planning and decision. While PPP projects have been widely researched on many aspects, not all viewpoints have been tackled. While the interest in the PPP projects has been growing, the projects require full consideration of all the factors, adequate structuring and the correct adoption of such factors. The failure to consider all factors that complete the life cycle of PPPs may lead to the failure of the project.

Many researchers have been directing their focus in the study of PPP projects to the scope of the financial model and risk allocation, leaving behind vital factors that contribute to the success of such projects. While the financial model is essential in the PPP projects for both the private and public sectors, it is just a tool used among other factors to contribute to the successful implementation of the project. Therefore to ensure the success of a PPP project, all factors have to be considered, analyzed, and integrated within a framework that demonstrates all theories and concepts relating to PPP projects. Limited research has presented an integrated framework approach for the adoption of PPPs. The framework for PPP projects should be conducted both simultaneously and iteratively for the project to succeed. This integrated framework approach is depicted through three steps: the technical structure of the project, developing a financial model

and finally, designing the procurement strategy of the PPP project. These three steps are the pillars that indicate the success or failure of any PPP project.

1.5 Research Objective

The objective of this research is to assist the government in the front end process of a PPP project, while contributing to the general understanding and filling some gaps in the research and study of such projects. This can be achieved by depicting an integrated framework approach for government adoption of PPP projects through three main pillars; the technical structure of the project, financial modeling and finally, structuring the procurement process of the PPP project. These pillars will be further subdivided into detailed steps that form the integrated framework.

1.6 Scope of Work

To achieve the above objective, each of the pillars referred to in the section above will be delineated through the following steps:

1. The first pillar: the technical structuring of the PPP project
 - a. Identifying, assessing, and allocating risks between the public and the private sectors.
 - b. Structuring of the contractual terms that make the project bankable and attractive to the private sector and lenders.
 - c. Developing the Public Sector Comparator to determine the go or no go of the project.
 - d. The technical structuring of a PPP project shall be applied on case studies for validation.

2. The second pillar: the financial modeling
 - a. Developing a financial model template that shall be applied and validated on a case study to ensure that the template is running properly.
 - b. Adopting a value for money (VFM) assessment process on a case study both quantitatively and qualitatively, as VFM is the essential element of the government decision making on PPPs.

3. The third pillar: structuring the procurement process
 - a. Designing the procurement process based on each project specifications and risk allocation that will serve the purpose of evaluating and selecting bidders.
 - b. Describing the weighing criteria for technical and financial offers of PPP project proposals according to the PPP Central Unit in Egypt and the procurement law 89.
 - c. The concept of structuring a customized procurement process shall be validated by a case study.

CHAPTER 2 : LITERATURE REVIEW

This section of the study seeks to explore and summarize some of the most common themes and research findings in relation to PPP projects. Given the topic's increasing popularity and interest of different entities and governments in the participation of such projects, this review is not limited to scholarly and academic literature. The review has instead been primarily directed at input from some of the world's leading institutional authorities, think tanks and policy-makers. The literature review reveals a number of key findings, which serve as the basis of this work.

2.1 What is PPP

It is the Public Private Partnerships that aim to finance, design, construct and operate public sector facilities and services. There are many forms of a partnership between public and private sectors depending on the political environment, the nature of the assets and the level of the private sector participation (Laing, et al. 2011). Figure 2.1 shows the existing services and facilities for both the public and the private sectors.

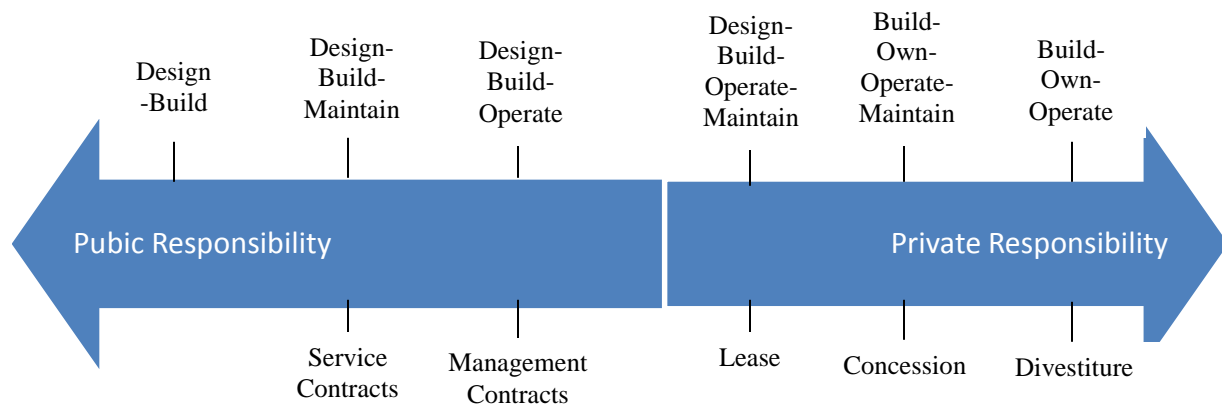


Figure 2.1: Existing Services and Facilities (Laing, et al. 2011)

2.1.1 PPP Definition

PPP is not a defined procurement model with a common understanding across the world; therefore there are several definitions for such participation. PPP Resource and Research Center in Kuala Lumpur (Kong, 2007) has provided some definitions for such scheme; some of these definitions are:

- “PPPs are aimed at increasing the efficiency of infrastructure projects by long term collaboration between the public and the private sector”
- “The term PPP refers to forms of cooperation between public authorities and private sector to ensure the funding, construction, renovation, management and maintenance of an infrastructure”
- “ The long term relationship between the public and private sectors, involving the sharing of risks and rewards of multi sectors skills, expertise, and finance to deliver desired policy outcomes”
- “PPP is a generic term for the relationships formed between the private sector and public bodies with the aim of introducing private sector resources and/or expertise in order to help provide and deliver public sector assets and services. The term PPP is used to describe a wide variety of arrangements from loose, informal and strategic partnerships to design build finance and operate (DBFO) type service contracts and formal joint venture companies”
- “A PPP is a partnership between the public and the private sector to deliver a project or service traditionally provided by the public sector. It recognizes that both sides have advantages and by allowing each to do what it does best, public services and infrastructure can be provided in the most efficient manner”.

However, the PPP Central Unit in Egypt located in the ministry of finance and responsible for regulating all PPP projects (PPP Central Unit, 2009) has defined the PPP projects as “the long term contractual relationship between the public sector and the private sector for the purpose of having the private sector deliver a project or service traditionally provided by the public sector. PPP projects do not minimize the public sector’s responsibility to improve public services, only the methodology for its provision and procurement is different.” The fundamental policy of PPPs in Egypt is further explained by the PPP Central Unit to be the use of

performance based contracts in which the private sector provides services over a contract duration and is paid by the public sector, end user or a hybrid of both. Output requirements are specified by line ministries, while inputs are generally the responsibility of the private sector partner through providing innovative methods, technology, expertise, and funds to achieve the output requirements. During the PPP contract, the government retains strategic control on the service, and allocates project and performance risks to the party best able to handle these risks. Some of the key risks that are usually transferred to the private sector are design, finance, construction, and operation risks (PPP Central Unit, 2009).

2.1.2 Different Models of PPP

There are many types of PPP participations that are described in the literature; however there are some common key features between all the different models of PPP. Some of these features are:

- All participations are long term
- The allocation of risk to the party best able to manage this risk
- Different forms of long term contracts drawn up between multiple entities and public authorities

The United Nations classified PPP participations into two broad categories: the Concession Model and the Private Finance Initiative Model (PFI). Concession models have the longest history of public private financing and are most associated with PPPs. They are contractual arrangements whereby a facility is given by the public sector to the private sector which then operates the PPP for a certain period of time. Concession models are financed by user fees (user pays) such as in drinking water, gas and electricity, and public transport projects. The Private Finance Initiative model (PFI) was developed in the UK in 1992, and has now been adopted by parts of Canada, France, Netherlands, Japan, Australia, the United States, and Singapore. In contrast to the concession model, PFIs are privately financed contracts for public facilities and works but are paid by a public authority and not by private users (public sector pays) such as in public lighting, hospitals, schools, and roads with shallow toll projects (United Nations Economic Commission, 2008).

The PPP Resource and Research Center in Kuala Lumpur (Kong, 2007) explained four main types of procurement alternatives depending on the involvement of both public and private

parties. Figure 2.2 shows the four project procurement options for both public and private sectors.

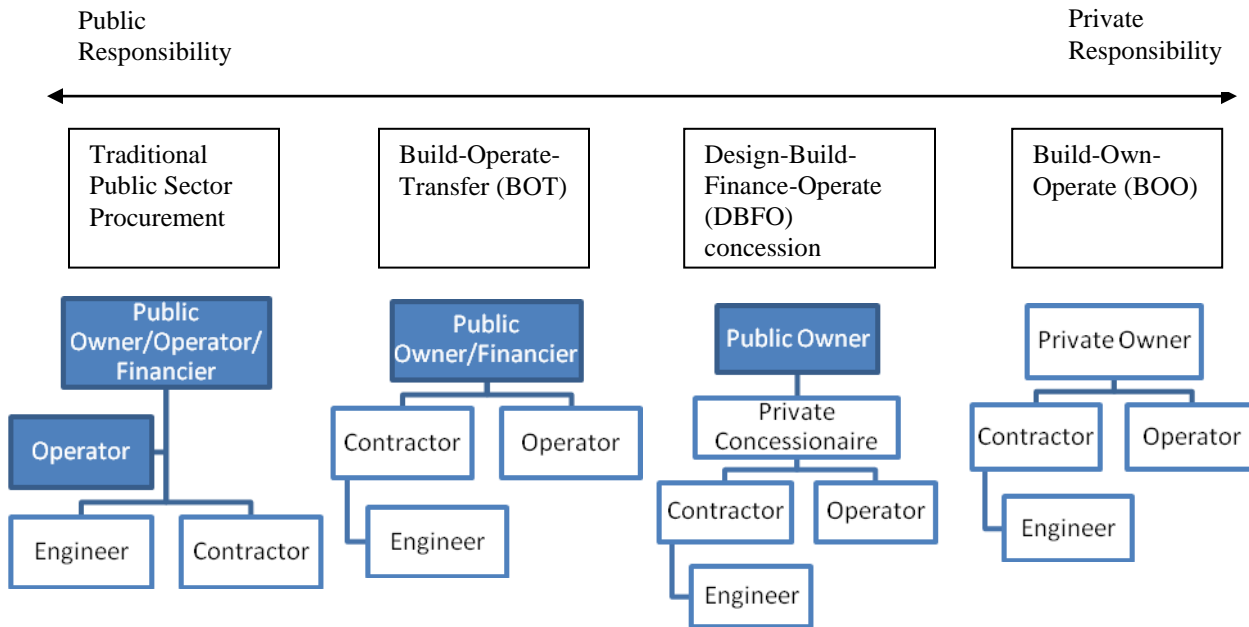


Figure 2.2: Project Procurement Options (Kong, 2007)

As the public responsibility increases, the Traditional Public Sector Procurement takes place where the government is the owner, operator, and financier in that case. On the other hand, as the private sector involvement and responsibility increases, PPP procurement methods start to take place until it reaches the Build Own Operate procurement (BOO) where the private sector has full responsibility over the project whereby the private sector is the owner, contractor, and operator.

The United Nations Economic Commission (United Nations Economic Commission, 2008) described different PPP models that allocate responsibilities and risks between the public and private partners in different ways. The following terms are commonly used to describe different types of contract and risk transfer:

- Buy-Build-Operate (BBO)
- Build-Own-Operate (BOO)
- Build-Own-Operate-Transfer (BOOT)
- Build-Operate-Transfer (BOT)
- Build-Lease-Operate-Transfer (BLOT)
- Design-Build-Finance-Operate (DBFO)

- Finance-Only
- Operation-and-Maintenance-Contract (O&M)
- Design-Build (DB) (not considered as PPP model)
- Operation-License

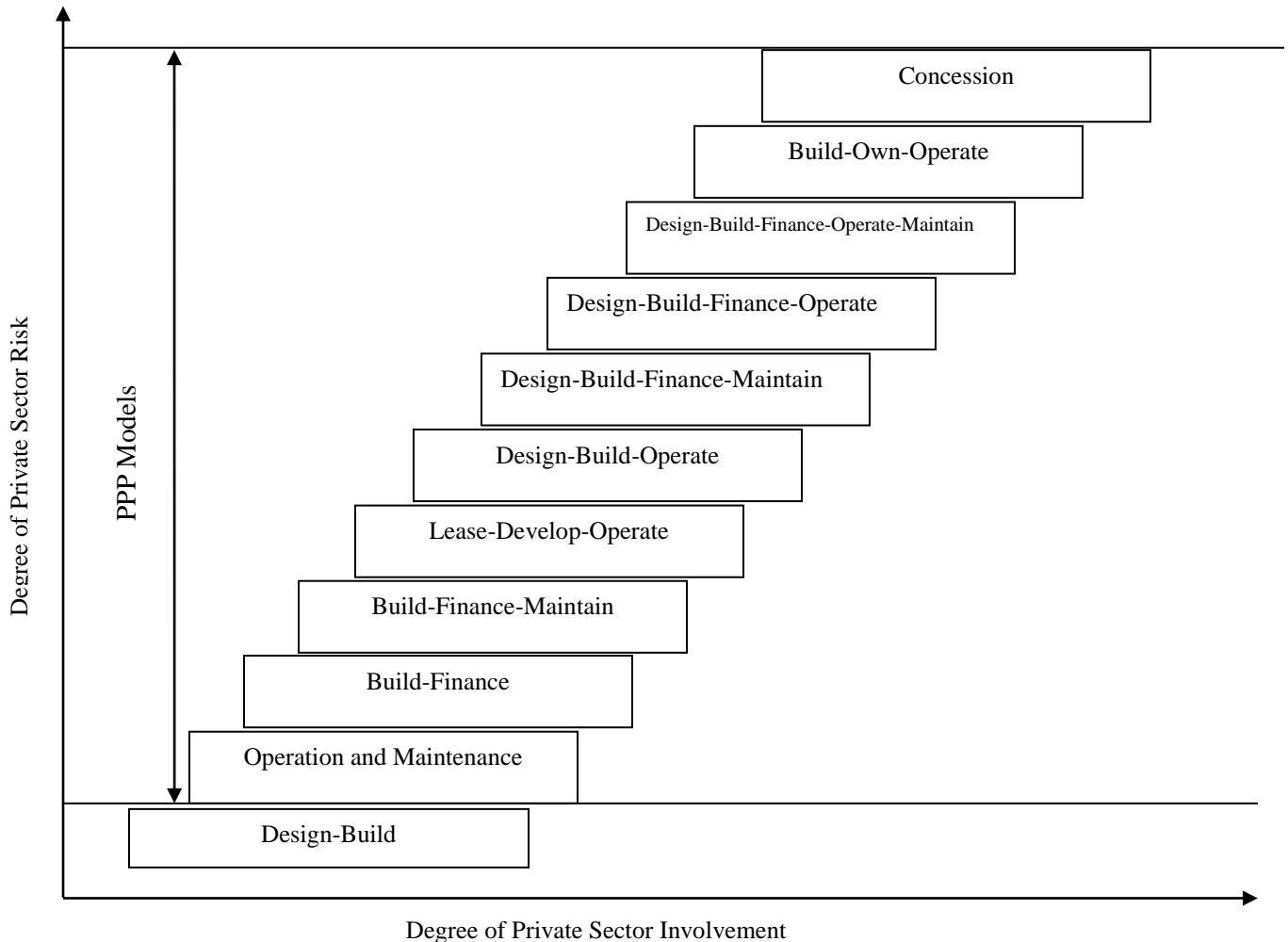


Figure 2.3: The Scale of PPPs (United Nations Economic Commission, 2008)

2.1.3 Advantages and Disadvantages of PPP

PPP projects are increasing nowadays due to its main advantage which is it can save resources for the government in many ways. Because of the private sector participation, the quality of the public services and facilities are improved, and all the government data and assets are utilized efficiently through innovation by the private sector. However, this scheme has some disadvantages due to the complexity of the contracts and the long term concessions. In the

literature, the benefits of PPP projects were described according to (Tang et al. 2010), (Li and Akintoye, 2008), and (Laing et al. 2011) to be as follows:

- Increasing the quality of public facilities and services, due to the proper use or maximization of the private sector's skills, experience, technology, and innovation.
- Public and private sectors can share risks at different stages.
- PPP leads to the reduction of lifecycle costs, since these projects spread government capital investment over the life of a project.
- Reduce the time to implement the project.
- Facilitate creative and innovative approaches.
- Attract larger and more sophisticated bidders to the project.
- Bring in private capital and make projects affordable.
- Public sector only pays when services are delivered.
- Ensures that assets are probably maintained.

However, the disadvantages of such scheme are described in (Tang et al. 2010), (Roehrich et al. 2014), and (Laing et al. 2011) to be as follows:

- Cost overruns, unrealistic price and income projections, and legal disputes between private operators and the government.
- Higher capital costs as compared to the traditional government procurement.
- Relationship management problems.
- Limited competition due to limited number of contractors.
- Long term relatively inflexible structures.
- Procurement delays and high procurement costs.
- Private sector has higher cost of finance.
- Does not achieve absolute risk transfer.

2.1.4 Why Should Governments Consider PPP?

As discussed in earlier sections, there are many benefits and advantages to such participation that make governments consider this type of procurement in many infrastructure projects. PPP has developed in the first place due to financial shortages in the public sector. It has demonstrated the ability of the private sector to add financial resources and operating

efficiencies into projects. These benefits to the government can be summarized according to (Li and Akintoye, 2008), (European Commission, 2003), (Kong, 2007), and (Laing, et al. 2011) to be as follow:

- Enhance government’s capacity to develop integrated solutions
- Delivering of quality services that provides VFM (whole life costing)
- Faster Implementation - the allocation of design and construction responsibility to the private sector, combined with payments linked to the availability of a service, provides significant incentives for the private sector to deliver capital projects within shorter construction timeframes
- New options for public sector finances
- Generation of additional revenues – the private sector can generate additional revenues from a third party
- Innovation
- Good principles of PPP
 - Substantial risk transfer to the private sector (who does what best)
 - Whole life costing (balance between construction and maintenance costs)
 - Maintain value of public asset
 - VFM (quantitatively and qualitatively)
 - Performance standards and competition (payments upon delivery – output focus stating the desired output quality and quantity)

2.1.4.1 Successful Sectors of PPP

PPP projects are most successful in the primary and social infrastructure projects, although in emerging markets generally limited to primary infrastructures (power, water, and transportation). However, they are not suitable where technology is likely to change rapidly over the life of the contract (i.e. IT sector).

Successful PPP sectors in some countries as stated by the United Nations Economic Commission are as follows (United Nations Economic Commission, 2008):

- *United Kingdom:* schools, hospitals, prisons, defense facilities, and roads
- *Canada:* energy, transport, environment, water, waste, recreation, information technology, health and education

- *Spain*: toll roads and urban regeneration
- *United States*: Projects which combine environmental protection, commercial success, and rural regeneration.
- *Greece*: transport projects – airports and roads

2.1.5 PPP Success Factors

There are necessary elements in order to achieve successful partnerships in PPP projects. Professor Cliff Hardcastle a member of the Chartered Institute of Building and the Association of Cost Engineers and he is currently the Dean of the school of the Built and Natural Environment at Glasgow Caledonian University has explained some critical success factors for PPP/PFI projects based on a survey with 16 Public Sector and 45 Private Sector of Directors and Managers of 21 years of experience (Hardcastle, 2005). This survey concluded that the critical success factors for a PPP project are:

- Strong private consortium
- Appropriate risk allocation and risk sharing
- Competitive procurement process
- Commitment/responsibility of public/private sectors
- Realistic cost/benefit assessment
- Project technical feasibility
- Transparency in the procurement process
- Good governance
- Favorable legal framework
- Available financial market
- Political support
- Multi-benefit objectives
- Government involvement by providing guarantees
- Sound economic policy
- Stable macro-economic environment
- Shared authority between public and private sectors
- Social support

However, the study concluded that the three top factors that have the most influence on the success of the project are; the strong private consortium, appropriate risk allocation, and easy access to financial market (Hardcastle, 2005).

The PPP Central Unit in Egypt (PPP Central Unit, 2009) described four success drivers for any PPP project based on the experience of the past PPP projects in Egypt. These Drivers are:

1. Standardization: PPP models and documentation that can be easily replicated (feasibility analysis, risk allocation, RFPs, PPP contracts, etc...)
2. Deal Flow:
 - a. Quantity – Sufficient scale to validate a PPP strategy
 - b. Quality – Determine which candidate is appropriate as PPPs, projects must be clear and bankable
3. Leverage: Create more opportunities to attract new finance using credit enhancements to reduce sovereign risk.
4. Capacity Building: PPP will not work unless the public sector understands its governance and oversight responsibilities from the beginning to end.

2.2 PPP in Egypt

PPPs in Egypt provide a new source of investment capital for infrastructure projects, in addition to the efficiency of the private sector's management and skill that will lead to a high quality of the service with the least cost. Throughout a PPP project, the government retains control over the delivery of the specified level and standard of service (PPP Central Unit, 2009).

2.2.1 PPP Central Unit

The PPP Central Unit (PPPCU) was established in 2006 within the Ministry of Finance. It acts as the PPP center for support and expertise. The PPPCU is responsible for the development of the PPP program in Egypt serving the needs of the public sector. Therefore, the role of the PPPCU can be summarized to be as follows (PPP Central Unit, 2009):

- Establish a national PPP policy framework for implementation
- Set PPP guidelines and methodologies appropriate to Egypt
- Assist the line ministries to identify potential PPP projects as part of line ministries' five year strategic plans

- Draft and issue standard project documents, contracts and PPP laws
- Provide technical advisory support to line ministries on project development and transaction implementation
- Monitor project implementation post contract closure
- Coordinate PPP program activities among line ministries, private sector partners and service providers, and the capital funding market
- Identify and resolve issues that may delay successful development of Egypt’s PPP program
- Serve as a capacity building center for PPP knowledge and expertise in Egypt

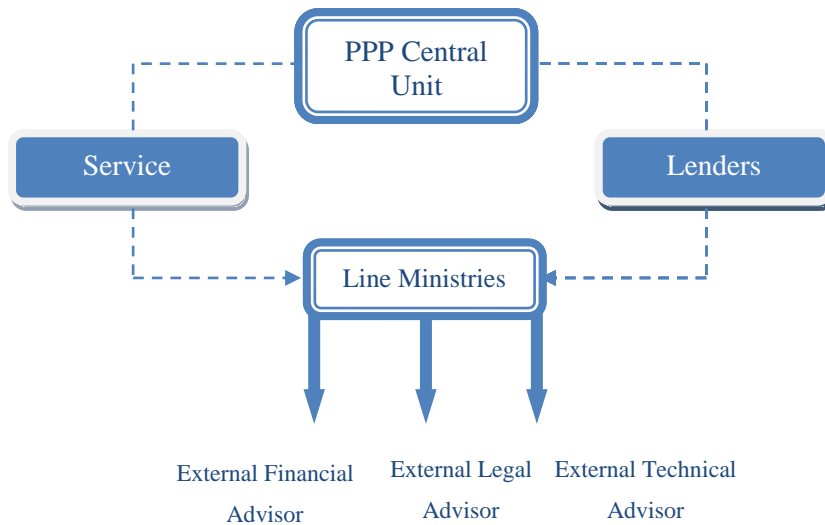


Figure 2.4: PPPCU Role (PPP Central Unit, 2009)

The role of the PPPCU starts from project screening, tendering and procurement, and bid selection to post award monitoring. Therefore, it works with line ministries closely to implement PPP projects.

2.2.2 The Start of a PPP Project Starting from the Line Ministry until the Tendering Process

As shown in figure 2.5, during the screening and approval project phase, PPPCU provides technical assistance to select bankable projects that meet the needs of the public sector and are attractive to the private sector (PPP Central Unit, 2009).

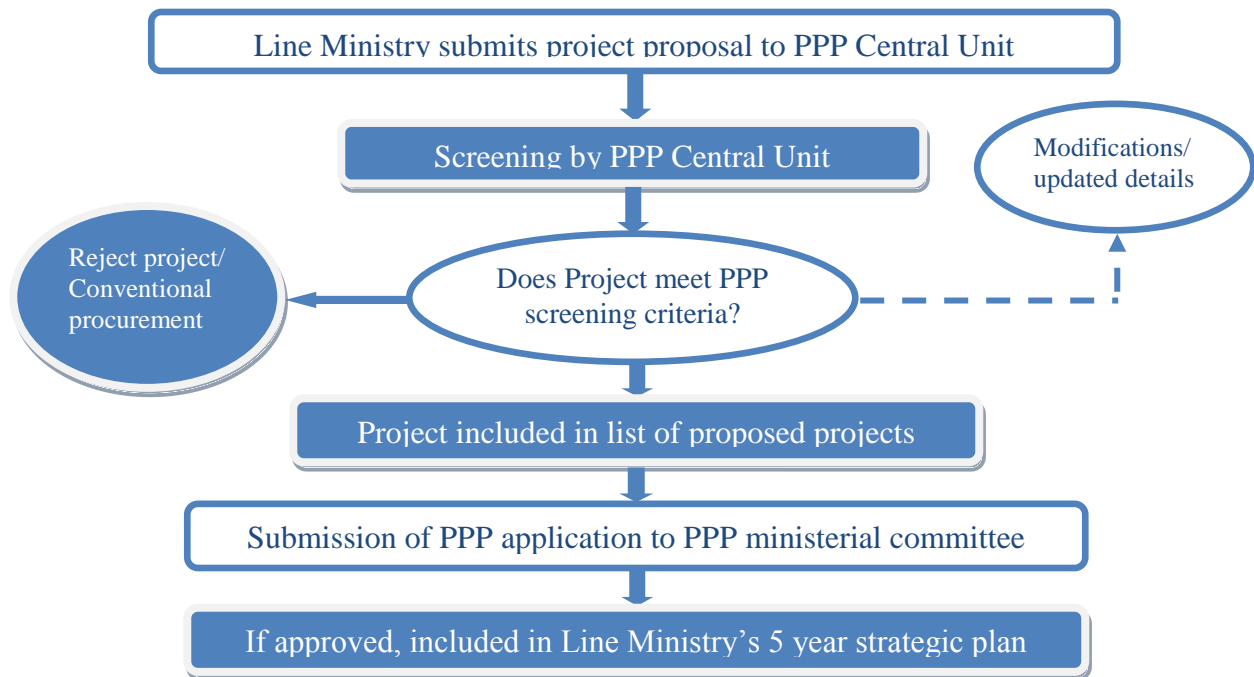


Figure 2.5: The start of a PPP project – Step 1 (PPP Central Unit, 2009)

Figure 2.6 shows the steps once a PPP project is approved by the Ministerial Committee; it goes to the tendering and monitoring project cycle. The PPPCU at this stage assists awarding authorities in the selection of service providers and ensures public sector contributions to a PPP project are optimized and monitored throughout the project life (PPP Central Unit, 2009).

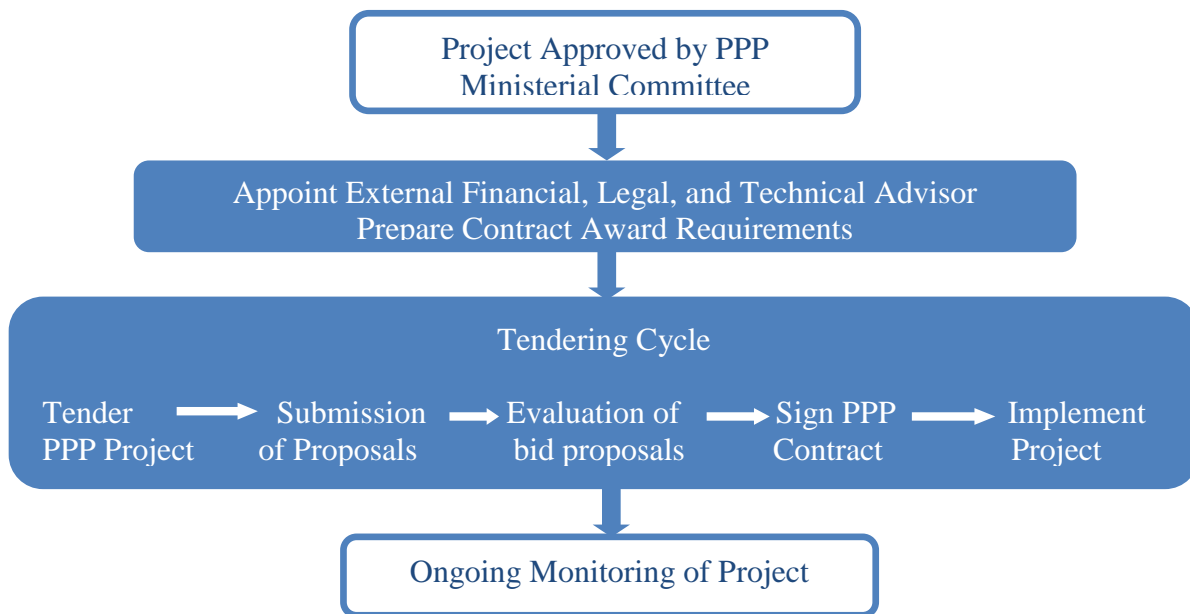


Figure 2.6: Approval of PPP project - Step 2 (PPP Central Unit, 2009)

2.2.3 PPP Project Life Cycle

This section describes the different PPP project phases in Egypt according to the PPP Central Unit in Egypt (PPP Central Unit, 2009). Figure 2.7 shows the PPP project lifecycle starting from phase 1 which is project initiation and screening until the post award and project monitoring in phase 7. However, the scope of this research will only focus on the first five phases (from phase 1 up to phase 5: bid selection).



Figure 2.7: The Overall PPP Project Lifecycle (PPP Central Unit, 2009)

2.2.3.1 Phase 1: Project Initiation & Screening

In this phase, the Line Ministry takes the lead of screening and selecting all of the projects within their sector. The PPP Central Unit at this stage reviews the PPP project documentation; however, the final decision whether the project should proceed to Phase 2 or not is taken by the PPP Ministerial Committee.

2.2.3.2 Phase 2: Business Case

This phase provides an analysis of PPP project feasibility; as well as proposing an approach to risk allocation by Line Ministries.

2.2.3.3 Phase 3: Risk Assessment, VFM Analysis and PSC

This phase is addressing the Public Sector Comparator (PSC) valuation in addition to the Value for Money (VFM) assessment for a PPP project; in order to compare PPP option to normal public procurement. The PSC is an essential component during the bidding process as it enables the public sector to compare and validate financial alternatives to confirm that PPP project will have better value for money than the normal public procurement method.

2.2.3.4 Phase 4: Tendering and Procurement

The Line Ministry together with the PPPCU will perform project tendering and procurement. PPPCU will review procedures and documents, and in many cases it provides qualification and tendering documents to the Line Ministry.

2.2.3.5 Phase 5: Bidders Selection

This phase includes opening technical and financial bids, and evaluating those bids in addition to completing the financial model's comparative. The PPPCU then reviews the Line Ministry's financial model and compares it to the financial models of the bidders which lead to the selection of the winning bidder.

2.2.3.6 Phase 6: Contract Signature and Financial Closure

The Line Ministry at this stage will sign the final contract with the successful bidder enabling it to finalize all financial closure agreements with lenders and co-financiers.

2.2.3.7 Phase 7: Post Award PPP Performance Monitoring & Contract Compliance

The Line Ministry at this stage monitors the performance of the private sector during the project construction and operation.

2.3 The Criteria of a Project to undergo a PPP Participation

Before going through the PPP option, the government and its advisors has to assess the project against certain criteria to determine whether this procurement method will succeed or not. These criteria are summarized by the European Investment Bank (EIB) to be the affordability of the project, the risk allocation and risk sources, the bankability of the project, and the value for money (European Investment Bank EIB, 2015). However, the assessment of the PPP option will be dependent on the specific situation of each country, in terms of its legal and institutional framework.

2.3.1 Project Affordability

Affordability relates to the capacity to pay for constructing, operating, and maintaining the project; in other words, the capacity of the end users or the government to pay for the proposed project in order to cover its costs and make profit. An affordability assessment first estimates the expected operating and maintenance costs of the project, together with the cash

flow required to repay the loans and provide a return on investment. The financial and technical advisers will develop a financial model to estimate capital, operating and maintenance costs, appropriate cost escalation indices, assumed financing structure and preliminary PPP contract terms. At this stage, the financial model is developed at a very basic level (European Investment Bank EIB, 2015).

The assessment of costs includes an estimate of the required revenues to cover those costs:

- “User-Pays PPPs”: In PPPs where users pay directly for the service, the government and its advisers need to examine the capacity and willingness of users to pay, especially if tariffs need to be increased from current levels. In many PPPs, the public sector will need to subsidize the service in order to make it affordable. Thus, the use of public subsidies can impact the value for money of a PPP arrangement; this will require that the savings from the PPP option be large enough to compensate for the use of public funds.
- “Government Pays PPPs”: In PPPs where the government makes the payments, the assessment of affordability is a key aspect in deciding on the PPP option. The government will enter into payment obligations over the life of the PPP contract that is called “service fee”, which represent long-term commitments (European Investment Bank EIB, 2015).

Thus, a PPP project is considered to be affordable if the present value of the expected future revenues of government equals or exceeds the present value of expected future capital and current expenditure of government, in other words, the net present value of the project yields a positive value (Burger, 2008).

2.3.2 Risk Analysis

Risks are crucial issue in PPP projects; in fact many PPP projects fail because the parties cannot agree on the allocation of risk. Considering the PPP option depends on the ability to identify, analyze and allocate project risks adequately. The failure to do so will have financial implications for the public sector. Therefore, in addition to assessing the sources of revenue linked with the affordability of the project, the government needs to assess and identify all risks associated with the project in order to manage them in a risk matrix form. Fig 2.8 shows the process of risk management, and it usually continues with the lifetime of the PPP process.

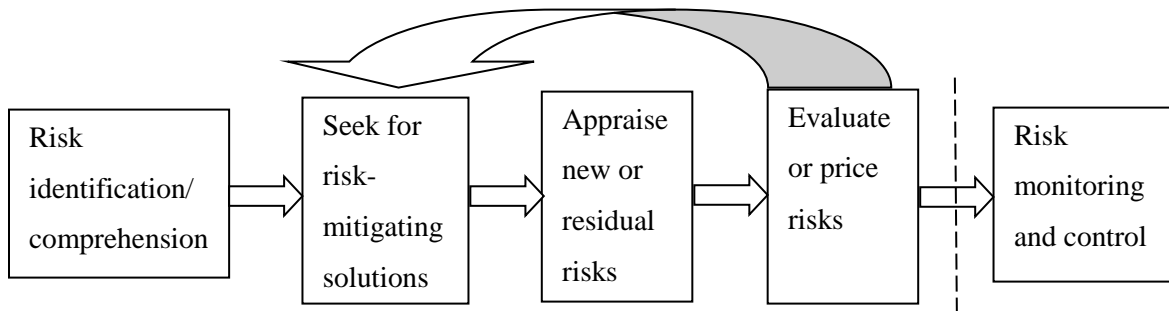


Figure 2.8: Illustration of Risk Management Process (Chinyio and Fergusson, 2008)

The risk management process takes place in five stages:

- i. *Risk Identification:* It is the process of identifying all the risks relevant to the project, during its construction and operational phase (European Investment Bank, 2015). Risk identification can be done by using a checklist or risk prompts. However, some new risks cannot be found in checklists, therefore, checklists should be used with caution. Sometimes organizations or consortia apply the 80-20 principle, in which 20% of the key risks must be identified and addressed. The effect of these key risks account for 80% of the cost and time implications of the entire risks. Risks can also be identified through real time practice, together with the use of personal and corporate experience; safety reviews; intuitive insights; brainstorming; site visits; the use of organizational charts; the use of flow charts; research, interviews and surveys; analysis of assumptions; and consultation of experts (Chinyio and Fergusson, 2008). The authors Shen and Chan conducted a study about identifying and allocating the most critical risk factors in PPP projects through a comprehensive literature review (Shen et al. 2006) and (Chan et al. 2011). Furthermore, Xu, Yeung, et al in the Southeast University in China developed a study on the critical risk factors in Highway PPP projects in China. They identified risks through a questionnaire survey in addition to literature (Xu et al. 2010).
- ii. *Risk Assessment:* It is the process of determining the likelihood (probability) of identified risks materializing and the magnitude of their consequences (their impact on the project) (European Investment Bank EIB, 2015). An accurate risk assessment will enable the private consortium to decide on a course of action. It also helps the private consortium to price its bid more competitively. Therefore, the private sector is heavily involved in the risk identification and assessment processes (Chinyio and Fergusson, 2008). An

assessment could be qualitative, quantitative or somewhere in between. The risk assessment classification is as follows:

- a. Qualitative: It is employed in the absence of information (uncertainty), in which both probability and impact of risk are assessed subjectively (Chinyio and Fergusson, 2008).
- b. Semi-quantitative: It is employed when the impact of risk can be established accurately, in which probability assessed subjectively but impact assessed objectively (Chinyio and Fergusson, 2008).
- c. Full quantitative: It is employed when information is available, in which both probability and impact assessed objectively (Chinyio and Fergusson, 2008).

Moreover, different organizations use different strategies for assessing risks, some of these strategies are: assess every risk as it is; assess every risk but model the price via probabilities; assess only the main risks; benchmarking; negotiation in risk evaluation; reactive risk assessment; pro-active risk assessment; and sensitivity analysis (Chinyio and Fergusson, 2008).

- iii. *Risk Allocation*: The concept of risk allocation in PPPs is relatively straightforward; risks should be allocated to the party best able to handle them. In other words, the party that is best able to understand a risk, control the likelihood of that risk and/or minimize the impact of that risk should also be responsible for managing it. When the party that manages the risk also bears its financial cost, it will face incentives to mitigate the risk. Therefore, risk allocation based on these principles is assumed to generate the most efficient risk allocation, the lowest costs to the project and the greatest value for money (Hovy, 2015). Ke, Wang, and et in the Tsinghua University, Beijing in China conducted a survey with experienced practitioners to identify the preference of risk allocation in China's PPP projects. The results showed that the public sector would take all risks related to government or government officials and their actions. As for the private sector, they would take the responsibility for all risks at the project level. Risks identified that neither the government nor the private sector could handle alone; it was recommended to be shared equally between both (Ke, et al. 2010). The study of Shen concluded some risk allocation that could be used for all researchers and practitioners in all countries. It stated that the allocation of site acquisition risk, legal and policy risks to the public sector is

more effective, while allocate the design, construction, and operation risks to the private. It was concluded that development risks, market risks, financial risks and force majeure could be shared effectively between the two sectors (Shen, et al. 2006).

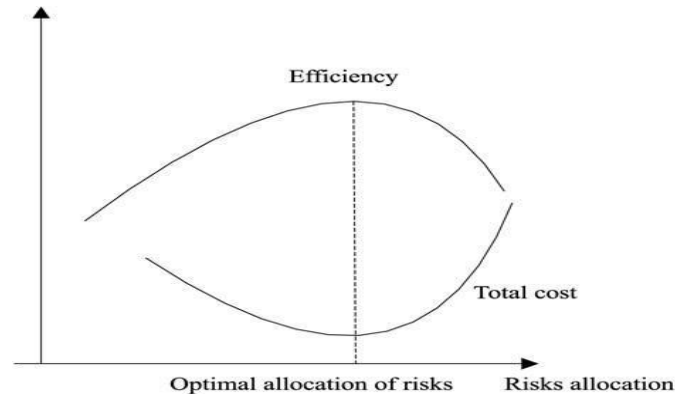


Figure 2.9: Risk Allocation vs project efficiency and total cost (Zou, et al. 2008)

- iv. *Risk Mitigation*: It is the process of attempting to reduce the likelihood of the risk occurring and the degree of its consequences for the risk-taker (European Investment Bank EIB, 2015). Risk mitigation involves finding solutions to counter risks. It should continue throughout the life of the project, as new solutions can emerge that will change previous actions (Chinyio and Fergusson, 2008). Darinka Asenova and Matthias Beck provide an investigation of the risk management practices in PPP projects in the book of “Public Private Partnerships: Managing Risks and Opportunities” and they explained that the risk mitigation strategy for all parties are very similar. Parties tend to manage the risks by seeking to mitigate them contractually. Therefore, the most important risks are mitigated upfront (Asenova and Beck, 2008). There are four general risk mitigation strategies according to (Chinyio and Fergusson, 2008):
- a. Risk Elimination: actions to avoid the risk can lead to the complete elimination of the risk.
 - b. Risk Reduction: actions that could be taken to minimize some risks such as redesigning of facilities to minimize health and safety risks. Risks can be reduced by acquiring more information.
 - c. Risk Transference: some risks can be transferred to other parties whenever possible. Some risks can be transferred through the use of insurance and performance bonds. Private sector consortium usually transfers the construction

tasks and risks to a distinct construction company. Similarly, the facilities management risks will be transferred to specialist service provider. Lenders do not want the SPV to bear significant risks. If inflation were to rise, the lenders would want to be satisfied that the project would not be aborted. Therefore, the private consortium transfers many risks and tasks to different experts who can handle them better depending on the requirements of each project.

- d. **Risk Retention:** it is also known as risk absorption and risk pooling. After reducing the potential impact of risks, those that cannot be eliminated or transferred away are absorbed by the organization. Retention risks are usually those with minimal consequences. Another criterion that influences organizations to accept risks is their ability to control those risks.

There are also some risk mitigation tools that can be applied in addition to the aforementioned strategies. These tools are more well-known in the financial sector. Some of these tools are guarantees, 'letter of credit' (LOC), bid bonds, performance bonds, surety bonds, insurance, risk premium, and risk adjusted discount rate (Chinyio and Fergusson, 2008).

- v. **Risk monitoring and review:** It is the process of monitoring and reviewing identified risks, and managing new risks as the PPP project develops and its environment changes. This process continues during the life of the PPP contract (European Investment Bank, 2015). Decisions reached regarding each risk are documented, and the records are used in monitoring the risks throughout the life of a project (Chinyio and Fergusson, 2008).

The following figure 2.10 illustrates the whole risk analysis process during the different project stages (feasibility study stage, bidding and negotiation stage, and during the construction and operation stages).

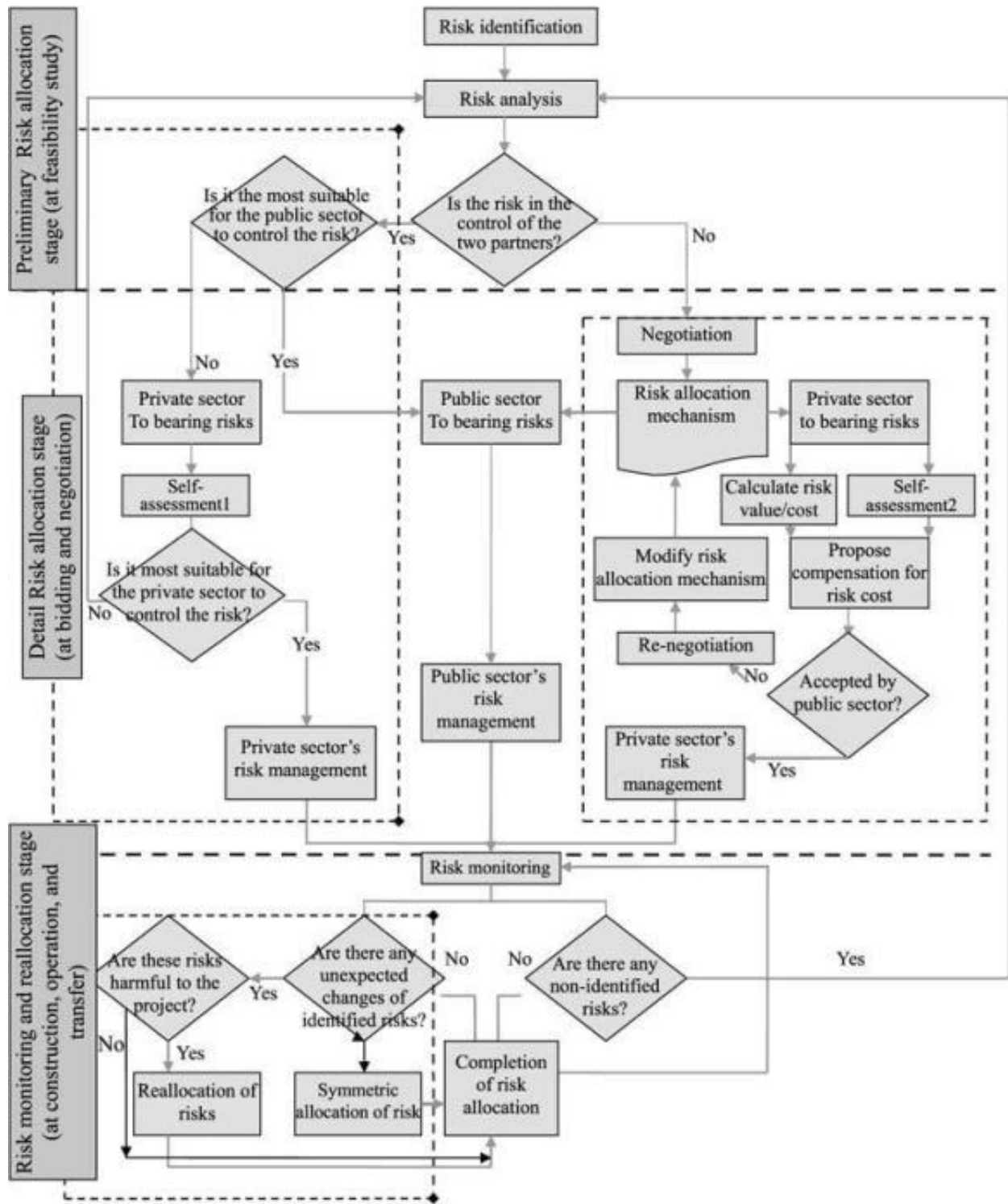


Figure 2.10: Risk Analysis Process (Zou, et al. 2008)

2.3.3 Bankability of the Project

Another important aspect for the government to decide whether the project at hand should be carried out by the PPP participation scheme or not is the bankability of the project; in other words, the appetite of the lenders to finance the project. A PPP project is considered to be bankable if lenders are willing to finance it. The majority of PPP projects are funded on a project finance basis where a special purpose vehicle (SPV) is established to be responsible for the project revenues and debt liabilities. The funding of PPPs is usually a long term debt which varies from 70% to 90% of the total funding requirement depending on the risks of the project. Lenders look to the cash flow of the project as the principal source of security (European Investment Bank EIB, 2015).

Banks or lenders have to examine some issues first before deciding on the finance of the PPP project in order to recover the debt owed to them by the private sector consortia. Issues they often examine include (Chinyio and Fergusson, 2008):

- The type and capability of employees who will run the project
- Assessing that the proceeds from the business will be channeled to an account that is tightly regulated
- Ensuring that sponsors are forced to contribute equity into the project
- Assessing the risk factors that affect the project
- Checking that the independent expert opinions have been required on different aspects of the project

However, the fundamental issue used by banks was explained by Hassan Ibrahim El Fathali in a study at the Concordia University in Canada about the private partner selection and the bankability assessment of PPP projects (El Fathali, 2015). He discussed the measures by which lenders assess PPP projects to decide upon their bankability. This fundamental issue was explained to be the cash flow available for debt service (CFADS), which was also termed the free cash flow to the firm. First, the potential feasibility of the project must be proven and presented to the lenders with the approval of external advisors and consultants. Second, an analysis of all the risks is prepared, along with a description of the methods for mitigating the effects of those risks. The project should also detail the allocation of risk to all the contractual partners involved in the project (El Fathali, 2015).

According to the European Investment Bank (EIB), in order to finance a PPP project, it has to follow the same EU and EIB rules as public-procurement projects. In some cases the private sector also had to follow EU procurement rules for sub-contracts (Thomson and Goodwill, 2005).

2.3.4 Value for Money (VFM)

Value for Money (VFM) is the core concept of PPP projects. The VFM aspect of a project and the comparison between PPP projects and the conventional procurement method in public assets are the essential elements of the government decision making process on PPPs. A PPP project yields value for money if it results in a net positive gain to society which is greater than which could be achieved through any alternative procurement method. It is defined as the effective use of public funds on a capital project that can come from the private sector's innovation and skills in the design, construction and operational practices; and also from transferring major risks in design, construction delays, cost overruns and finance to the private sector (Zou et al. 2008). VFM is obtained by the comparison between the PPP financial model and the Public Sector Comparator (PSC). PSC is a model of costs incurred by the government through conventional procurement method, including risks during the lifecycle of the project as costs. The achievement of the VFM depends on appropriate risk allocation process, together with the ability of the private party to manage risks transferred to it and how the public sector manages the long duration contract (Zou et al. 2008).

The European Investment Bank (European Investment Bank EIB, 2015) describes that a PPP project will provide value for money when all or most of the following conditions are met:

- The private sector has the expertise to design and implement complex projects;
- The public sector has the ability to define output specifications that can be written into the PPP contract ensuring effectiveness of the service;
- Proper risk allocation between the public and private sectors;
- It is possible to estimate the long-term costs of providing the assets and services involved;
- The project value is sufficiently larger than the procurement costs; and
- The technological aspects of the project are stable (i.e. PPPs are not suitable for IT projects) (European Investment Bank, 2015).

2.3.4.1 VFM Tests

The VFM test is a new terminology for the traditional cost-benefit analysis that has been used by governments for decades to determine whether the public sector should or should not undertake a project. While there are many possible value-for-money tests, they can be grouped into four broad categories. The four general models for VFM tests are described by Paul A. Grout in the EIB report 2005 about “Value-for-money measurement in public-private partnerships”, which are:

Test 1: performing a full cost-benefit analysis

This approach seeks to identify the net benefits of each possible option. The option with the highest net benefit is undertaken. PPP approach will be chosen if the net present value of the project is greater than the present value of the public sector conventional procurement. A full cost-benefit approach requires identifying all prices for project inputs and outputs. This approach can be used later in the selection process between different private consortia (Grout, 2005).

Test 2: assessing the cost of service delivery to the government

This approach is the total opposite of a full cost-benefit study. Whereas, a full cost-benefit study aims at assessing the benefits and costs of all possible impacts on the economy, this approach aims at minimizing the cost of delivery for government. In other words, this test compares the cost to the government of traditional public sector procurement with the cost to the government of conducting the project as PPP (Grout, 2005).

Test 3: comparing private alternatives

This test is conducted in the selection process of the private bidders. This VFM test focuses on the quality of the bidding process and the ability to correctly identify and value deviations in service quality between bidders. The value for money is present if the differences in the service quality of all potential bidders are corrected and identified, thus the bidder with the lowest cost is chosen (Grout, 2005).

Test 4: confirming the viability of the chosen project

This test focuses only on the viability of the specific project that has been chosen. In this case value for money exists if the project delivers a positive net present value (Grout, 2005).

The VFM tests show that there are two kinds of tests; the full cost-benefit tests and the simpler more focused tests such as simple comparisons of private alternatives. The cost-benefit test has quite large level of uncertainty; however, the simple comparisons of private alternatives test is very focused and accurate but assumes that part of the decision making process has already been made. This implies that it may be inappropriate to try to identify a unique VFM test that should be used in all situations. The tests identify and categorize many types of specific project risks. This categorization is very useful in the analysis and pricing of these risks and is also used to ensure that all risks are considered (Grout, 2005).

2.3.4.2 VFM Evaluation Criteria

There are two ultimate goals in conducting VFM assessment of PPP projects. The first goal is to determine whether a project delivers VFM to stakeholders. The second goal is to assess potential bidders that can significantly contribute VFM to the projects. A study was conducted in Malaysia in the postgraduate studies center in the Faculty of Architecture Planning and Surveying, in the Universiti Teknologi MARA (Ismail et al. 2011) in order to determine the perception of both public and private sectors of PPP stakeholders in evaluating the VFM criteria involved in PPP bids. The data was collected from 216 target respondents which were comprised of top management levels of contractors, consultants and governments' officers. They were chosen as they were the key stakeholders in PPP projects. The study yielded 6 criteria, the government and the consultants identified all of them as "very critical"; however the contractors identified only 4 as "very critical". These six criteria are: optimum whole life cost, innovation, fit for purpose, comprehensive specification, compliance on time, and appropriate risk allocation. The optimum whole life cost is believed to be the most critical criterion in VFM evaluation of PPP bids, as it is the core concept of PPP procurement. All respondents (government, consultants and contractors) agreed that this criterion is the most important. Since PPP is a form of procurement that involves an integration of finance, design, construction and operation; thus, the understanding of the concept of whole life cost is very important in order to achieve VFM. Therefore, PPP projects should be assessed over the entire whole life cost of a project throughout the concession period.

The second critical criterion is innovation. The study showed that contractors rated innovation as very important in the evaluation of VFM of PPP bids. This indicates that contractors believed that in order to win the PPP bids, it is important for them to offer innovative

solutions in their proposals to achieve the outputs specified by the government. The third critical criterion is fit for purpose, both government and consultants believe that the achievement of VFM should be assessed from the perspective of quality and should comply with building functionality (fit for purpose). The fourth critical criterion is comprehensive specification; the study showed that government and consultants are more aware on the comprehensive specification of the proposed projects compared to contractors. The reason for that is they are more concerned with the project outputs. The compliance on time and appropriate risk allocation criteria are ranked in the fifth and sixth places. This was explained in the study by the fact that the respondents are more cost- quality oriented rather than the configuration of these factors (Ismail et al 2011).

2.4 PPP Project Viability “Private Sector Point of View”

The authors Salman in the Zagazig University in Egypt and Li and Akintoye in the Glasgow Caledonian University in the UK (Salman et al. 2007) (Li et al. 2005) discussed the attractiveness and viability of PPP projects from the private sector’s perspective. The studies yielded three broad categories for decision factors for the viability of a PPP project. These categories are; legal and environmental, financial and commercial, and technical aspects. However, Expert respondents to questionnaires used in the researches indicate the financial and commercial category of project viability factors as the most important, the legal and environmental category somewhat less important, while technical aspects being the least important.

The financial and commercial category has ten sub-factors; some of these factors are acceptable tariff level, forecast of future demand, reasonable high debt/equity ratio, and reasonable return on investment (project is fundable if IRR is sufficiently high). The legal and environmental factors include four sub-factors; while, the technical category has six sub-factors. In order for the PPP project to be attractive to private sector, the design guidelines for the project should be flexible and adaptable to change to accommodate any design errors or future growth. In addition, the technical design of the project should be simple and functional to satisfy the government and conform to user’s expectations. This will save a considerable amount of time and construction cost and will make the technical proposal highly attractive to the government. The private sector should assess the availability of construction materials, operating equipment,

skilled labor, etc, and the other resources need to be imported before starting to bid for the project. Innovation is another aspect to be considered by the private sector for PPP project viability as it offers both the public client and the private contractor more freedom to select innovative methods in the provision of assets and services. This leads to time saving by accelerating project development and by avoiding delays in project delivery (Salman et al. 2007) and (Li et al. 2005).

2.5 Financial Models of PPP projects

The financial model is a tool for evaluating a new project and facilitating negotiations among lenders, sponsors and the government. In PPP projects, the private sector (or sponsor) composes a special purpose vehicle (SPV) or a concessionaire company to deal with the lenders, investors, insurance providers, contractors, and the government. A successful PPP project has mutual agreement and balance risk sharing between the government and the private sector prior to financial close (Kurniawan et al. 2015). The financial model is needed by the investors and lenders to assess the cash flows under different scenarios throughout the life of the project. It is also needed to evaluate Value for Money (VFM) as opposed to the normal public procurement method (Macgillivray, 2010). The project developers are more concerned with the project's resulting internal rate of return (IRR). However, the lenders are concerned more on: (a) Projected revenues, operating expenses, Cash Available for Debt Service (CADS); and (b) Realistic estimates of future project revenues are sufficient to cover operating expenses and repay project debt with an acceptable margin of safety. Financial models are developed by a financial advisor that is assigned by both or either the government and/or the SPV company (Kurniawan et al. 2015).

2.5.1 Financial Model Usages

According to Chang and Chen the financial model assist the government in the negotiation process with the sponsors (Chang and Chen, 2001). Therefore, the financial model is used in five stages in the PPP project with different purposes. These stages are the pre-proposal stage, contract negotiation stage, finance-raising stage, construction stage, and operation stage (Kurniawan et al. 2015). Altin Turhani and Fredy Kurniawan described in their studies the different uses of a financial model by the different stakeholders involved.

Firstly, the government uses the model in the initial feasibility stage (pre-proposal stage). A shadow financial model will attempt to predict the bidder's costs, finance structure, and other assumptions and the outcome is the service fees. The government also uses the model in structuring the bidders' financing and reviewing the benefits of different financial terms and arrangements (calculating the service fees to cover capital expenditures CAPEX, operating expenditures OPEX, debt service, and the investors return). This stage is the main focus of this research, thus a shadow financial model will be developed later to complete the integrated framework approach. The financial model is also used by the government later in the bidding and contract negotiation stage to evaluate the competitive bidders' proposal. Finally during the operation phase, the government could use the financial model to evaluate new tariff pricing (Kurniawan et al. 2015) (Turhani, 2012).

Secondly, the project sponsor uses the model as a budgeting tool in the pre-proposal stage in order to facilitate the submission of proposal. During the bidding and contract negotiation stage it is used to negotiate the risk sharing mechanism and capital structure of the project with other potential bidders, lenders, and the government. It is used in the construction stage to monitor and track the performance of the project. During the operation phase, it is used to calculate and refinance gain to be shared between the government and the project company (Kurniawan et al. 2015) (Turhani, 2012).

Thirdly, financial models are used by lenders in the finance raising stage in order to test the project's financial viability and review their continuing risk exposure. During the construction stage, lenders maintain the financial model and monitor the costs of the project. Finally in the operation phase, lenders review the impact of the annual operations budget submitted by the project sponsor to lenders (Kurniawan et al. 2015) (Turhani, 2012).

2.5.2 Data Collection

The financial advisor depends on other parties to collect data for the model. The government provides policy initiatives data such as fiscal incentives scheme, retained responsibilities for the delivery of core services, governmental loan guarantee, royalty, tariff cap, etc. The SPV Company provides initial cost of the project and its management cost. The Engineering, Procurement and Construction (EPC) Contractor provides construction cost and also Life Cycle Cost (LCC) on a monthly basis. Operation and maintenance costs data are

provided by the operator company or facilities management contractor. The lenders will provide financial information related to the project financing. These inputs are adjusted in coordination and negotiation with the parties who provide the data. The financial advisor assembles all project costs estimation, and feeds them into model together with adjustments to the forecasted traffic volume and variable rates (Kurniawan et al. 2015).

2.5.4 Design of the Model

The design of the financial model should be as flexible as possible, so that it can allow for changes in the start date, the construction schedule, the design, the capital and operating costs. The model should have separate sheets for input and output with color coding to help the user to understand which figures are inputs and which are calculated. Technical conversions are very crucial issue to the model (McGillivray, 2010). The structure of a financial model will depend on its purpose and use (Swan, 2008). Typically, a financial model is arranged in a spreadsheet with different worksheets. The architecture of a typical financial model is illustrated as shown in fig 2.11 by Khan and Parra in their book about “Financing Large Projects” showing the standard parts or worksheets of a financial model (Khan and Parra, 2003). This design is adopted later in this research in the design of the financial model template. The standard worksheet consists of three categories which are: (1) Input Worksheet, (2) Calculation Worksheet, and (3) Output Worksheet.

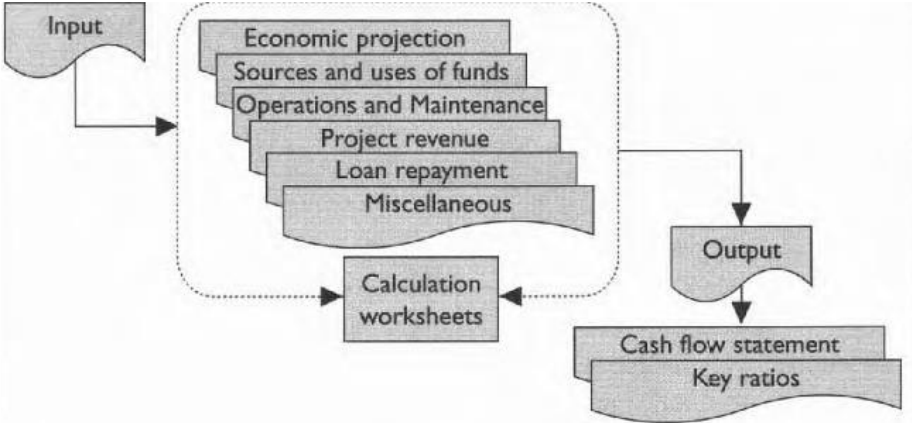


Figure 2.11: Architecture of a financial model (Khan and Parra, 2003)

Input Worksheets: These worksheets contain most of the user various assumptions that feed into the rest of the model which are derived from the project documents or from other relevant sources. Usually nothing is calculated in the input sheet; and they are designed to allow the users to change the numbers used in the model, but not the formulas (Khan and Parra, 2003).

Calculation Worksheets: These worksheets are the most important part of a financial model; they contain calculations regarding projections such as inflation and exchange rate indices, calculation of interest during construction, computation of tariff, calculation of operation and maintenance expenses, etc (Khan and Parra, 2003).

Output Worksheets: Readers get an overall summary from this worksheet. The Output worksheet includes pro forma financial statements (e.g. income statement, balance sheet and cash flow statement), and key ratios such as debt service coverage ratio (DSCR), net present value (NPV), interest rate of return (IRR) and return on equity (ROE) (Khan and Parra, 2003).

2.5.4.1 Design Approaches

Fredy Kurniawan in his study (Kurniawan et al. 2015) about financial models discussed two methods of developing a financial model. The two methods are the bottom-up and the top-down approaches. He explained that the majority of the financial modelers adopt the bottom-up approach; whereby the input identification of the raw data along with basic calculations is a priority. However, he discussed that a good financial model is done by starting with designing the output first and then identifying the output rather than the input. This approach is the top-down approach (Kurniawan et al. 2015). Depending on the PPP project's nature that outputs are defined prior to inputs, the top-down design approach will be adopted in this research.

2.5.4.2 Model Inputs and Outputs

The financial model inputs and outputs are described by John McGillivray and Altin Turhani. The model inputs are divided into four main categories: macroeconomic assumptions (such as interest rates and interest), capital expenditure (CAPEX), operating and maintenance costs (OPEX), and revenues. The CAPEX of the project takes into account costs incurred during the bidding, development, and construction phases of the project, it includes: bidding and development cost, project company costs, construction subcontract price, working capital (current assets and liabilities; the initial costs that the project company has to incur until it receives its first revenues), reserve accounts, interests during construction (IDC) and funding

drawdown (get the right balance of debt and equity), and contingency. OPEX is deducted from projected revenues to calculate the cash flow available for debt service (CADS), it includes: the project company's own direct costs, subcontract payments, insurance, and taxation. However, maintenance costs are the largest part of the operating costs, it includes: lifecycle costs, routine maintenance, and major maintenance. Finally the revenues should cover OPEX, fit within the envelope of the public authority requirement, meet lender debt services and other requirements, and give the investors their required rate of return.

The outputs of the model typically include the following: CAPEX, drawdown of equity, drawdown of debt, service fees, other operating revenues, OPEX, interest calculations, tax, debt repayments, income statement, balance sheet, cash flow (source and use of funds), lenders cover ratios, investors returns, and NPV (Net Presented Value) of these payments to enable the public authority to compare bids (McGillivray, 2010) (Turhani, 2012).

2.5.4.3 Sensitivities

The financial model flexibility allows both investors and lenders to calculate a series of sensitivities (also known as cases) which show the effects of variations in the key input assumptions (Turhani, 2012). This calculation of several different events is also called "scenario analysis". Sensitivities include calculating the effect on cover ratios and equity IRR due to: construction cost overrun, delay in completion, deduction or penalties for failure to meet availability or service requirements, reduced usage of the project, higher OPEX and maintenance costs, higher interest rates, and changes in inflation (Turhani, 2012).

2.5.5 Stakeholders' Preference on Financial Indicators

According to the study of Fredy Kurniawan (Kurniawan et al. 2015), he concluded the most important variables of the financial model according to the different stakeholders involved. He presented the stakeholders' preference on input assumptions and output indicators as illustrated in the following table (2-1).

Table 2-1 Comparison of the top rank preferred input assumptions (Kurniawan et al. 2015).

<i>Stakeholder</i>	<i>Input Assumptions</i>	<i>Financial Model Outputs</i>	<i>Rank</i>
	<i>Top 5</i>	<i>Top Rank</i>	
Sponsors	Project costs	IRR	1
	Volume/Demand	Net cash flow	2
	Revenue forecast	EBITDA	3
	Operating cost	CADS	3
	Loan repayment schedule	Loan Life Coverage Ratio LLCR	3
	Financing cost	Interest covering ratio	3
Authority	Volume/demand	IRR	1
	Operating cost	NPV	2
	Maintenance cost	Revenue	2
	Project timelines	Operating cost	2
	Revenue forecast	DSCR	3
Lender	Volume/demand	IRR	1
	Project costs	DSCR	2
	Revenue forecast	CADS	2
	Operating cost	Net cash flow	2
	Interest and fees	LLCR	2
		Revenue	2
		ROE	2
Consultant	Project costs	DSCR	1
	Volume/demand	CADS	2
	Revenue forecast	LLCR	2
	Capital structure	Net cash flow	3
	Operating cost	IRR	4
	Loan repayment schedule		4

2.6 Public Sector Comparator (PSC)

The Public Sector Comparator (PSC) is the assessment of whether a PPP procurement option offers VFM or not. The VFM is obtained by comparing the cost of the proposed PPP with the cost of public sector undertaking the project with the required output specifications and risk allocation stated in the contract. The PSC is an estimate of the Net Present Cost (NPC) to government if the project were delivered under a traditional procurement method. It is based on life-cycle costing, the most recent public sector delivery of similar projects, and it is risk adjusted (Melbourne Partnerships Victoria, 2001) (Government of Western Australia, 2011).

Cruz and Marques in their book about “Infrastructure Public-Private Partnerships” (Cruz and Marques, 2013) defined the PSC to be “a theoretical calculation of the total costs for the public sector of developing and operating an infrastructure and/or service. It is basically the sum

of cash-flows (including CAPEX and OPEX) for a pre-determined duration, incorporating the efficiency gains arising from the manager learning curve and the retained risk, assuming a public management model". The PSC takes also into account the revenues whether direct or indirect. The direct revenues are those coming from user charges (such as tariffs, tolls, etc.), while indirect revenues are related to third party revenues (such as parking tickets, rentals, advertising, etc) (Cruz and Marques, 2013).

2.6.1 Purpose of PSC

The Australian Government (Australian Government, 2013) stated that the main purpose of the PSC is to provide governments with a quantitative measure of the value for money it can expect from a private sector proposal to deliver the output specification compared to public sector delivery. According to Cruz and Marques the purpose of the PSC is to provide a tool for the decision making process of the procurement model (Australian Government, 2013) (Cruz and Marques, 2013).

Partnerships Victoria discussed the several roles of the PSC to be as follows: promotes full cost pricing at an early stage in the procurement process; acts as a management tool during the procurement and assists the government to manage the process by focusing on the output specification, risk allocation, and development of a comprehensive costing of the project; demonstrates value for money; and provides a consistent benchmark and an evaluation tool (Melbourne Partnerships Victoria, 2001) (Partnerships Victoria, 2003).

2.6.2 Components of PSC

The PSC is a valuation of the life-cycle costs of the project, in addition to risks associated with that project. Therefore, the PSC core elements were identified in literature to be Raw PSC (base costing), Competitive Neutrality, Transferable Risk, and Retained Risk (Kerali, 2006) (Cruz and Marques, 2013). The PSC and its components are adopted in this research at the first pillar of the integrated framework approach.

The raw PSC which is the base costing accounts for all life-cycle costs of the infrastructure and/or service. The cash-flow is then discounted, and the sum of all cash-flow for the entire duration represents the raw PSC. In other words, it is the expected capital and operating costs both direct and indirect associated with building, owing, maintaining, and delivering the service over the same period and output specifications specified to private sector

before any risks are taken into account (Cruz and Marques, 2013) (Melbourne Partnerships Victoria, 2001) (Australian Government, 2013).

Competitive Neutrality corrects the PSC from biases due to public ownership and management such as taxes, stamp duty, construction permits or environmental permits. This allows a fair assessment between PSC and bidders (Cruz and Marques, 2013) (Melbourne Partnerships Victoria, 2001) (Australian Government, 2013).

Transferable risks are those risks that fall under the private sector responsibility in the PPP model such as construction, availability or demand risks. The estimated value of the transferred risk should be added to the raw PSC to reflect the full risk adjusted expected cost to government of delivering the project (Cruz and Marques, 2013) (Melbourne Partnerships Victoria, 2001).

Finally, retained risks are those risks that even in the PPP model are managed by the public sector. Any risk not to be transferred to a bidder is considered retained by the government. The cost of the retained risk should be included in the PSC to provide the full cost to government. Its value is needed to be added to the private sector's bids to allow for a meaningful comparison (Cruz and Marques, 2013) (Melbourne Partnerships Victoria, 2001).

2.6.3 PSC and the Procurement Process

Partnerships Victoria described the procurement process as eight stages which are: (1) establish need, (2) option appraisal, (3) business case, (4) project development, (5) bidding process, (6) project finalization review, (7) final negotiations/contract awarded, and (8) contract management. The PSC is used in stage 2 as initial costing of the partnerships option, while at stage 4 the detailed costs of the PSC is developed and finalized. At stage 5 and 7 the PSC is used as a test of the VFM in the bid evaluation process (Melbourne Partnerships Victoria, 2001) (Partnerships Victoria, 2003).

2.6.4 PSC and Bid Evaluation

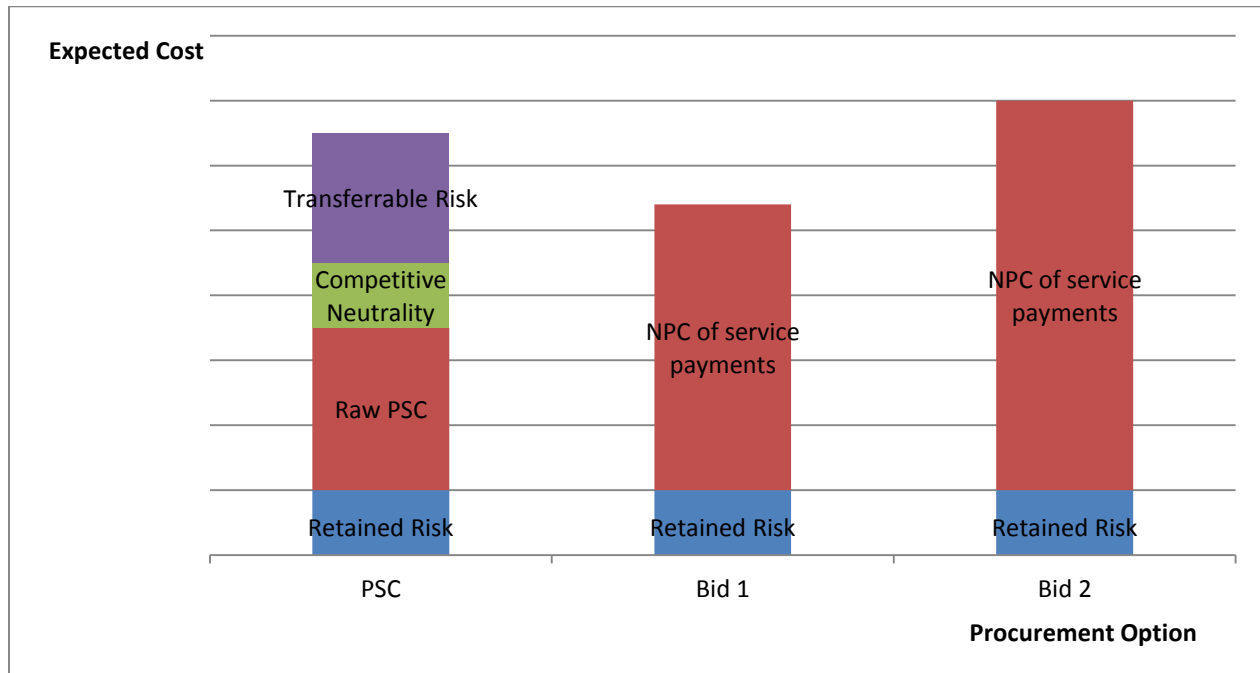


Figure 2.12: Bid Evaluation (Melbourne Partnerships Victoria, 2001)

The above figure describes the bid evaluation process against the public sector comparator in order to obtain the value for money for the project. As shown in the figure, bid 1 would be selected against the PSC as it has less cost thus provides value for money to the government. On the other hand bid 2 would not be selected over PSC assuming that there is no private bid lower than bid 2 (bid 1 does not exist in this case) then the public sector delivery method would be preferred (Melbourne Partnerships Victoria, 2001).

2.7 Hypotheses

The literature review conducted in this study has suggested a number of hypotheses all of which have served as the basis for the development of the integrated framework approach:

- PPP is not a defined procurement model with a common understanding across the world
- PPP has many forms depending on the political environment, the nature of the assets and the level of the private sector participation
- PPP projects in Egypt provide a new source of investment capital for infrastructure projects in addition to the high quality of the service to the Egyptian citizen

- Considering the PPP option depends on the legal and institutional framework of each country
- Risks are a crucial issue in PPP projects; many PPP projects fail because the parties cannot agree on the allocation of risk
- Value for Money (VFM) is the core concept of PPP projects
- Financial and commercial aspects are the most important aspects in the attractiveness of a PPP project from the private sector's perspective
- The financial model is a tool for evaluating a PPP project and for facilitating negotiations among lenders, sponsors and the government
- The Public Sector Comparator (PSC) is a tool for the decision making process of the procurement model by the government
- The financial model together with the PSC are needed by the government to evaluate the VFM of a PPP project as opposed to the normal public procurement.

CHAPTER 3 : RESEARCH METHODOLOGY

3.1 Introduction

The aim of this study is to depict from the existing practice an integrated framework approach for the front-end process of PPP projects in Egypt. The framework is derived from two methods; firstly findings from the literature survey that lead to the development of various steps that consists the integrated framework approach. However, due to the fact that there are some gaps in research and in the study of such projects, and there is limited research about integrated framework approach presented or explained in literature, the framework steps were further developed by information obtained from the PPP Central Unit in Egypt, their advisors (such as International Finance Corporation “IFC”), and contractors (such as Orascom Construction) in order to develop the detailed process.

The framework’s methodology is divided into three main parts. These parts are the pillars of the integrated framework approach of PPP projects. The first pillar is the initial assessment of the proposed project. The initial assessment includes the technical structuring of the project and calculating the Public Sector Comparator (PSC) model. Information regarding the technical structuring of the project was obtained from the PPP Central Unit in Egypt. However, The PSC model is driven by the findings derived in section 2.6. The second pillar is about developing a financial model template with its main components that can be applied to any PPP project. This model is derived according to the findings in section 2.5. These two pillars together are required to evaluate whether the given project yields value for money or not. Finally, the last pillar is a qualitative assessment about structuring the procurement process of the PPP project. The data required for this part was obtained from the PPP Central Unit and their advisors.

The research methodology flowchart is outlined in the following figure 3.1. Each pillar is applied on a case study with its validation and risk mitigation strategies in the following chapter.

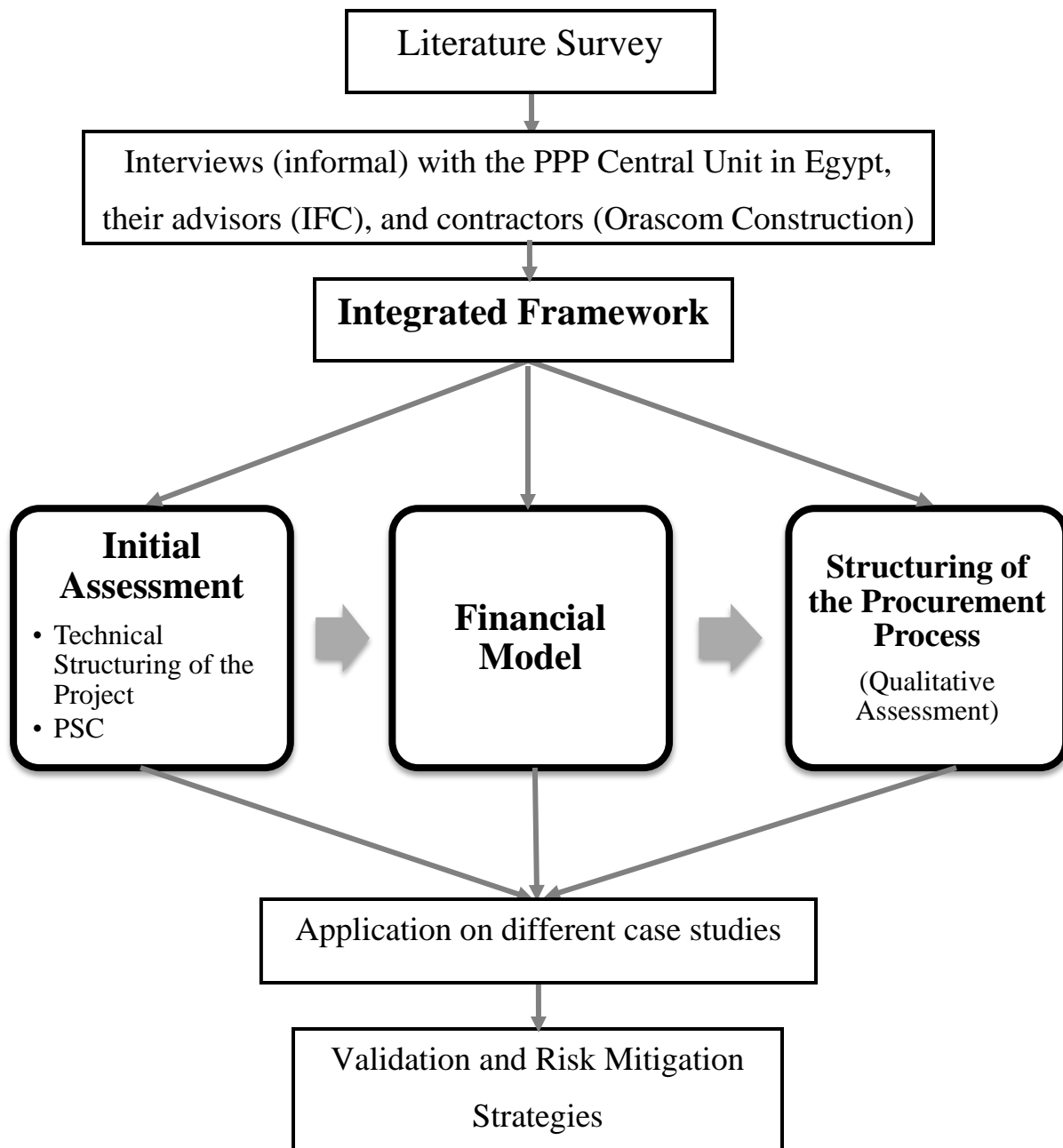


Figure 3.1: Research Methodology Flowchart

These three pillars are then subdivided into a series of steps that form the detailed process of the integrated framework approach of a PPP project. All the detailed steps are illustrated in the below figure 3.2 with the inputs on the left side and outputs on the right side of each aspect.

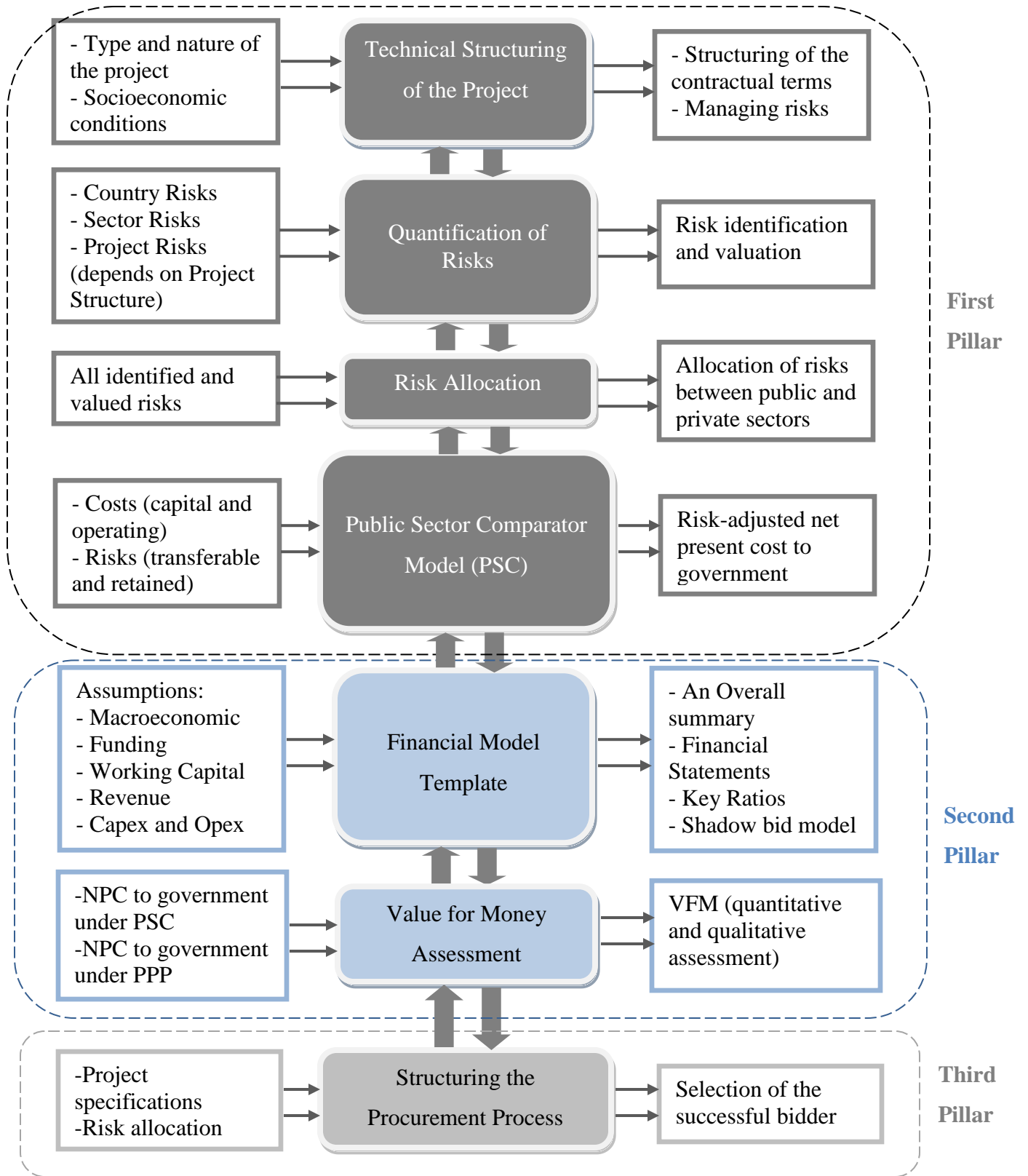


Figure 3.2: The integrated framework approach flowchart

The below figure 3.3 shows the application and validation exercises for each aspect in the integrated framework approach

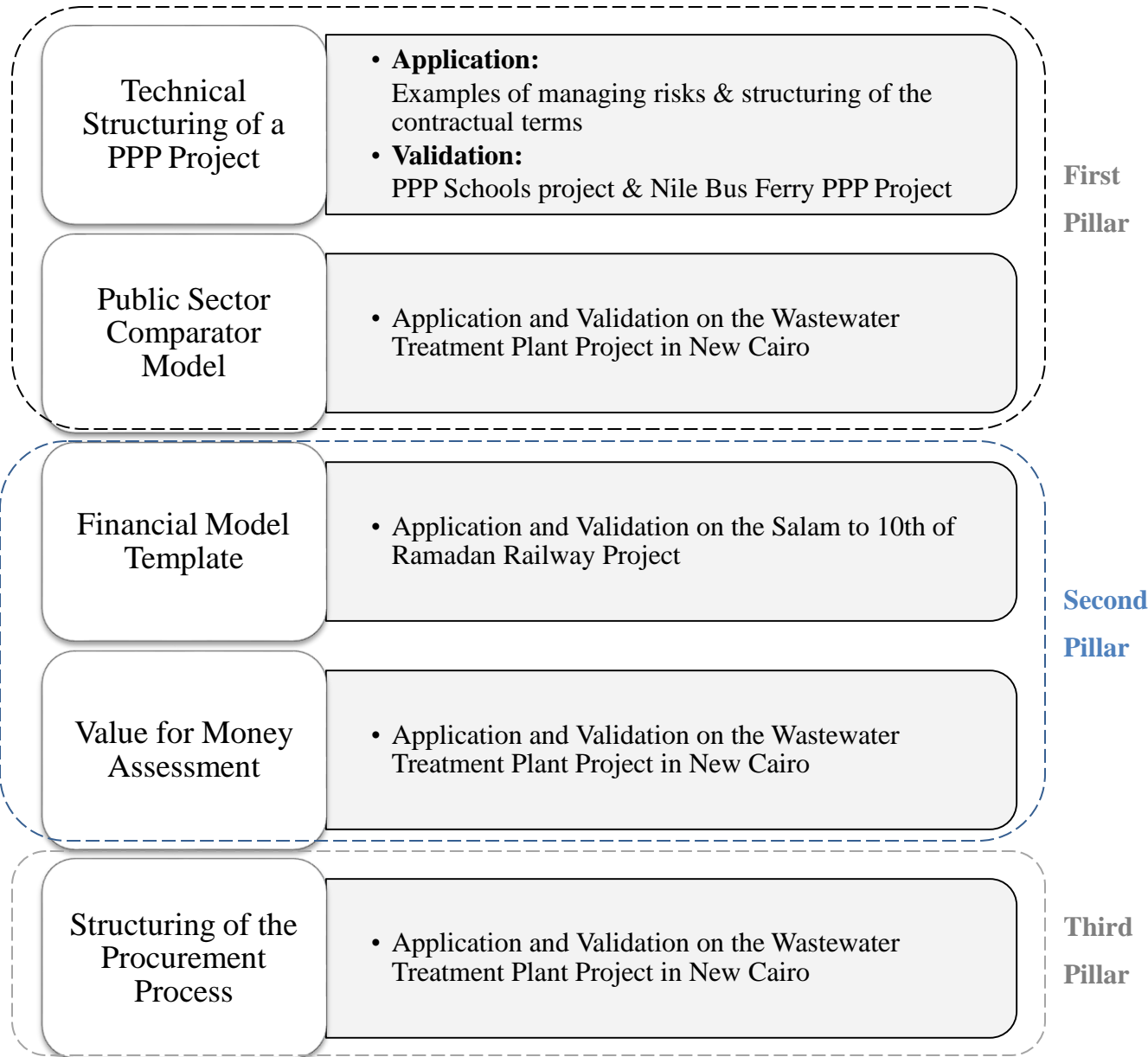


Figure 3.3: Application and Validation Exercises

3.2 Technical Structuring of a PPP Project

The first step in the development of a PPP project is the structuring of the project. By structuring we mean that each PPP project differs depending on the nature of the project and the socioeconomic conditions of each country. Therefore, the concept where we “cut and paste” cannot be applied on PPP projects. The technical structuring of the project includes the identification, assessment, and allocation of risks between the public and the private sectors. It also includes structuring the contractual terms that make the project bankable and attractive to the private sector and lenders. The data acquired for this work was collected from different sources. Some data was gathered through interviews with the director of the PPP Central Unit in Egypt. Data concerning quantification of risks were obtained from Partnerships Victoria guide (Melbourne Partnerships Victoria, 2001).

In some cases during the structuring phase, the PPP Central Unit conducts a market soundness survey or questionnaire to test the appetite of the private sector towards a certain project. In other cases, the private sector submits a letter of intent showing his willingness to bid for a certain project. In this case, both the government and the private sector will be engaged in an informal debate discussing the different aspects of the project.

3.2.1 Quantification of Risk

Risks reflect the potential for additional cost in the project, and as mentioned earlier in the literature, the lack of identifying all risks can lead to project failure. Therefore, a realistic pricing of all quantifiable and material risks is crucial to PPP projects. Once all material risks are identified and valued, they can be allocated between the public and the private sector. This is done through four steps:

Step 1: Identifying Risks

This step includes identifying all the material risks. There are three types of risks; country risk, sector risk, and project risk. Country risks include foreign exchange rate risk, interest rate risk, inflation risk, and change in law risk. Sector risks include design and construction risks. Finally, project risks depend on the structure and the location of the project. It includes demand (usage) risk, environmental risk, financial risk, cost overrun and time overrun risk, operating risk, performance risk, and technology obsolescence risk.

Step 2: Quantify the Consequences of Each Risk

In order to identify the consequence of risk, four factors are taken into account. These factors are:

- Effect: risk may increase cost or reduce revenue
- Time: the expected timing of the consequence will have an impact on the NPC cash flow
- Severity of risk consequence: the cost of minor repairs to a building will be less than if the building collapses due to major structural flaw
- Type of risk

Risk consequences include cost and time overruns. Each consequence has different probability of occurring, thus by multiplying each consequence by the relevant probability to give the total value of that risk.

Step 3: Estimate Probability of Each Risk

According to literature, there are different methods to estimate the probability of risk depending on the risk level of the project. High project risk level requires more advanced probability techniques such as Monte Carlo simulation, while low project risk level requires more simple probability techniques such as point estimate approach. In this research, the probability and the consequence of each risk identified in the application chapter were obtained from the International Finance Corporation (IFC) (the financial advisor of the PPP Central Unit). However, future researchers are encouraged to use more complex techniques to calculate the probability of risk occurrence in order to obtain more accurate results.

Step 4: Calculate Value of Risk

After obtaining the consequence (%) and the probability (%) of each risk, the impact of risk is calculated using this equation:

$$\text{Impact of risk (\%)} = \text{consequence (\%)} \times \text{probability of occurrence (\%)}$$

The value of each risk is then calculated by multiplying the percentage impact of risk by the capex amount for construction risks and/or opex amount for operating risks.

3.3 Public Sector Comparator (PSC) Model

The second aspect in the initial assessment of a PPP project is the development of the PSC model. It is developed at this stage (pre-feasibility study stage) in order to determine the go or no go of the project. The methodology of the PSC is based on the literature review section 2.6 (Melbourne Partnerships Victoria, 2001). The PSC is fine tuned in the feasibility study and it is revisited later in the procurement stage. It is preferred to finalize the PSC as early as possible to promote certainty in the bid process. The PSC should only be refined after release of the project brief if the scope of the project changes or a component has been mispriced or omitted.

According to literature, non-cash items such as depreciation should not be included in the calculation of the PSC. The PSC only includes costs in addition to risks. The methodology of the PSC can be summarized as shown in figure 3.3.

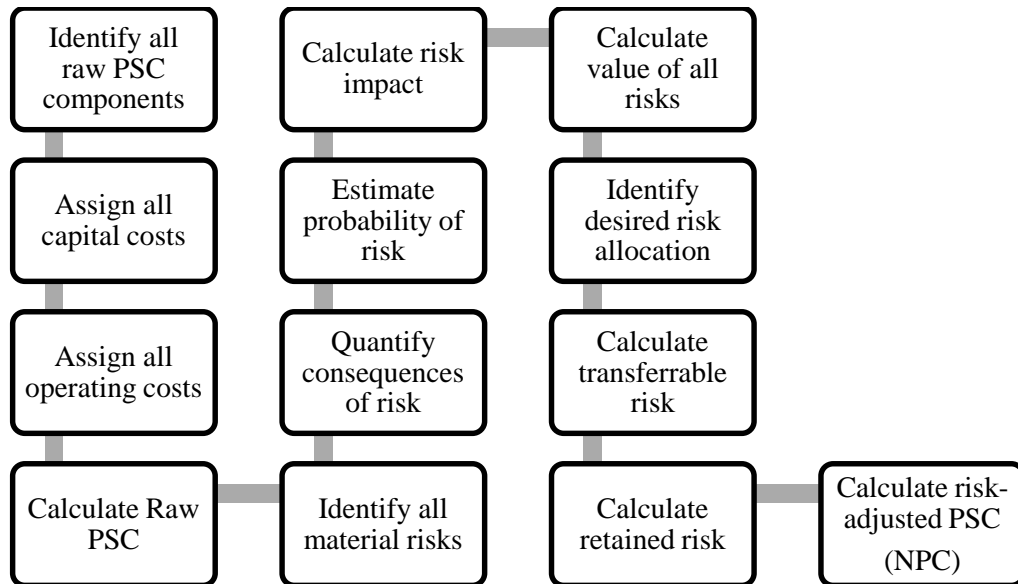


Figure 3.4: PSC Methodology

3.3.1 Raw PSC

The raw PSC is the base cost as defined earlier in section 2.6.2 in the literature review. It is the capital and operating costs to the government before any risks are taken into account.

Figure 3.4 shows the different components of the raw PSC.

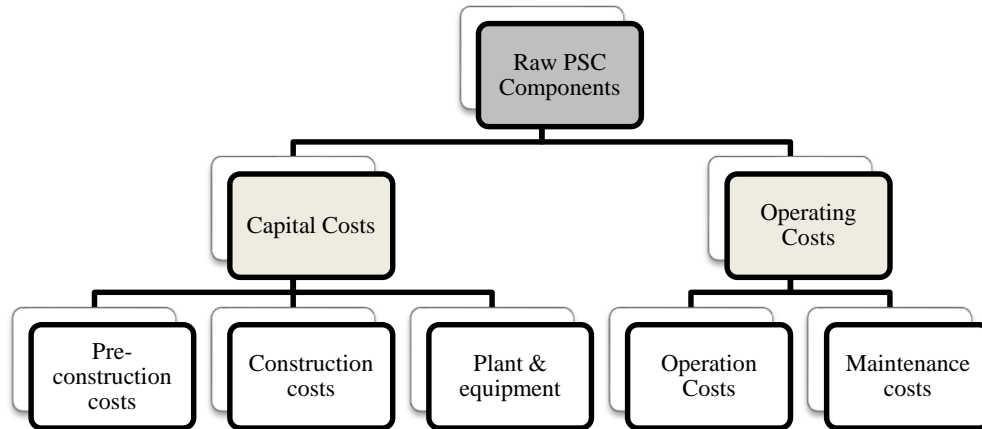


Figure 3.5: Raw PSC Components

The raw PSC is calculated through the following steps:

Step 1: Identify raw PSC costs

- Forecast all material costs over the life of the project.

Step 2: Assign all capital costs

This step includes assigning all direct and indirect capital expenditures. Capital costs are pre-construction costs (such as design fees, land and development costs, etc.), construction costs, and plant and equipment. Capital costs may also include major maintenance costs for capex components.

There are also some factors that need to be considered when determining the capital and maintenance costs such as the periodic maintenance requirements, the capital improvements and upgrade to existing facilities, and the capital expenditure of additional facilities (expansion). The whole life cost of maintaining the asset should have the same standards required from the private sector.

Step 3: Assign all operating costs

This step also includes assigning all direct and indirect operating and maintenance costs. Direct operating costs are associated with the daily operation of the infrastructure and related services. It includes cost of inputs, employees directly involved in the service provision (wages and salaries, training and development, etc.), direct management costs and insurance. Indirect operating costs are other costs incurred that are not directly related to the service provision. It includes corporate and administrative overheads such as running costs (power, stationary, etc.), and noncore IT and equipment (used for administration).

Maintenance costs are associated with maintaining the capability and quality of the existing asset rather than improving it. It includes raw materials, tools and equipment, and labor required for maintenance (wages and salaries).

Step 4: Calculate Raw PSC

The non risk-adjusted raw PSC is calculated by adding the net present values of all costs

$$\text{Raw PSC} = \text{NPV of operation and maintenance costs} + \text{NPV of capital costs}$$

3.3.2 Retained and Transferable Risks

Risks are the additional costs above the base case assumed in the raw PSC. The PSC must include a comprehensive and realistic pricing of all quantifiable and material risk in order to provide a VFM test against PPP option. The failure to include a financial assessment of material risk may lead to a significant mispricing or underestimation of the PSC. A survey report of projects in the United Kingdom found that risk transfer accounted for approximately 60% of the total cost savings across a sample of projects (Melbourne Partnerships Victoria, 2001). The methodology of identifying and valuing risk was described in the previous section, once all risks are valued they can be classified between retained and transferable risk.

3.3.2.1 Calculating Transferable Risk

Transferable risks are those that are likely to be transferred to the private sector under PPP arrangements. The decision to allocate a risk to the private sponsors depends on their ability to manage and mitigate the risk at least cost. The value of transferrable risk in a PSC measures the cost government would expect to pay for the risk over the term of the project in a public procurement scenario. The estimated value of the transferred risk should be added to the raw PSC to reflect the full risk-adjusted expected cost to government of delivering the project. Transferable risk is calculated through the following steps:

Step 1: Analyze all material and quantifiable risks

Before the risk allocation process, the government has to ensure that all risks have been identified and comprehensively valued. One of the problems in Egypt is that the government does not identify and value all risks, thus underestimating the value of the PSC against PPP. This problem appears especially in the brown field PPP projects due to its complexity. The brown field PPP projects are existing projects that need renovation or extension.

Step 2: Identify optimal risk allocation

- Risk allocation is done by assessing which party is best able to manage and control each risk. In other words, assessing the ability of each party to reduce the probability of risk occurring and minimize the consequences of it.
- Risks are allocated between transferable, retained, and shared risks.

In Egypt, the government always bears the inflation risk, financing risk, and regulatory (or change in law) risk. However, in other countries the private sector is the party that takes the inflation risk. This depends on the economic stability environment of the country. Cost overruns and time overruns are always allocated to the private sector. An efficient risk allocation allows government to obtain greatest VFM.

Step 3: Calculate Transferable Risk

- Each of the risks should be included as a separate cash flow item and then added to form the transferrable risk component
- Calculate present value of transferrable risk using appropriate discount rate

3.3.2.2 Calculating Retained Risk

Any risk not to be transferred to a bidder is considered retained by the government. Retained risks are also calculated through the same steps as the transferable risks described earlier. Retained risks are calculated through two steps:

- Each of the risks should be included as a separate cash flow item and then added to form the retained risk component
- Calculate present value of retained risk using appropriate discount rate

3.3.3 Discount Rate

The cash flows of the raw PSC and the adjustment for project specific risks (retained and transferred) are converted into net present cost (NPC) by applying the appropriate discount rate. This allows the comparison between PSC and the PPP option (quantitative assessment) on a single cost basis. The discounting process takes into consideration two aspects; the time value of money and the systematic risk transferred to the private party.

(Systematic risks are market risks that impact all assets and are not specific to a certain project e.g. general inflation is higher than expected)

The discount rate is calculated based on the CAPM formula: $R_a = R_f + \beta_a (R_m - R_f)$

R_a : cost of capital or required return on the asset whose risk class is determined by the asset beta or systematic risk

R_f : risk free rate

β_a : the asset beta that reflects the degree of systematic risk affecting the asset i.e. the extent to which returns on the asset are expected to vary with returns on the market.

$(R_m - R_f)$: the return over the risk free rate that investors need or expect to invest in an asset.

This is known as the market risk premium

Since, the cost of the PSC is based on the assumption that all systematic risks are retained by the government and there is no any transferred risk. Thus, PSC discount rate is the *risk free rate*.

3.4 Financial Model

The financial model is the second pillar in the integrated framework approach. It is one of the fundamental tools that contribute to evaluating the potential success of the PPP projects. It is a tool needed by the government in order to estimate the price expected from the contractor during the bidding process and to negotiate with the bidders. It is also required in the value for money assessment against the public sector comparator. In this section of the study, a financial model template with its main components is developed. The design of the template model adopts a top-down approach.

3.4.1 Model Design

The design of the template is based on section 2.5.4 in the literature review and actual PPP models. The model is divided into three main categories; the assumptions (input) worksheet, calculation worksheets (for the calculation of the revenues, expenses, capex, and funding need), and output worksheet (to display the income statement, balance sheet, cash flow statement, and KPIs of the project).

Assumptions Worksheet

It is divided into; macroeconomic assumptions, funding assumptions, working capital assumptions, revenue assumptions, CAPEX and OPEX assumptions. The macroeconomic assumptions are constant for all projects; as listed in table 3-1:

Table 3-1: Macroeconomic Assumptions

<i>Macroeconomic Assumptions</i>	<i>Unit</i>
Foreign exchange rate (if applicable)	FX rate EGP/USD or Euro/USD
Annual devaluation	% per annum
Foreign inflation rate (if applicable)	% per annum
Egypt inflation rate	% per annum
Tax rate	% percentage
Number of days in a year	365 days
Number of working days	300 days
Model start year	Date
Financial statements start	Date

Table 3-2: Funding Assumptions

<i>Funding Assumptions</i>	<i>Unit</i>
Equity	% CAPEX Ranges from (10 -30%)
Total debt	% CAPEX Ranges from (70 – 90%)
Local currency debt	% Total debt Assuming no foreign currency (100%)
Interest rate paid on the debt	% Percentage On available balance
Drawdown period	Years During construction period typically ranges from 2-3 years
Repayment period	Years During operation period
Tenor	Years Drawdown period + repayment period

Table 3-3: Working Capital Assumptions

<i>Working Capital Assumptions</i>	<i>Unit</i>
Initial cash	Value (EGP)
Minimum cash maintained	As a % Sales
Initial inventory level	Value (EGP)
Inventory days	Days of COGS
Initial receivables balance	Value (EGP)
Days of receivables	Days of sales
Initial payables balance	Value (EGP)
Days of payables	Days of COGS

Revenues are calculated by multiplying the price of an item multiplied by its quantity sold respectively (revenue = Price X Quantity). Hence, the revenue assumptions include the price (USD or EGP/quantity), the increase in price (% per annum), the quantity, and the forecasted increase in quantity. It also includes any third party revenues.

CAPEX and OPEX assumptions are specific to the project. CAPEX assumptions include cost of construction of the infrastructure or building and the cost of installing the plant, machinery and/or equipment. While, the OPEX assumptions include the following: maintenance expense, increase in maintenance (% per annum), insurance premium, salaries, power consumption (if any), and the selling and administrative expenses (SG&A) (% revenues).

Calculation Worksheets

The calculation worksheets are composed of: (i) calculation of revenues, (ii) calculation of CAPEX, (iii) calculation of OPEX, and (iv) funding calculations for both debt financing and equity financing.

Output Worksheet

The output worksheet includes the three financial statements which are income statement, balance sheet, and cash flow statement, in addition to key ratios which are debt service coverage ratio (DSCR), leverage, internal rate of return (equity IRR and/or project IRR), and net present value (NPV). It also includes a summary of the following:

- CAPEX
- Drawdown of equity

- Drawdown of debt
- Total revenues
- Total costs of goods sold (OPEX excluding SG&A)
- Total operating expenses (OPEX including SG&A)
- EBITDA (earnings before interest, tax, depreciation, and amortization)
- Interest expense
- Net income
- Cash
- Total assets
- Long term debt
- Total shareholder's equity

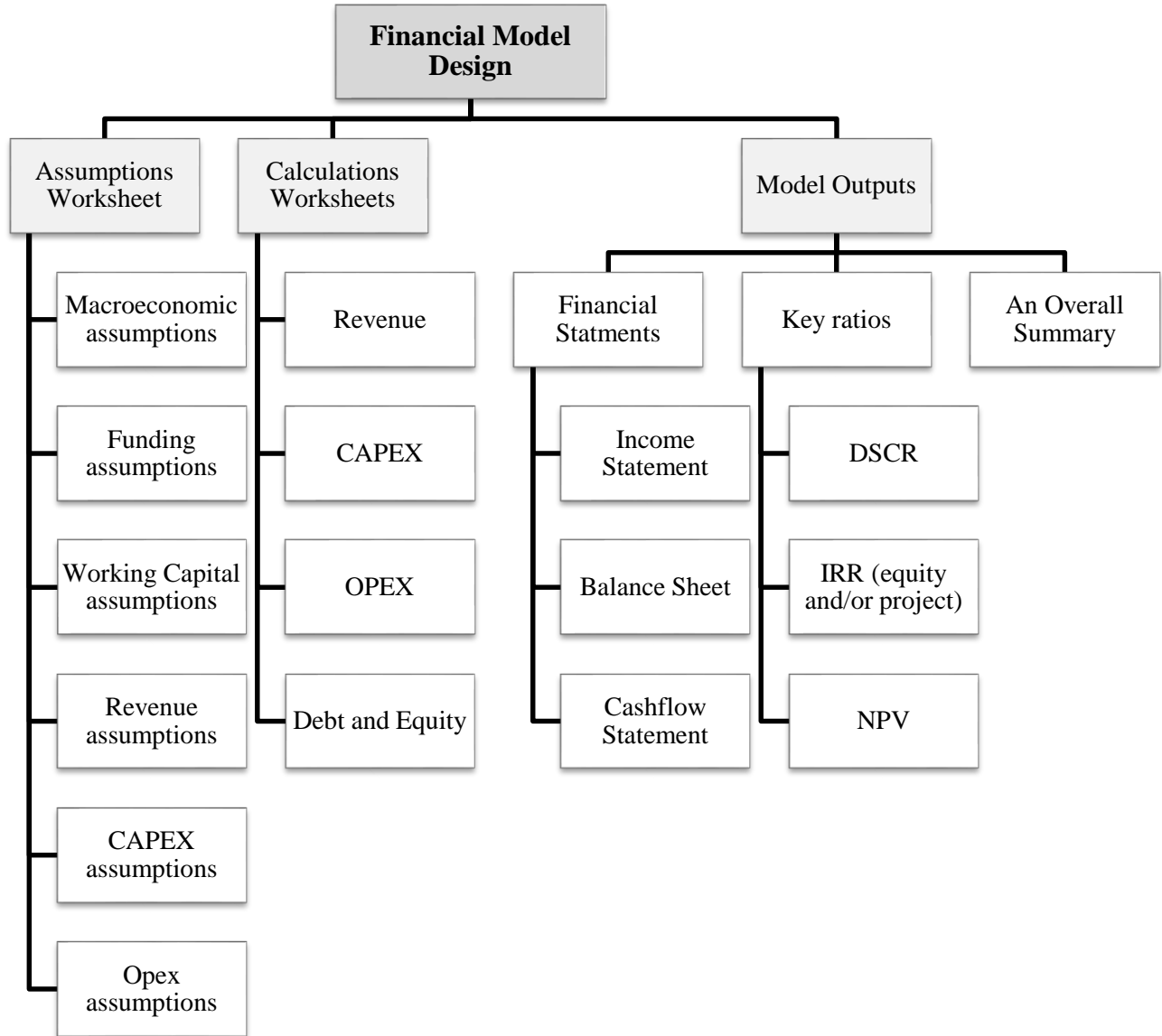


Figure 3.6: Model Design

Once the framework for the model had been conceptualized, it is further developed based on each project specifications and data.

3.4.2 Model Calculations

Revenue

There are two sources of revenues. There are revenues related to the project's core operations and there are revenues that the company derives from any source other than its operations. Revenues are a function of price and quantity.

CAPEX

The calculation of CAPEX includes the CAPEX deployed during the construction period of the project which is typically 2-3 years. During the operation period the cost of machinery, equipment, vehicles, computers, generators, etc are calculated and the cost of the total CAPEX deployed is obtained. In this model a straight line depreciation method is adopted in order to calculate the depreciation expense (depreciation expense = asset/useful life). The accumulated depreciation is then deducted from the total assets to give the net book value of fixed assets.

OPEX

The OPEX expenses are divided into fixed expenses and variable expenses. It includes maintenance expense (infrastructure, equipment, machinery, etc.), insurance expense, salaries, electricity or power consumption, and selling and administrative expenses (SG&A). The maintenance expense is a percentage assumed from the CAPEX value.

Debt and Equity

The debt and equity are calculated from the total CAPEX deployed based on their corresponding weights. The equity drawdown is usually during the construction period of the project and it includes the capitalized interest expense on debt during the construction period. It is assumed that the drawdown of debt takes place during the construction period. The project starts repaying the debt after operation. The interest expense is calculated based on the debt outstanding balance (interest expense = interest rate% X outstanding balance).

Model Outputs

The outputs to the financial model, each relate to a financial statement as previously mentioned. The model shows 5 levels of profit. The gross profit level is calculated by deducting the cost of goods sold (COGS) from the net revenues. The EBITDA (earnings before interest, tax, depreciation, and amortization) is the gross profit net any selling and administrative expenses. The EBIT is the EBITDA (explained above) net depreciation. The EBT is the earnings before tax after deducting interest expense. Finally, there is the net income, which is the EBT after deducting the tax expense for the year as shown in figure 3.6 below.

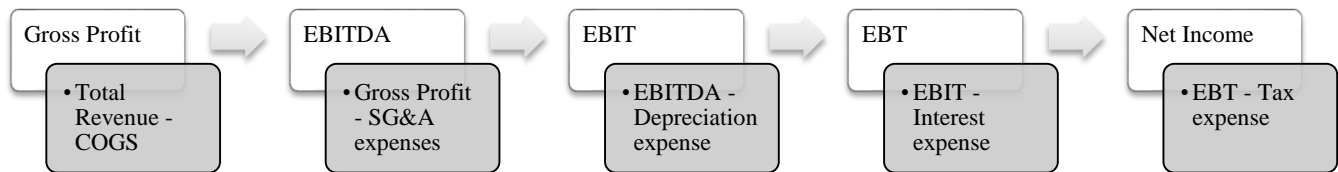


Figure 3.7: Net Profit Calculation

The balance sheet is the second financial statement showing the project’s assets, liabilities, and owner’s equity balances at a point in time. Assets are composed of current assets and long term assets. The current assets include cash, accounts receivable, and inventory. The long term assets include machinery, plant and equipment (net accumulated depreciation). Liabilities are composed of current liabilities and long-term liabilities. Current liabilities include accounts payable and long term liabilities include the long term debt. The final component of the balance sheet is the shareholder’s equity which includes paid in capital (equity funding) and retained earnings. Retained earnings are calculated by adding the net income to the retained earnings of the previous year and deducting dividends paid (RE = retained earnings of last year + net income – dividends). A balance sheet checker is included to make sure that the amount of total assets is equal to the amount of total liabilities and shareholder’s equity.



Figure 3.8: Balance Sheet Calculations

The cash flow statement has three main cash components; cash flow from operations, cash flow from investing activities and cash flow from financing activities, displayed in fig 3.8. The change in the three cash components is added to calculate the change in cash for each financial year, which is then added to the beginning cash balance to obtain an ending balance for the whole year (ending cash = beginning cash + change in cash).

Cash Flow from Operations	Cash Flow from Investing	Cash Flow from Financing
<ul style="list-style-type: none"> • Net income + depreciation expense - change in A/R + change in A/P - change in inventory 	<ul style="list-style-type: none"> • CAPEX (-ve) (subtracted from cash) 	<ul style="list-style-type: none"> • Long term debt (issuance is added and reypayment is subtracted) • New equity investments (added) • Dividends (subtracted)

Figure 3.9: Cash Flow Activities

Another component of the financial model is key financial ratios calculated based on the findings of the financial statements. These ratios include but are not limited to debt service coverage ratio (DSCR), IRR, and the net present value (NPV). According to literature, these outputs are the most important factors for the public authority. The DSCR is a measure of the cash flow available to pay for debt obligations. This factor is also important to lenders to evaluate the ability of the private sector to repay the debt. It is calculated by this formula: $EBITDA / (\text{interest} + \text{principle repayment})$. The higher the DSCR is the better project sponsor's debt paying ability. Generally, a DSCR that at least equals to or larger than 1.0 is acceptable.

The Internal Rate of Return (IRR) is a factor that measures the profitability of potential investments. It is a discount rate that makes the net present value (NPV) equal to zero. IRR is an important financial indicator for all parties (sponsors, lenders, and the government). To evaluate a project with IRR, just compare it to the estimated cost of capital. If the IRR is greater than the weighted average interest rate, the project is acceptable. Otherwise, it is a better idea to reject the project. Both project and equity IRRs could be calculated depending on the interested party (public or private). Project IRR that takes into consideration the CAPEX component (equity + debt) while calculating the cash outflows. Equity IRR takes into consideration only the equity component.

The Net Present Value (NPV) compares the amount invested today to future cash flows. It is also a measure of the profitability of a projected investment or a project. A zero value of NPV represents the break-even point of a project. If the value of the NPV is zero or positive, the project is worth investing. Conversely, if the value of NPV is negative, it is better to decline the project. The NPV is required in the bidding process to compare between different bid proposals.

A higher NPV indicates higher profitability. The NPV is calculated based on the estimated cash outflow, cash inflow, and discount rate.

3.4.3 Model Sensitivities

As described earlier in literature, sensitivities are conducted on the financial model to test the effect of variations in key input assumptions on IRR (project or equity). These key input assumptions include; change in construction costs, operating costs, maintenance costs, revenues, inflation, interest rates, and higher foreign exchange rates.

3.4.4 Shadow Bid Model

The shadow bid model is an output derived from the financial model of the project. It includes only cost estimates on privately procured PPP projects. In order to compare the net present cost (NPC) to government under conventional procurement (PSC) with PPP, all government's costs are obtained from the financial model to calculate the net present cost to government under PPP procurement. All retained risks by the government are added to the net present cost.

3.5 Value for Money (VFM) Assessment

The Value for Money (VFM) is obtained by the comparison between the PPP financial model and the Public Sector Comparator (PSC). The VFM aspect of the project is the essential element of the government decision making on PPPs. A PPP project yields VFM if the net present cost of the project is less than that obtained by public sector comparator. VFM assessment is developed through:

- i. *Quantitative assessment* - is the comparison between the net present cost to government (NPC) under PSC and the net present cost (NPC) to government under PPP as shown in the below figure.
- ii. *Qualitative assessment* - qualitative factors are not included in the PSC as they are not accurately quantifiable. The qualitative assessment includes any benefits or costs that a partnership approach may bring that are not capable of being quantified.

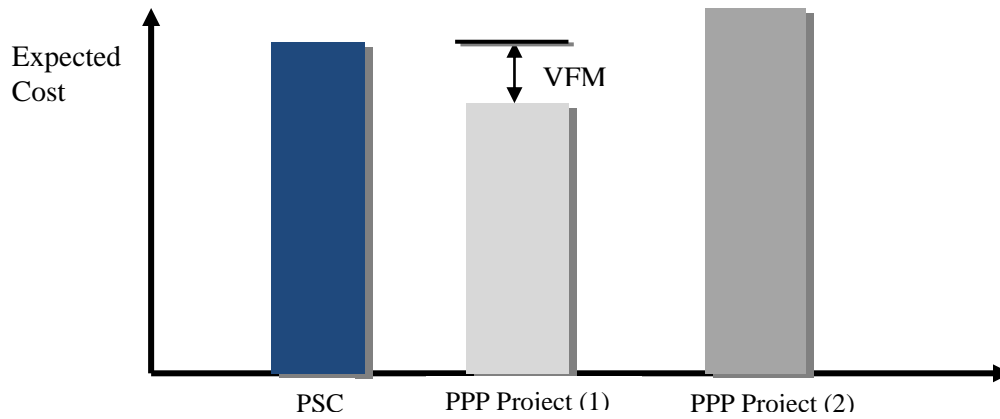


Figure 3.10: VFM Quantitative Assessment

VFM Assessment Results

Case (1) - PSC is higher than (or equal to) the PPP

In this case, the project yields value for money (VFM) and should be carried out and executed as PPP.

Case (2) – PSC is lower than the PPP

In this case, there are three reasons that could lead to this conclusion, these reasons are either:

- (1) The project is not eligible for PPP procurement
- (2) The risks are not allocated properly
- (3) The project is not well structured

The below figure illustrates both procurement options (traditional and PPP) with the following tests or assessments done by the government in order to choose the most convenient option for a certain project.

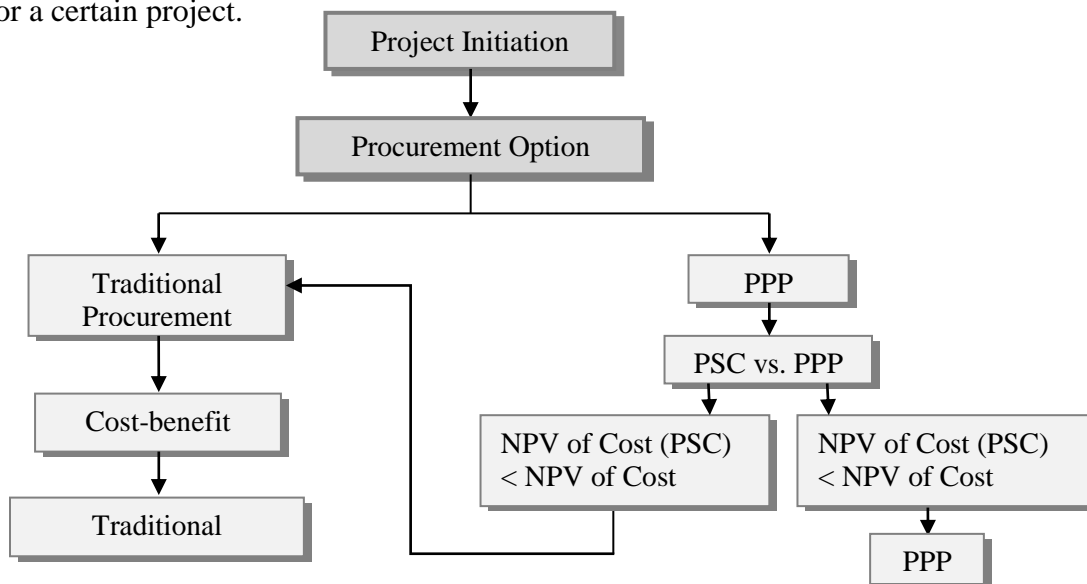


Figure 3.11: Procurement Options (Burger and Hawkesworth, 2011)

3.6 Structuring of the Procurement Process

The final pillar in the integrated framework approach for developing PPP projects is the procurement process. This section of study is a qualitative assessment for structuring a procurement model for PPP projects. In Egypt according to the previous PPP projects performed, the PPP Central Unit concluded that if the procurement process was not structured correctly it can lead to the failure of the whole PPP process. Thus, the proper handling of procurement activities is crucial to the success of the PPP project in achieving value for money. Accordingly, structuring a competitive and transparent procurement process is one of the key success factors for PPPs. This section outlines the general procurement steps in any PPP project, together with the weighing criteria for the private bidder's offers. However, structuring of the procurement model depends on the specifications of each project and it also depends on the risks that each party carries. A case study is presented in the next chapter to show and validate the idea behind structuring a procurement model custom-made for a specific PPP project and how to select bids not based on price only. Data acquired for this section are gathered from the PPP Central Unit in Egypt and the European Investment Bank (European Investment Bank EIB, 2015).

3.6.1 Bidding Steps

The bidding process of any PPP project involves a series of steps; these steps are: procurement notice, prequalification and short listing; invitation to tender; interaction with bidders; and evaluation of tenders and PPP contract award. Structuring of the procurement process focuses only on the last bidding step of evaluating tenders and PPP contract award.

Once the bids are submitted, they must be evaluated in order to select the preferred bidder. Technical bids are evaluated firstly then financial bids are compared with the government's financial model. The authority shall ensure that the technical solution proposed by a bidder is feasible, deliverable and robust and it is based on reliable technologies, that it meets all minimum technical requirements and that the costs and financial structure are consistent with the technical solution.

In some cases, only one bidder will submit a tender despite the authority (or the line ministry) having issued the invitation to tender to several shortlisted candidates. According to the Egyptian PPP Law 67 for the year 2010 that regulates Partnership with the Private Sector in infrastructure projects, services and public utilities and its executive regulations Article no.81 a

single bid may be accepted if other qualified bidders have failed technically and it appears that the bid was made in the bidder's belief that there would be a good level of competition. In other cases, this single bid is not accepted if the other bidders failed at the prequalification stage, therefore the best solution is to repeat the whole bidding process. According to Law 67/2010 and its executive regulations Article no.81, a bid price higher than that expected by the government can be accepted if the bid price is not more than 20% of that price expected the government. Therefore, in good procurement practice case by case should be considered. At the end of the procurement process the winning bidder is selected and announced.

3.6.2 Weighing Criteria

PPP projects are known for their complexity, sophistication, and long concession periods. Therefore, the technical offer of such projects has to take higher weight or percentage based on the degree of sophistication (technically) of the project. The technical offer according to common practice usually weighs 70% while the financial offer weighs the remaining 30%. The following table (3-4) shows the difference between the traditional selection process based on the Law 89 and the selection process of PPP projects according to Law 67. The Law 89 is the Tenders and Auction Law of 1998 (Law 89/1998), and its executive regulations issued by the Ministry of Finance in 1998. It governs all procurement of goods and services. However, the selection process in PPP projects was developed by the PPP Central Unit in Egypt according to Law 67 for the year 2010.

Table 3-4: Law 89 Procurement vs. Law 67/2010 PPP Procurement

Law 89 (selection based on lowest)	Law 67 (selection based on highest)
<ul style="list-style-type: none"> - Offers are evaluated on pointing system basis - The financial offer is divided by the technical offer (F/T) - The bid with the lowest point is selected assuming the technical and financial offers have the same weight (T=F). 	<ul style="list-style-type: none"> - Technical offer wt.% + Financial offer wt.% = 100% - $\frac{T_x}{T_{highest}} * wt + \frac{F_{lowest}}{F_x} * wt = 1$ (optimum or maximum value)** - By using this formula, the bid with the highest value is selected assuming the maximum or optimum value is 1. <p>(** Source: Director of PPP Central Unit in Egypt)</p>

CHAPTER 4 : APPLICATION

This chapter discusses the application of the integrated framework approach described earlier in the methodology chapter. Each aspect in the integrated framework is applied and validated on a different case study. The first section covers the first aspect in the framework which is the technical structuring of a PPP project. It explains the concept of structuring a PPP project and how it affects the success of the project by describing real cases and their solutions. It also includes structuring of risks and contractual terms that will lead to the development of the Public Sector Comparator (PSC). The second section is about applying the financial model template on the Salam to 10th of Ramadan LRT project. The outputs of the model are compared with the actual numbers for validation of the template. The third section adopts the value for money analysis process for the Wastewater Treatment Plant (WWTP) project located in New Cairo including both quantitative and qualitative assessments. It includes developing of the public sector comparator in addition to the shadow bid model. The data acquired for this section was gathered from the International Finance Corporation IFC (The PPP Central Unit advisor). The final section tackles the last aspect in the integrated framework approach. This section is a qualitative application of structuring of the procurement process. It includes the weighing criteria of bids conducted by the PPP Central Unit in Egypt and a case study to validate the concept of the customized procurement process for a specific project. All three sections summarize the full front end process of a PPP project with application and validation for each part.

4.1 Technical Structuring of the Project

As described in the methodology chapter, the technical structure of the project is the first step in developing a PPP project. It is part of the initial assessment of the project whether it should be carried out as PPP or not. The first step in structuring a project is to identify and value the risks through the steps explained in the previous chapter. After all risks are quantified, they are allocated between the public and the private sectors based on the ability of each to handle these risks. The second part of the technical structure is structuring the contractual terms of the project to make the projects desirable for lenders and service providers. The concept of these two aspects is validated by describing examples of risks and clauses, in addition to two case studies adopted from the PPP Central Unit in Egypt.

4.1.1 Managing Risks

PPP projects are known for their long term concessions. Therefore to finance such projects, sponsors will require long term debt from lenders so that the project will be able to generate revenues during the operation period to start repaying the debt amount. Usually, the loan tenor for PPP projects is 15 years or more. The problem in a locality like Egypt is that banks do not agree on loan tenors more than 7 years. As explained in the risk allocation section in the methodology, the government bears the financing risk. Therefore, this risk has to be mitigated to make PPP projects bankable and affordable. The reason banks in Egypt do not agree on long tenors is the instability of the economic environment in Egypt and the accompanying fluctuation of interest rates. Therefore, as a risk mitigation strategy the way the government structured the deal is that it agreed with the banks on a refinancing scheme. Every three years (or another agreed period) both parties will revisit the interest rate and change it. If the value of the interest rate is increased, the government will add this value to the private sector. On the other hand, if the value of the interest rate decreases, the gains will be shared equally (50% / 50%) between the government and the service provider. This is considered as an incentive for the service provider to agree on the refinancing scheme. By doing so, banks will agree to provide project sponsors with long debt tenors.

There are some cases when risk becomes a deal breaker. Any risk that cannot be quantified is considered as a deal breaker for the PPP project. The waste water treatment plant PPP project in Abou Rawash area in Egypt was considered a failure because of the environment risk. In this project, the discharge of the plant was dumped at nearby water that polluted the water and the whole area. That kind of risk may lead the private sector to go to jail; accordingly no private sector will bid for that project or bear this risk. Thus, the environmental risk in that project was considered as a deal breaker for the whole project because there are no ways to avoid it or mitigate it.

4.1.2 Structuring of the Contractual Terms

The termination term is an example of the important clauses in a PPP contract. Upon termination due to service provider default, the essential rights of the service provider shall be terminated and the service provider shall no longer have the right to use or access the site. In addition, the service provider shall bear any costs to be incurred as a result of the handover and

no compensation will be paid. In Egypt, in that case no penalty is paid by banks so that PPP projects remain bankable. The banks will take 100% of the outstanding debt assuming it has properly financed the project assets.

Upon receipt of the early termination notice sent by the government to the service provider and the lenders, the lenders shall have the right to step in to rescue the PPP project and protect their loan. They can take over the role of the service provider in the execution of the project. Lenders may notify the government of their intention to step in within a certain period of time from the date of receipt of the early termination notice. In this case, lenders shall bear all obligations and enjoy all the rights of the service provider under the contract. In case lenders decide to step in through replacing the service provider with a new entity, the new entity shall be liable for all obligations of the service provider and its right under the contract. In other cases, lenders may bring a co-service provider with the existing one to ensure the availability of the service and the inflow of cash. The PPP contract will be terminated only if lenders choose not to step in, fail in the step-in or choose to step out of the non-performing project.

In the UK, lenders are penalized in early termination of PPP projects due to private sector's default. Lenders shall only take 90% of its loan money assuming they have not properly financed the project assets. This concept is not applied here in Egypt so that PPP projects remain bankable and desirable. In other words, banks do not agree on loan tenors more than 7 years unless there is a refinancing scheme and no penalty is applied in case of early termination due to private sector's default.

4.1.3 Case Study (1) – PPP Schools Project

The concept of the technical structuring of a PPP project including managing risks and contractual terms is validated by presenting two case studies. The first one is the PPP schools project that was a pilot project developed by the General Authority of the Educational Buildings and the PPP Central Unit. The General Authority of the Educational Buildings is the authority responsible for building public schools and their maintenance. The project is composed of 345 new public schools in 18 governorates for a period of 15 years divided into 7 geographical groups. The role of the private sector was the design, construction, equipping, furnishing, maintenance, financing, and provision of non-educational services (including cleaning, pest control, security, help desk facilities, and other services of the schools). The failure of this

project was due to its technical structure. The project was tendered without an initial feasibility study due to political reasons. Therefore, as a risk mitigation strategy the project had to be restructured. The two main reasons behind this failure were:

1. The fact that the project consists of 345 schools scattered over 18 governorates increased the operating and maintenance costs of the project. The private sector shall assign different maintenance groups for each school in order to cover all schools in different areas. This task incurs very high operation and maintenance expenses on the private sector against the project's income.
2. The second reason is that the private sector is only handling the non-educational services, while the authority is the one dealing with the educational part. The fact that both the private and the public sectors have different backgrounds made the communication between both hard. Accordingly, this separation created very high friction between both sectors which rendered the project not doable.

Solution

The project was re-structured and became eligible for a PPP procurement approach. The PPP Central Unit together with the granting authority (The General Authority of the Educational Buildings) started by making the private sector responsible for all school operation including the educational services under certain conditions stated in the contract. These conditions are acknowledged in order for the government to ensure the quality of the education service provided by the private sector. Secondly, they reduced the number of schools to 290 and grouped them into nearby areas to reduce the operating expenses incurred on the private sector. The government considered providing the land with no fees to the private sector is an incentive in order to make the project desirable for private consortia.

4.1.4 Case Study (2) – Nile River Bus Ferry in Cairo

The second case study is the Nile River Bus Ferry. The project is developed by the Cairo Transport Authority (CTA), as the Tendering Authority with the technical assistance of the PPP Central Unit of the Ministry of Finance and the River Transport Authority of Ministry of Transportation. The private sector was requested to bid on a PPP tender to design, build, finance, maintain and operate the Nile river bus vessels and the provision of the new service that will be delivered through the PPP Contract. The Project includes financing and procuring the fleet;

rehabilitation of the existing piers and building new piers; in addition to the operation and the maintenance of the fleet and piers, the ownership of the new assets, new piers and fleet shall be transferred to the CTA at the end of the contract duration or upon earlier termination.

The CTA agreed that the demand risk will be allocated to the private sector; however there is no track record or log for ridership for the private sector to estimate the amount of that risk. As a result, this structuring will make the PPP project undesirable and not affordable to the private sector.

Solution

In order to overcome the problem and make the PPP project affordable, the government will give the private sector a minimum ridership in order to cover the expenses but not the profit. The PPP Central Unit is currently studying the possibility of giving this minimum ridership for only a certain period of time and not during all the concession period, assuming that the private sector should develop a track record to estimate the ridership (demand).

4.2 Financial Model Validation

The financial model template is applied on the Salam to 10th of Ramadan LRT project. The model outputs are compared to the actual numbers in order to validate that the template is running properly and all financial formulas and equations are correct. Different financial models for different projects are then compared in terms of utilization, units, funding ratios, and financial outputs.

4.2.1 Model Application on the Salam to 10th of Ramadan LRT Project

Salam to 10th of Ramadan LRT project is a railway project with lifespan of 30 years. The project is composed of the infrastructure of the railroad, the stations, and the rolling stock. The railway stops at El Salam, Shorouk, 10th of Ramadan, and Belbeis areas with total number of 11 stations. The construction of the project was supposed to start on the 31st of December 2016 and last for a duration of three years. The operation period will start at the end of year 2019 for the remaining life of the project of 27 years. As described earlier in the methodology chapter, the template design is composed of an assumption sheet, calculation sheets, and an output sheet. All the assumptions made in this exercise were computed according to the time the model was

developed in 2014/2015. The macroeconomic, CAPEX, OPEX, revenue, funding, and the working capital assumptions of the project are explained as follows:

Table 4-1: Macroeconomic Assumptions

<i>Macroeconomic Assumptions</i>	<i>Unit</i>	
FX Rate	EGP/USD (2014)	7.15
Annual devaluation	% per annum	2.5%
Foreign inflation rate	% per annum	3%
Egypt inflation rate	% per annum	10%
Tax rate	% percentage	35%
Number of days in a year	days	365
Number of working days	days	300
Model start year	Date	31-Dec-15
Financial statements start	Date	31-Dec-16

CAPEX Assumptions

The project total distance is 69.7 km (9.5 km elevated and 60.3 at grade) with a total number of stations 11 (2 elevated and 9 at grade). The total units of the rolling stock required in each year are as follows:

- In 2019 – 37.4 units
- In 2024 - 44.2 units
- In 2029 – 47.6 units
- In 2034 – 49.3 units
- Passengers per train (capacity) – 1482 Pax

The cost of construction of infrastructure is 13.88 \$/km. The cost per station elevated is 2.8 mln \$/station and the cost per station at grade is 2.38 mln \$/station, therefore the total cost of stations is 26.99 US\$ mln. The total CAPEX of infrastructure and stations is 995.1 US\$ mln (14.27 US\$/km X 69.7 km). The cost estimate of rolling stock is 13.5 \$mln/vehicle. The CAPEX implementation start year is 2016 and end 2018 with percentage per annum of 33.3%.

OPEX Assumptions

The maintenance for the infrastructure of the railroad is calculated as 0.5% of CAPEX amount of infrastructure, while the maintenance for the stations is calculated as 3% of CAPEX

amount of stations. The increase in maintenance of both is according to the Egyptian inflation rate. The maintenance of rolling stock is calculated as 1.5% CAPEX amount of rolling stock with an increase per annum according to the FX rate and foreign inflation.

The direct operating costs in this project are insurance, salaries, and power consumption (for rolling stock, depots, and stations). The assumptions are as follows:

Table 4-2: Direct Operating Costs Assumptions

<i>Insurance</i>	<i>Staffing</i>	<i>Power Consumption (rolling stock, depot, and stations)</i>
<ul style="list-style-type: none"> - Insurance premium is 0.3% from CAPEX. - Increase in insurance per annum is 0%. 	<ul style="list-style-type: none"> - No. of drivers 3.3 drivers/car - Additional staff 200 persons - Average salary per driver 2,500 EGP/month - Average salary other staff 15,000 EGP/month - Annual increase 10% 	<ul style="list-style-type: none"> - Power consumption /Train/Km 16.1 kwh/ km - Price/kwh 0.75 EGP - No. of operating hours/day 18 hrs - Length of full trip including stops 1.73 hrs - No. of trips/train/day 10 trips (no of operating hrs/day 18/1.73 length of full trip = 10 trips) - Capacity per train 1,482 pax - % of trains in maintenance 10% of total fleet - Depot power consumption per annum 568, 182 kwh - Power consumption stations at grade 200,693 kwh and elevated 375,000 kwh - Contingency 2%

Other direct operating costs are assumed to be 50 EGP mln with escalation of 10% per annum. The indirect operating costs are the selling and administrative expenses which are assumed 2% of revenues.

Revenue Assumptions

Table 4-3: Revenue Assumptions

<i>Main Revenue Source</i>	<i>2019</i>	<i>2024</i>	<i>2029</i>	<i>2034 & Thereafter</i>
No. of Passengers (pax)	464,671	594,456	730,227	846,532
Annual Increase	5%	4.2%	3%	0%
Ticket Price	10			
Increase in ticket price	5%	5%	5%	5%
Third Party Revenue (Other Revenue)				
Advertisement per station EGP	200,000			
Advertisement per train EGP	120,000			
Increase in Ad revenue	5%	10%	10%	10%
Parking Space:	500			
Cars slots per station				
Parking ticket price EGP/day	3			
Increase in parking revenue	5%	10%	10%	10%

Funding Assumptions

Table 4-4: Funding Assumptions

<i>Funding Assumptions</i>	<i>Unit</i>
Equity	% CAPEX 40%
Total debt	% CAPEX 60%
LCY Debt (local currency)	% Total debt 20%
LCY Debt	Interest rate on avg. balance 14%
LCY Debt	Drawdown years 3
LCY Debt	Repayment years 12
LCY Debt	Tenor 15 (drawdown + repayment)
FCY Debt (foreign currency)	% Total debt 80%
FCY Debt	Interest rate on avg. balance 5%
FCY Debt	Drawdown years 3

FCY Debt	Repayment years	12
FCY Debt	Tenor	15 (drawdown + repayment)

Working Capital Assumptions

Table 4-5: Working Capital Assumptions

<i>Working Capital Assumptions</i>	<i>Unit</i>	
Initial cash	EGP mln	40
Minimum cash maintained	% Sales	2%
Initial inventory	EGP	10
Inventory days	Days of COGS	30
Initial receivables	EGP	-
Receivable days	Days of sales	15
Initial payables	EGP	-
Payable Days	Days of COGS	30

4.2.1.1 Model Calculations

After inputting all the above mentioned assumptions regarding the macroeconomic assumptions, capex, opex, revenues and financing assumptions; the following was calculated; (1) Revenues, (2) Capex, (3) Opex and (4) Project Financing. The Macroeconomic assumptions applied in this model are the EGP/USD exchange rate, the devaluation rate for the exchange rate and Egyptian inflation rate. The EGP/ USD exchange rate is indexed each year by the amount of devaluation for that year. The devaluation rate for the exchange rate is fixed each year at 2.5%. The inflation rate is also fixed at an amount equivalent to 10% throughout the model.

1. The revenue component is a function of the total demand of passengers per annum and the ticket price for each passenger. The number of passengers per day for the year 2019 (start year of operations) was given as well as the percentage increase in number of passengers per annum. The total number of passengers per day was multiplied by 300 (number of working days) to obtain the total passengers per year. The demand of passengers per year was then increased by a given percent indicated in the above revenue assumptions. The cost component of the revenue – ticket price, is projected throughout the project by indexing the current ticket price in 2014 by 5%. A delinquency rate of 0% was assumed throughout the model. Other revenues in the project

are composed of advertisements in the rolling stock and stations and parking tickets for each station. The revenue advertisement in the stations is obtained by multiplying a given amount of EGP 0.2 mln by the total number of stations. The given cost of advertising is indexed throughout the project by 5% each year. Similarly, the revenue from advertising in the rolling stock is projected by multiplying the number of rolling stock vehicles each year by a given amount of EGP 0.12 mln. The cost of advertising in the vehicles was indexed by 5% per annum. The methodology for obtaining the number of stock vehicles each year will be explained later in the Capex section. The final component of other revenues is the revenue generated from the parking slots in each of the stations. The number of parking slots available per day is multiplied by 300 to obtain the number of cars per annum (150, 000 car). The number of cars per annum is then multiplied by the total number of stations (11 stations) to obtain the total available parking slots per year for all the stations (1.5 mln parking slots). The cost of parking ticket is then multiplied by the total number of available parking slots per year to obtain the total revenue of EGP 4.5 mln - generated from the parking tickets ($3 * 1,500,000 = 4,500,000$). It is important to mention that the parking ticket price is also indexed by 5% each year, up until year 2025 and then it is assumed to increase by 10% until the end of the concession period. Total revenue is a summation of the revenues obtained from the ticket sales and the revenues from advertisements and parking tickets.

Table 4-6: Revenue Calculations

Passengers Tickets	No. of passengers (464,671) * % inc. per annum	X	Ticket Price (10 EGP) * %5 inc. per annum
Ads in Stations	Revenue per station (0.2 mln) * %5 inc. per annum	X	Total no. stations (11)
Ads in Rolling Stock	Revenue per train (0.12 mln) * %5 inc. per annum	X	Total no. of rolling stock in
Parking Tickets	No. of car slots/station/day (500)*300 working days per year = 150,000 cars/year * total stations (10 excluding 1) = 1,500,000 * parking ticket (3 EGP * %5 inc. per annum) = 4,500,000 EGP/annum		

2. The Capex is composed of cost of construction of infrastructure and stations, and cost of rolling stock. The model assumed total cost of USD 14.27 mln per kilometer of construction the infrastructure and stations. The total kilometers needed are given to be equivalent to 69.74 km. It is assumed that the construction will take place over a period of 3 years, dividing the total cost of construction equally among each year. The cost of rolling stock is composed of the number of stocks needed which is given in the model to be 38 vehicles in the first year. The cost of each vehicle is USD 13.5 mln, which is indexed by the devaluation rate of the USD of 2.5%, to obtain the cost of vehicle each year throughout the concession. The cost of the rolling stock is then multiplied by the EGP/USD exchange rate to obtain the cost in EGP for each year. The order for the vehicles is made two years prior to the year it is needed. Straight line depreciation was used to calculate the depreciation expense. The accumulated depreciation was calculated by adding the depreciation expense each year starting from the date the asset was bought throughout its useful life. The net book value of the asset is calculated by deducting the total accumulated depreciation. The useful life of infrastructure is assumed to be 50 years while the useful life of the rolling stock is 30 years.

3. The three main components of Opex are maintenance, power consumption, and staff salaries. For the first year of operations, the maintenance is calculated as a percentage of the cost of capex. For infrastructure maintenance 0.5% is applied to the total cost of infra structure (EGP 11.378 mln) to give total maintenance expense for infrastructure of EGP56.9 mln. The same methodology is applied for maintenance of rolling stock and stations with percentage of maintenance of capex of 3% and 1.5% respectively. The second main cost component is the cost of power consumption of the rolling stock. The power consumption is a function of the number of kilometers traveled per annum multiplied by the fuel consumption per km. It was assumed that 10% of the total number of rolling stock was to be in maintenance throughout the day. The remaining number of rolling stock was then assumed to be completing full round trips all day. In order to find the total amount of power consumed, the number of operating hours per day were divided by the length of one trip to find out the number of trips per train per day ($18/1.73=10$) The total number of trips for all the rolling stocks were obtained by multiplying the number of rolling stocks (330 vehicles) by the number of trips made by each vehicle per day (10 trips/ day). Then the total distance covered by all trains was calculated by multiplying the total number of trips per day (10 trips/ day) by the total distance covered in each route (69.744 km). This

distance is then multiplied by 300 working days to find the distance covered per annum (6.9 mln km) To find the total power consumption, the distance covered per annum by all vehicles was multiplied by the power consumption per km ($16.1 * 6.9 = 111.1$ kilowatt hour) Then the total power consumption was multiplied by the price per kilowatt hour. ($111.1 * .75 =$ EGP 83.4 mln). Similarly the power consumption for all the stations and the depot were calculated, by multiplying the amount of power consumed by the cost of kwh. The total cost of power in the project is then calculating by adding that of the rolling stock, depots and stations. The third main component of the opex is the staff salaries. The number of drivers required per train is then multiplied by the number of trains to get the total number of staff ($3.3 * 37 = 124$ drivers). The average salary per driver is then multiplied by the number of drivers to obtain the total salaries paid per annum to drivers. The salary per annum was inflated each year by 10%. Salaries of other staff have been added by applying the same logic explained previously. Another additional opex component is the cost of insurance which is assumed to be fixed throughout the concession period. It is calculated by multiplying a fixed rate of 0.3% by the total cost of infrastructure excluding cost of stations and rolling stock. The final cost component is the Selling, General and Administrative expenses. This is a fixed cost of EGP 50 mln and is indexed each year by 10%. The total opex per year was calculated to be EGP 367 mln. This value constitutes about 5% from the initial investment of the project which is considered higher than the normal which is 2-3%. In order to account for the major maintenance or major over whole of the rolling stock cars every 8 years or another specified period; the opex amount in the model is higher than usual (5%) and it was assumed a EGP 50 mln amount each year as other opex.

All Opex calculations are illustrated in the below figure.

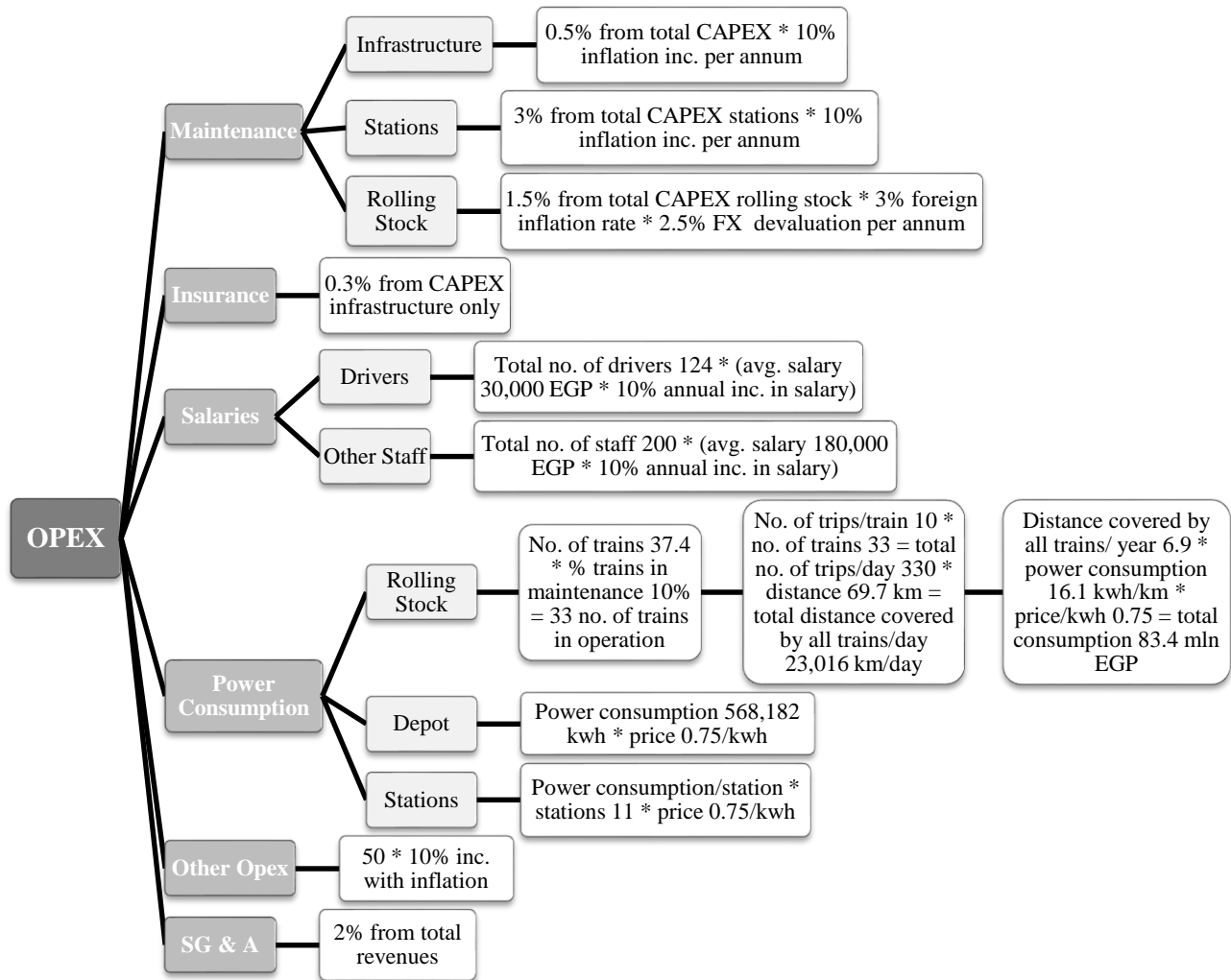


Figure 4.1: OPEX Calculations

4. The total initial investment required during the construction phase of the project is the total CAPEX which includes the cost of construction of infrastructure and stations, and initial rolling stock which is estimated to be EGP 11,377 million. According to the funding assumptions, 40% of this value will be funded through equity together with the capitalized interest expense during the construction period. The drawdown of equity is during the three years of construction. The other 60% of the CAPEX amount is funded through debt in both foreign and local currencies. The drawdown of debt will be during the construction period and the repayment will start on 31 December 2019 with the start of the operation period. The weight of the local currency debt is 20% of the total debt; therefore the total debt in local currency is EGP

1,365.3 million. The weight of the foreign currency debt is 80% from the total debt; therefore the total debt in foreign currency is \$ 709.3 million which is equivalent to EGP 5,461.1 million.

4.2.1.2 Model Outputs

As explained earlier in the methodology chapter, the outputs of the financial model are; key ratios such as DSCR and Equity IRR, financial statements, and an overall summary of the entire model. Financial statements are income statement, balance sheet, and cash flow statements.

Income Statement

The income statement is composed of total revenues and COGS to obtain the gross profit. COGs and gross profit are also calculated as a percentage of revenues. Selling and administrative expenses are deducted from the COGS to obtain the EBITDA. Depreciation expense is deducted from the EBITDA to obtain the EBIT or the total operating income. The net of the interest expense and interest income are calculated to obtain the taxable income (EBT). It was assumed in the model a 5% of annual nominal interest rate earned on cash. The interest income is calculated by multiplying the 5% earned on cash by the average of the beginning of cash assumed in the first year 2017 (40 mln EGP) and the ending cash balance calculated at the end of the same year. Tax expense was calculated by the automatic carry forward approach. The tax expenses are then deducted from the taxable income or EBT to obtain the net income. The net income of the project was in negative value for the first two years (2017 and 2018) and then it started to break-even and producing positive value by the year 2019. The net income was calculated as a percentage from revenues by starting as 21.3% in 2019 to 68.3% in 2045.

Balance Sheet

The current asset components in the balance sheet are cash, accounts receivables and inventory; while the long term asset component is the net book value of fixed assets (obtained in the Capex calculation sheet). Accounts receivables was calculated by multiplying receivable days by total revenue for each year ($15 \text{ days} * 1,405/365 = 58 \text{ mln EGP}$) and following the same methodology, inventory was calculated by multiplying the inventory days by total COGs for each year ($30 \text{ days} * 339/365 = 28 \text{ mln EGP}$). The value of the total assets was calculated by adding the value of the current assets and the long term assets for each year. Current liabilities components are revolver (short term debt) which is in this project equal to zero and accounts payable. Accounts payable was also calculated by multiplying payable days by total COGs for

each year ($30 \text{ days} * 339/365 = 28 \text{ mln EGP}$). All accounts receivables, payables, and inventory will start with the operation period of the project. The long term liability is the long term debt obtained from the funding calculation sheet. The shareholder's equity is composed of paid in capital and retained earnings. The paid in capital is the equity funding cumulative, and assuming no dividends are distributed among shareholders, thus the retained earnings are equal to the net income and the retained earnings of the previous year. Retained earnings are negative in the first three years of the project and it will yield a positive value by year 2020. The balance sheet checker indicates that all calculations are correct.

Cash Flow Statement

1. The cash flow from operations includes (net income + depreciation expense – change in accounts receivables – change in inventory + change in accounts payables)
2. The cash flow from investing activities is the CAPEX in negative value
3. The cash flow from financing activities includes long term debt issuance in positive value and repayment in negative value added to new equity investments in 2017 and 2018 (2,840 and 1,394 respectively).

The cash flows from operation, investing, and financing activities are calculated to obtain the change in cash for each year. By adding the change amount to the beginning balance of cash, an ending balance for each year is obtained.

Key Ratios

After obtaining the change in actual cash, the equity IRR was calculated. The equity IRR calculation is based on equity cash flows; the cash outflow in the first three years (2016, 2017, and 2018) is the equity investments of values 1,022, 2,840, and 1,394 mln EGP respectively, while the cash inflow is the change in cash calculated in the cash flow statements taking into account only the positive values starting from year 2019 (after equity investments). The Equity IRR for the project was calculated to be 15%.

The Debt Service Coverage Ratio (DSCR) was calculated and it started to be more than one in year 2019 (1.01) which is considered acceptable by lenders. The DSCR increased until it reached a value of 19.34 in 2031 which indicates a fine ability of the project sponsor to repay debt.

Some of the model outputs are presented in the following table (4-7) for the given years:

Table 4-7: Model Outputs

EGP millions	Year 2019	Year 2022	Year 2025	Year 2027
Leverage (Debt/debt + equity)	59%	47%	18%	0%
DSCR	1.01	1.48	2.17	2.81
EBITDA	1,038	1,440	1,946	2,357
Net Income	300	486	866	1,209
Net Income (as % of revenues)	21.3%	25.8%	34.5%	40.3%

4.2.1.3 Sensitivity Analysis

Sensitivity analysis was conducted on the following key inputs; construction costs, change in revenues (or change in demand), change in operating costs, and foreign exchange rate (FX EGP/USD), and the change in the equity IRR was calculated. The following table shows the original value for each variable and the percentage change in each with their corresponding values.

Table 4-8: Change in Variables

Variable	Unit	Original Value	-30%	-20%	-10%	0%	10%	20%	30%
Construction Cost	EGP mln	7,292.84	5,105	5,834.3	6,563.6	7,292.8	8,022.1	8,751.41	9,480.69
Change in Revenues (Demand)	No. of Passengers	464,671	325,270	371,737	418,204	464,671	511,138	557,605	604,073
		594,456	416,119	475,565	535,010	594,456	653,902	713,347	772,793
		730,227	511,159	584,181	657,204	730,227	803,249	876,272	949,294
		846,532	592,572	677,226	761,879	846,532	931,185	1,015,838	1,100,492
FX Rate	EGP/USD	7.15	5.01	5.72	6.44	7.15	7.87	8.58	9.30
OPEX	EGP mln	367	257	294	330	367	404	440	477

The results are presented in following table showing the effect of change in each variable on the equity IRR.

Table 4-9: Sensitivity Results

Key Inputs	Equity IRR						
	% Deviation in Variable from Base Case						
	-30%	-20%	-10%	0%	10%	20%	30%
Construction Cost	18%	17%	16%	15%	14%	14%	13%
Change in Revenues (Demand)	11%	12%	14%	15%	16%	18%	19%
Change in OPEX	17%	16%	15%	15%	15%	14%	13%
FX Rate	20%	18%	16%	15%	14%	13%	12%

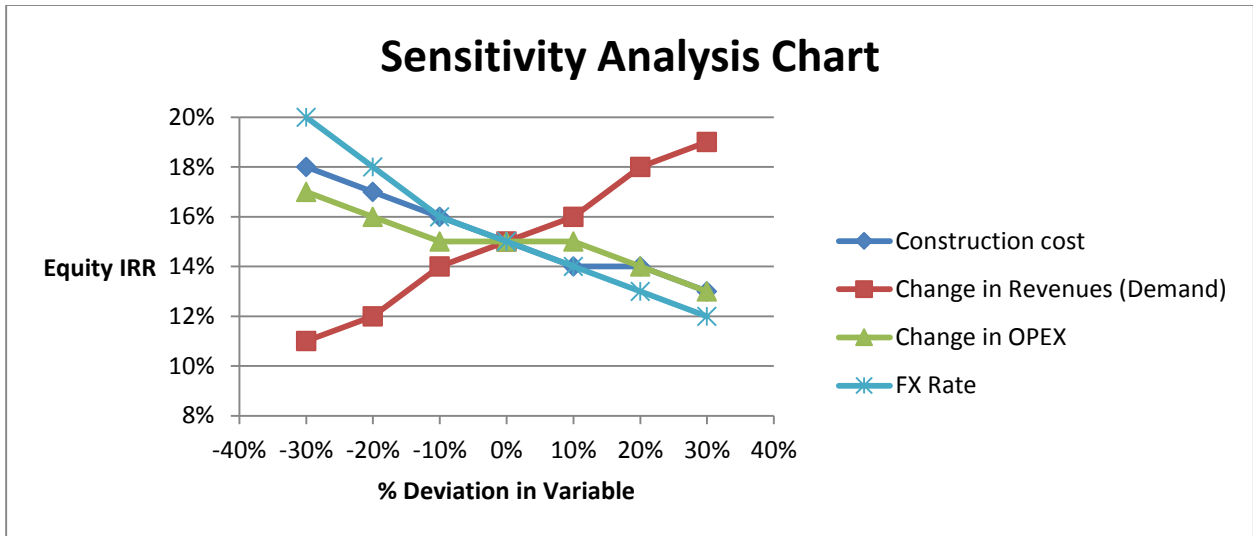


Figure 4.2: Sensitivity Chart

The chart shows that the variables with the largest effect on IRR are the FX rate and change in revenues. Changing the cost of construction from the original value and change in opex also affects the equity IRR. The foreign exchange rate which has the largest effect on the equity IRR, given the fact that 80% of the debt financing is in US dollars, was increased with the percentages shown in the below table to calculate the expected equity IRR.

Table 4-10: FX Rate Sensitivity

% Increase	FX Rate	Equity IRR
0%	7.15	15%
5%	7.51	14%
10%	7.87	14%
15%	8.22	13%
20%	8.58	13%
25%	8.94	12%
30%	9.30	12%

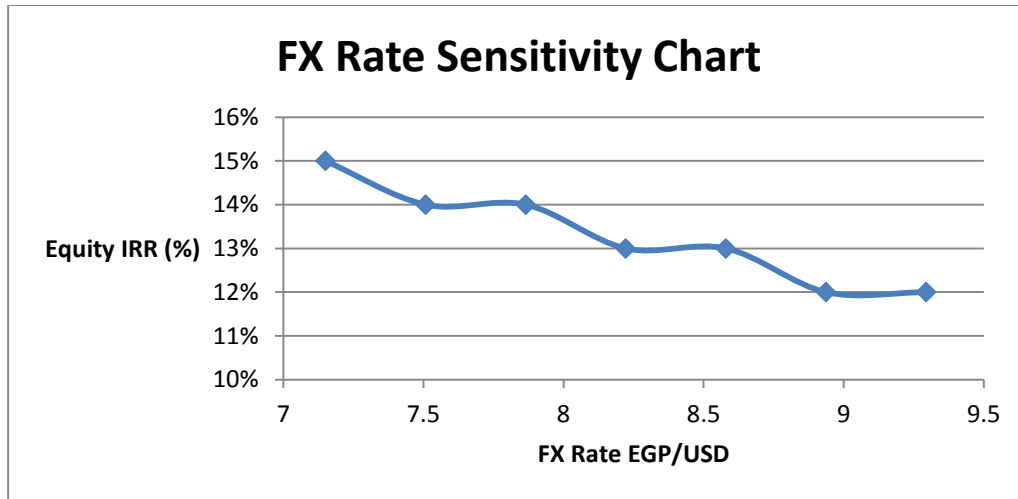


Figure 4.3: FX Rate Sensitivity Chart

4.2.2 Case Studies Comparison

The financial models of three case studies were compared according to: the type of each project, total project duration, the CAPEX or project unit, CAPEX components, funding assumptions (D/E ratios), unit of cost (OPEX), components of cost (OPEX), unit of revenue, components of revenue, IRR, and NPV. These case studies are the Salam to 10th of Ramadan LRT project described earlier in the previous section, East Port Said Port project, and the Wastewater Treatment Plant project in 5th settlement in New Cairo area. This comparison is conducted in order to show the main aspects of the financial model and how it differs from one project to another.

Table 4-11: Financial Models Comparison

Case Studies Comparison (Financial Models)			
Project Name	Salam to 10th of Ramadan LRT	East Port Said Port Project	WWTP in 5th Settlement
Duration	30 years	32 years	20 years
Type	Rolling Stock	Container Terminal + General Cargo / Roro Terminal	Waste Water Treatment Plant
Project Unit (CAPEX)	km	m ²	m ³

CAPEX Components	Infrastructure Stations Rolling Stock	Infrastructure Equipment Service vehicles Generators IT	Buildings Machinery and equipment Vehicles Computers
Funding Assumptions	Equity: 40% Debt: 60%	Equity: 50% Debt: 50%	Equity: 20% Debt: 80%
Unit of Cost (OPEX)	Rolling Stock/Drivers	Equipment/Staff	Machinery and Equipment/staff
Components of Cost (OPEX)	Maintenance: - Infrastructure - Rolling Stock - Stations Insurance Staff/Drivers Salaries Power Consumption -Traction -Depot -Stations SG & A	Maintenance: - Infrastructure (Quay Wall, Yard Infrastructure) - Equipment - IT Insurance Staff Salaries Other OPEX SG & A	Fixed operating expenses Variable operating expenses Electricity expenses SG & A
Unit of Revenue	Passengers	Containers (TEU)	Sewage Treatment Charge
Component of Revenue	Main Revenue Source: Ticket Sales. Other Revenues: Advertisements in stations and rolling stocks, parking tickets.	Transshipment Containers: Full Empty Foreign Trade: Import Export	Main Revenue Source: Capacity Charge, Fixed/variable operations charge. Other Revenues: Sludge Sales
IRR	Private Sector: Equity IRR 15%	Private Sector: Equity IRR 13% Government: Project IRR 26%	Private Sector: Project IRR 21.1%
NPV	-	Private sector (Developer) \$46.65 mln	-

4.3 Value for Money Analysis

This section adopts the value for money analysis process of the Wastewater Treatment Plant (WWTP) project in New Cairo including both quantitative and qualitative assessments. It includes the development and validation of the Public Sector Comparator model together with the shadow bid model derived from the financial model of the WWTP project. After obtaining the net present value for both procurement options (public and PPP), values are compared in order to achieve the VFM for different discount rates. The data acquired for this section was gathered from the IFC (PPP Central Unit advisor).

4.3.1 Public Sector Comparator (PSC) for WWTP Project

The PSC was developed following the same methodology described in the previous chapter. Results were validated by comparing the numbers obtained with the actual numbers given by the IFC for that project. The total duration of the WWTP project is 20 years; the construction was the first two years (2010 and 2011) in addition to the pre-construction costs incurred 6 months beforehand (i.e. in 2009). The operation phase started in the year 2012 for the remaining 18 years.

4.3.1.1 Raw PSC

1. CAPEX

The cost of construction for this project was obtained from reference projects, in other words, the conventional public works of 15 plants (small, medium, and large) constructed over the last 20 years in Egypt. It was concluded that the capital costs ranging average was 2,500-3,000 EGP/m³ for comparable plants in the year 2007. As for the major maintenance for capex components, it was assumed that mechanical equipment, civil works, electrical systems require major refurbishment once in 20 years. The pre-construction and construction costs are 106.2, 305, and 266 EGP mln for years 2009, 2010, and 2011 respectively. Major maintenance costs were calculated by adding the pre-construction and construction costs, and multiplying them with the percentages given in the following table.

Table 4-12: Major Maintenance Percentages

Year	2016	2020	2021	2023	2028
% Capex Maintenance	0.43%	1.58%	2.10%	0.61%	7.95%

The nominal values of capex were obtained by applying the following inflation rates for each year.

Table 4-13: Inflation Rates

Year	2007	2008	2009	2010	2011	2012	2013	2014	..2028
Inflation	9.9%	7%	7.2%	6.5%	4.8%	5.2%	5.5%	7%	7%

2. OPEX

The operation and maintenance costs assumptions are based on the conventional public works contracts in Egypt. The data were provided from the General Organization for Sanitary Drainage GOSD. The operation and maintenance costs were assumed to be EGP 13.7 mln/year. However, the insurance cost was accounted for in the capex (EGP 1.2 mln/year). Therefore, the O&M costs are EGP 12.5 mln/year ($13.7 - 1.2 = 12.5$ mln). The nominal values of opex were obtained by applying the inflation rates mentioned in the previous table 4-12.

4.3.1.2 Financing Costs

They are the cost of financing of the Government of Egypt to pay contractor under a public works project. The cost of funds (or interest) was assumed to be 9.5% on a 20 years term with grace period of three years (initial construction period). The beginning of year bond principal is the initial capex amount cumulative. There are three bonds; bond no1 with value of EGP 127.8 mln, bond no 2 with value of EGP 421.3 mln, and bond no 3 with value of EGP 320.2 mln. The drawdown of bonds was during the construction period of the project. Bond no.1 was collected in the first year, bond no.2 was collected in the second year, and bond no.3 was collected in the third year. Repayment for bond no.1 was calculated by dividing the bond value by the remaining years ($127.8 / 19 = 6.7$ mln), repayment for bond no.2 and 3 were also calculated following the same methodology ($421.3 / 18 = 23.4$) ($320.2 / 17 = 18.8$). Total repayment amount was calculated by adding the repayment values for the three bonds. The total bond repayment was deducted from the beginning of year bond principal to obtain the end of year bond principal. The interest paid during operation period was calculated by multiplying the interest percentage (9.5%) by end of year bond principal. The net present value (NPV) for the interest amount during operation is calculated to be added to the PSC components.

4.3.1.3 Risk Analysis

Risks were identified through two group discussions with panel of five experts as stated by the IFC. The probability and quantity (or consequence) of each risk were obtained based on international benchmarks of public works projects. A total of 25 risks were identified; 14 risks associated with construction phase and 11 with operating phase. The most significant construction risks identified by the panel are cost overrun, time overrun, changes in costs of imported goods, latent defect risk, default risk (due to government), performance risk, and assets condition. However, the most significant operating risks identified by the panel are; changes of costs in imported goods, inflation risks, maintenance risks, and regulatory risk. The following table (4-13) shows the probability of occurrence, the consequence, and the impact of each risk (impact of risk = probability X consequence) under both conventional and PPP procurement. The allocation of risks between retained, transferable and shared is also presented in table (4-13).

The value of each risk was calculated following the methodology described in the methodology chapter by multiplying the percentage impact of risk by capex for construction risks or opex for operating risks.

Table 4-14: Risk Analysis

Allocation	Risk	Description	Consequence	Risk Quantification						Risk Allocation as a %			
				Consequence (%) PSC	Probability (%) PSC	Impact (%) PSC	Consequence (%) PPP	Probability (%) PPP	Impact (%) PPP	Public Procurement		PPP Procurement	
										by SP	by Gov	by SP	by Gov
Transferable	Cost Overrun (as a % of CAPEX)	Risk that construction cost are greater than estimated	Increase in costs	25%	50%	13%	25%	15%	4%	0%	100%	100%	0%
Transferable	Time Overrun (as a % of CAPEX)	Risk that construction timelines are not met	Increase in cost including escalation of prices and time delays	25%	50%	13%	25%	15%	4%	0%	100%	100%	0%
Transferable	Design Risk (as a % of CAPEX)	Risk that the design may not achieve output specifications, hence does not accommodate demand needs	Additional cost to rectify or operate	5%	10%	1%	5%	10%	1%	0%	100%	100%	0%
Transferable	Changes in costs of imported goods (as a % of CAPEX)	Risk that exchange rate fluctuations impact on the envisaged costs of imported inputs required for construction	Additional cost or reduction in cost	-10%	100%	-10%	-10%	100%	-10%	0%	100%	100%	0%
Transferable	Insolvency Risk (as a % of CAPEX)	Risk that the service provider can go insolvent as a result of cash flow problems	Termination. If PPP, termination is subject to lender step in right	20%	15%	3%	20%	15%	3%	0%	100%	100%	0%

Retained	Interest Rate Risk (as a % of CAPEX)	Risk that the interest rate assumed by the service provider is exceeded by the actual interest rate	Increase in costs. Trigger of interest rate adjustment mechanism	10%	10%	1%	10%	10%	1%	0%	100%	0%	100%
Transferable	Latent Defect Risk (as a % of CAPEX)	Risk that a latent defect is discovered during or at the end of the construction period	Increase in costs and delay in the availability of the facility	10%	15%	2%	10%	15%	2%	0%	100%	100%	0%
Transferable	Planning Risk (as a % of CAPEX)	Risk that the proposed plan of the project will not comply with GOE's requirements	Increased planning and approval costs and perhaps design, construction, and operating costs	1%	2%	0.02%	1%	2%	0.02%	0%	100%	100%	0%
Shared	Site Risk (as a % of CAPEX)	Risk of unforeseen ground conditions	Additional costs	5%	3%	0.2%	5%	3%	0.2%	0%	100%	50%	50%
Transferable	Environmental Risk (as a % of CAPEX)	Risk of liability for losses caused by environmental damage	Additional costs	2%	2%	0.04%	2%	2%	0.04%	0%	100%	100%	0%
Retained	Default Risk (GOE) (as a % of CAPEX)	Risk that GOE will default on its obligations with SP (ex. Delay in payment)	May lead to compensation	20%	10%	2%	20%	10%	2%	0%	100%	0%	100%
Transferable	Default Risk (SP) (as a % of CAPEX)	Risk of default may arise for SP as a result of non	May lead to termination	10%	5%	1%	10%	5%	1%	0%	100%	100%	0%

		performance											
Transferable	Performance Risk (as a % of CAPEX)	Risk that the quality of service is not as required	Partial or delay in availability of service	5%	50%	3%	5%	50%	3%	0%	100%	100%	0%
Transferable	Assets Condition (as a % of CAPEX)	Risk that the project assets condition will not be in the required condition for hand back to the GOE	Increased costs. There may be a delay in handover of the plant or delay in operations after handover	20%	30%	6%	5%	15%	1%	0%	100%	100%	0%
Transferable	Odor Risk (as a % of O&M)			10%	25%	3%	10%	2%	0.2%	0%	100%	100%	0%
Transferable	Effluent Wastewater Quality Risk (as a % of O&M)	Risk that effluent wastewater does not meet required output specifications		10%	5%	1%	10%	5%	1%	0%	100%	100%	0%
Transferable	Sludge Risk (as a % of O&M)	Risk that sludge does not meet required output specifications		2%	5%	0.1%	2%	5%	0.1%	0%	100%	100%	0%
Transferable	Changes of costs in imported goods (as a % of O&M)			30%	40%	12%	30%	40%	12%	0%	100%	100%	0%
Retained	Inflation Risk (as a % of O&M)	Risk of inflation during O&M period	Increased costs	50%	50%	25%	50%	50%	25%	0%	100%	0%	100%
Transferable	Operating	Risk that	Increase in	1%	5%	0.1%	1%	5%	0.1%	0%	100%	100%	0%

	Risk (as a % of O&M)	operating cost are underestimated	operating costs										
Transferable	Maintenance Risk (as a % of O&M)	Risk that maintenance costs differ from expectations	Increase in operating and maintenance costs	10%	30%	3%	10%	2%	0.2%	0%	100%	100%	0%
Shared	Regulatory Risk (as a % of O&M)	Risk of change in law	Increased costs	20%	40%	8%	20%	40%	8%	0%	100%	10%	90%
Transferable	Technology Risk (as a % of O&M)	Risk that the technology may fail to deliver required output specs	Increase in cost to maintain or replace obsolete technology	5%	10%	0.5%	5%	2%	0.1%	0%	100%	100%	0%
Retained	Utilities Risk (as a % of O&M)	Risk that the utilities required for operation of the plant may not be available	Delay in construction or operation of the plant	10%	5%	0.5%	10%	5%	0.5%	0%	100%	0%	100%
Transferable	Public Liability Risk (as a % of O&M)	Risk for liability for injury or damage to any property or item on the premises	Compensation costs	5%	25%	1%	5%	2%	0.1%	0%	100%	100%	0%

4.3.1.4 Discounted PSC

The net present value for capex, opex, financing costs, transferable risks, retained risks, and shared risks were calculated at different discount rates, however the base case is the 12%, in order to obtain the risk-adjusted PSC.

Table 4-15: Risk Adjusted PSC

NPV (EGP millions, discounted)	10%	11%	12%	13%	14%
Raw PSC					
Capital Costs (CAPEX)	766	744	723.0	704	686
O&M Costs	163	148	133.7	121	111
Subtotal	929	892	857	825	797
Financing Costs					
Financing Costs	363	340	319.0	300	282
Total non risk adjusted PSC	1,292	1,232	1,176	1,125	1,079
Transferable Risks					
Cost Overrun	95.7	92.9	90.4	88.0	85.8
Time Overrun	95.7	92.9	90.4	88.0	85.8
Design Risk	3.8	3.7	3.6	3.5	3.4
Changes in costs of imports	(76.6)	(74.4)	(72.30)	(70.4)	(68.6)
Insolvency Risk	23.0	22.3	21.7	21.1	20.6
Latent Defect Risk	11.5	11.2	10.8	10.6	10.3
Planning Risk	0.2	0.1	0.1	0.1	0.1
Environmental Risk	0.3	0.3	0.3	0.3	0.3
Default Risk (Service Provider)	3.8	3.7	3.6	3.5	3.4
Performance Risk	19.1	18.6	18.1	17.6	17.2
Assets Condition	45.9	44.6	43.4	42.2	41.2
Odor Risk	4.1	3.7	3.3	3.0	2.8
Effluent Wastewater Quality Risk	0.8	0.7	0.7	0.6	0.6
Sludge Risk	0.2	0.1	0.1	0.1	0.1
Changes in costs of imports	19.6	17.7	16.0	14.6	13.3
Operating Risk	0.1	0.1	0.1	0.1	0.1
Maintenance Risk	4.9	4.4	4.0	3.6	3.3
Technology Risk	0.8	0.7	0.7	0.6	0.6
Public Liability Risk	2.0	1.8	1.7	1.5	1.4
Subtotal	255.1	245.4	236.7	228.7	221.4
Retained Risk					
Interest Rate Risk	7.7	7.4	7.2	7.0	6.9
Default Risk GOE	15.3	14.9	14.5	14.1	13.7
Inflation Risk	40.9	36.9	33.4	30.4	27.7
Utilities Risk	0.8	0.7	0.7	0.6	0.6

Subtotal	64.64	59.95	55.8	52.10	48.81
Shared Risks					
Site Risk	1.1	1.1	1.1	1.1	1.0
Regulatory Risk	13.1	11.8	10.7	9.7	8.9
Subtotal	14.22	12.93	11.8	10.78	9.88
Total Risks	334	318	304.3	292	280
Total risk adjusted PSC	1,626	1,550	1,480	1,417	1,360

The Following chart shows the components of the PSC (raw PSC, financing costs, retained risks, transferable risks, and shared risks) at different discount rates

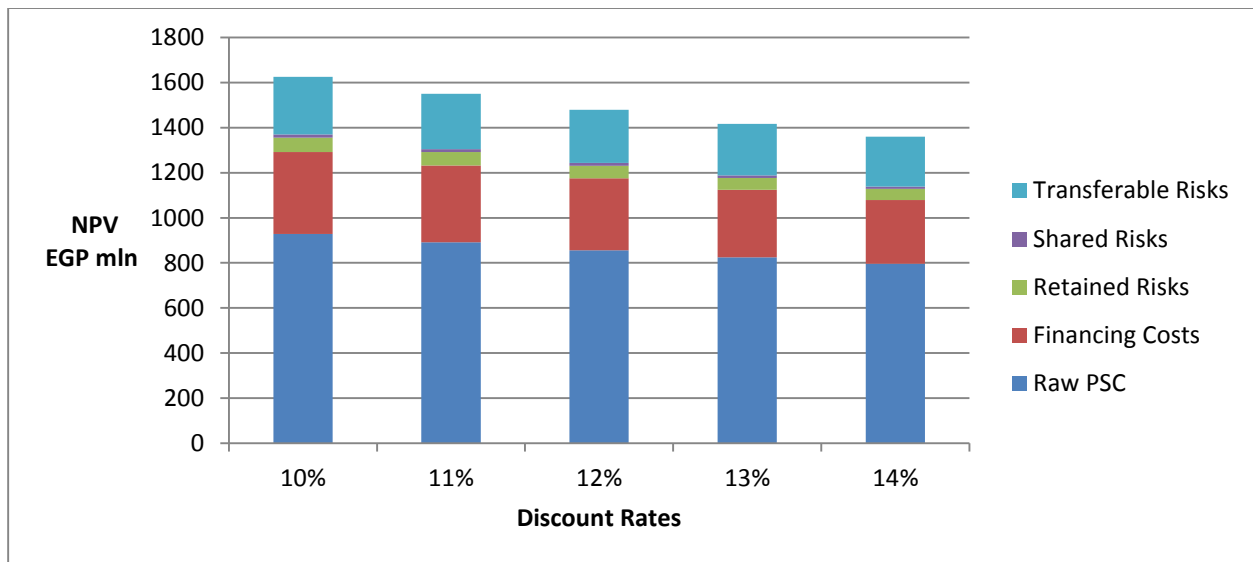


Figure 4.4: PSC Components

4.3.2 Shadow Bid Model for WWTP Project

The shadow bid model data is derived from the financial model of the project which includes cost estimates on privately sector procured PPP projects. The financial model is considered just a tool, thus in order to compare the net present cost to government (NPC) of conventional procurement (PSC) with PPP, all government costs are obtained from the financial model to calculate the net present cost to government if project was carried out by PPP procurement. The financial model of the WWTP project was obtained from the International Finance Corporation (IFC).

4.3.2.1 Assumptions

CAPEX Assumptions

Capex assumptions in the model are composed of pre-construction costs, construction costs of the wastewater treatment plant and other construction, and major maintenance. The following table (4-15) shows the assumptions of the pre-construction and construction costs. Major maintenance for capex is given at year 2016, 2020, 2021, 2023, and 2028 to be EGP mln 2.6, 9.8, 13, 3.8, and 49.2 respectively.

Table 4-16: CAPEX Assumptions

Costs (EGP mln)	2008	2009	2010	Total
Pre-Construction	53.5			53.5
WWTP Construction		309.6	132.6	442.2
Other Construction		49.1	73.6	122.7

OPEX Assumptions

Operating Costs are incurred starting the first year of operation 2012; it is divided into fixed portion and variable portion. The fixed portion is composed of wages, consumables, insurances, and performance bond fees to be EGP 11.6 mln. The variable portion is composed of consumables (chemicals, spare parts, other consumables) which has the value of EGP 4.8 mln. Thus the total value of opex is EGP 16.5 mln. Opex is indexed to the local Producer Price Index (PPI) throughout the contract duration (until 2029) except for (i) insurance premium; and (ii) performance bond fees, which are not indexed. The inflation values are the same values illustrated in the previous section in table (4-12).

4.3.2.2 Costs

In this project, it was agreed that the government will pay a service availability payment to the service provider each year during the operation period, in order to cover all his expenses, financing costs, and profit. In other words, the availability payment is required to cover the Sewage Treatment Charge (STC) which is composed of capacity charge (CC), fixed operating charge (FC) in nominal values and variable operating charge (VC) in nominal values. The STC was paid at start of operations (i.e. after construction period). In addition to availability payment, as described earlier electricity costs are added back to the government (it is excluded from opex

calculations in the model) due to the 'pass through' concept stated in the PPP contract. Therefore, costs to government in this project under PPP procurement are the availability payment and the electricity costs.

1. Availability Payment

The service availability payment or the sewage treatment charge was calculated by adding the capacity charge, insurance, fixed charge, variable charge, and inflation. All values are derived from the WWTP financial model. The capacity charge was calculated in the model by setting a target return on equity (ROE) that equals to 22%. By doing so, the model will generate this fixed portion of the tariff that will give the required ROE. The capacity charge value is EGP 177 mln/year.

It was assumed in the model that insurances are composed of; insurance breakdown policy, insurance against theft, third party insurance, civil liability insurance, and insurance against pollution. The insurance value is EGP 1.2 mln/year.

The fixed operating charge value was calculated to be EGP 8.2 mln/year, while the variable operating charge was calculated to be EGP 4.9 mln/year. Inflation adjustments were calculated only on the fixed and variables operating charges.

2. Electricity Costs

Electricity costs are divided into: (i) electricity connection cost which is part of the fixed opex and represents 5% from the total fixed operating expenses; and (ii) electricity consumption cost which is part of the variable opex and represents 49% from the total variable operating expenses. It was assumed in the model that the electricity connection cost is 9.5 EGP/month while the electricity fixed load is 4,530 KW. Thus, the electricity connection cost per year was obtained by multiplying the cost 9.5 EGP/month by 12 months by the fixed electricity load to get 516,466 EGP/year ($9.5 * 12 * 4530 = 516,466$). This amount is inflated each year by the inflation rates presented earlier in the previous section starting from the year 2012.

As for the variable portion, it was assumed that the electricity consumption cost is 0.21 EGP/kwh. The quantity of electricity purchased per day was calculated by deducting the electricity generated per day from the electricity consumed per day for each year. The total electricity consumption cost was calculated by multiplying the electricity cost per kwh by the quantity of electricity purchased per day, this amount was then multiplied by 365 days to get the consumption per year ($0.21 * 56,259 * 365 = 4,394,405$ EGP). The electricity consumption amount

per year was inflated by the inflation rate given for each year in the previous table (5-2) starting from year 2012.

4.3.2.3 Adjustments

The PPP value was adjusted by corporate taxes, as they are revenues to the government. Thus, taxes were deducted from the total cost to the government under a PPP. Taxes values were also derived from the financial model of the project. It was assumed a 20% corporate tax. Taxes were calculated by multiplying the 20% by the EBT (profit or earnings before taxes).

4.3.2.4 Risk Analysis

Most risks are transferred to the private sector under the PPP scheme; however, some risks remain fully or partially shared with the government. These risks were identified in the risk allocation process as retained or shared. These risks are interest rate risk (interest rate compensation by government), site risk (pollution risk covered by government), default risk GOE (delay in payment compensated with interest), inflation risk (compensation on fixed charge and variable charge in addition to inflation adjustments), regulatory (or change in law) risk, and utilities (or electricity supply) risk. Same methodology as in the PSC was followed in calculating the value of risks in the PPP comparator. All risk probabilities and consequences are presented in the previous table (4-13). The value of each risk was calculated by multiplying the percentage impact of risk by capex for construction risks or opex for operating risks.

4.3.2.5 Discounted Shadow Bid Model (PPP Price)

The net present value for all costs (availability payment and electricity cost), adjustment (taxes), and risks were calculated at different discount rates with the 12% as base case. Similar to the PSC, risk adjusted PPP price was obtained by adding all the present values of costs and risks and deducting taxes.

Table 4-17: PPP Price (Risk Adjusted)

NPV (EGP millions, discounted)	10%	11%	12%	13%	14%
Availability Payments	1,256	1,146	1,048.1	961	884
Electricity Costs	63	57	51.2	46	42
Retained Risks					
Interest Rate Risk	6	5	5	5	5
Site Risk	0.42	0.41	0.39	0.38	0.37
Default Risk GOE	11	11	10	10	10

Inflation Risk	42	38	34	31	28
Regulatory Risk	12	11	10	9	8
Utilities Risk	1	1	1	1	1
Subtotal	72	66	60.4	56	52
Adjustments (Taxes)	(143)	(129)	(117.2)	(106)	(97)
PPP Price (risk adjusted)	1,248	1,140	1,043	957	881

4.3.3 Value for Money (VFM) Assessment

The Value for Money (VFM) concept is the essential element of the government decision making on the PPP project. VFM assessment is done through quantitative and qualitative assessments as described in the methodology chapter. The quantitative assessment is obtained by the comparison between the risk-adjusted PPP price with the risk-adjusted PSC value. While, the qualitative assessment includes intangible factors that are not included in the PSC as they are not accurately quantifiable. These factors need to be considered in conjunction with PSC as part of a fully informed evaluation process.

4.3.3.1 Quantitative Assessment

The cost to government through conventional procurement was calculated through the PSC to give the following values in table 4-17.

Table 4-18: Cost to Government under Public Procurement - PSC

Net Present Value (EGP mln)	Discount Rate				
	10%	11%	12%	13%	14%
CAPEX	766	744	723	704	686
O&M	163	148	134	121	111
Financing Costs	362.6	339.8	319.0	300.0	282.5
Total Risks	334	318	304	292	280
PSC Price (risk-adjusted)	1,625.5	1,550.1	1,480.0	1,416.6	1,359.6

However, the cost to government under PPP procurement was calculated to give the following values in table 4-18.

Table 4-19: Cost to Government under PPP Procurement - Shadow Bid Model (PPP Price)

Net Present Value (EGP mln)	Discount Rate				
	10%	11%	12%	13%	14%
Availability Payment	1,256	1,146	1,048	961	884
Electricity Cost	63	57	51	46	42
Retained Risks	71.9	65.8	60.4	55.7	51.5
Adjustments	(143)	(129)	(117)	(106)	(97)
PPP Price (risk-adjusted)	1,247.9	1,139.8	1,042.5	956.7	880.5

The value for money (VFM) was calculated to be the following values in table 4-19.

Table 4-20: Value for Money to Government - VFM (EGP mln)

Net Present Value (EGP mln)	Discount Rate				
	10%	11%	12%	13%	14%
VFM	377.7	410.4	437.5	459.9	479.1

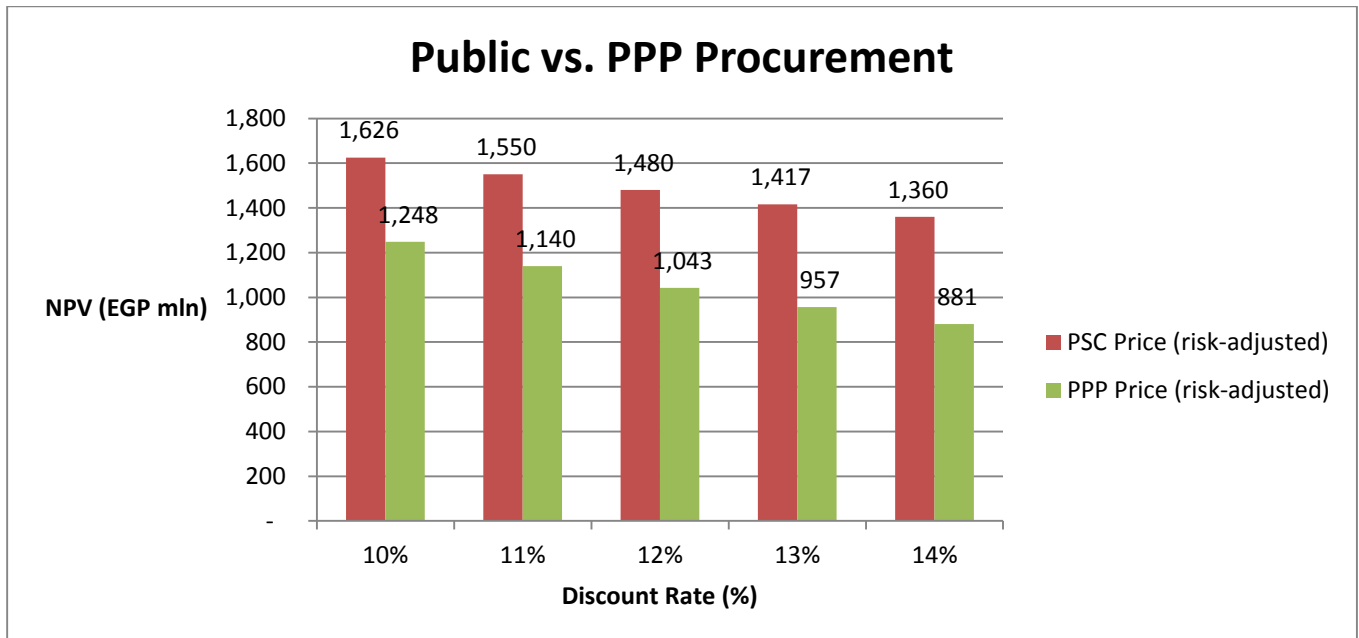


Figure 4.5: Value for Money Analysis

The chart shows cost savings for the government from structuring the project through PPP procurement as opposed to traditional public sector procurement. For a 250,000 m³/day plant, VFM estimates were around EGP 437.5 million at 12% discount rate over a 20-year concession period. The results should only be taken as a reference to the government about the

savings that the private sponsor could generate to the government if project is carried out by PPP.

4.3.3.2 Qualitative Assessment

There are a number of qualitative intangible elements not captured in the VFM quantitative analysis that should be taken into consideration in the decision to structure PPP projects. These elements are:

- **Quality of Service:** Usually higher quality construction, maintenance and operation in PPP projects as concessionaire remains involved in the project over the long run to meet contractual targets.
- **Contract Enforcement:** Contracts easier to enforce under PPP scheme.
- **Institutional Capacity:** PPP contract is an incentive for government to develop local capacity to structure future PPP transactions.
- **Fiscal Savings:** Freeing up of government funds to pursue other critical sectors (e.g. Water).
- **Promotion of Competitive Markets:** Competition for a PPP contract ensures the best price to the government.
- **Innovation:** Development of local capital markets to finance future PPP transactions.

4.4 Structuring of the Procurement Process

In this section a case study is presented in order to validate the concept of customizing the procurement process. As described in the previous chapter, selection of the successful bidder does not only depend on the lowest price; however, it depends on the nature of each project and the risks assigned to each party in order to ensure the success of the project.

4.4.1 Case Study – New Cairo Wastewater Treatment Plant

The case study adopted in this section the New Cairo Wastewater Treatment Plant (WWTP). This is the same project that was presented in the financial model and the value for money sections. It is the first public-private partnership (PPP) project in Egypt. The plant will initially have a capacity of 250,000m³/day, to serve over one million people. The final capacity will be 500,000m³/day. The \$472m project contract was awarded by the Egyptian Ministry of Housing, Utilities & Urban Developments (MHUUD) through the New Urban Communities Authority (NUCA) in June 2009. With a concession period of 20 years, the contract involves design, construction, financing, operation and management of the new plant. The project ownership will be transferred to NUCA at the end of the concession period. The purpose of this project is to provide the city of New Cairo and the surrounding area with a cost-effective, environmentally safe wastewater treatment facility to meet the requirements of present and projected population growth. It is also intended to promote PPP as a model for future water and wastewater projects in Egypt.

In this project, the government took over the electricity consumption risk through following the concept of the “pass-through charge”. The “pass through charge” was stated in the contract as the amount paid by NUCA to reimburse the Service Provider for the full cost of paid electricity bills, up to the Maximum Electricity Consumption during Operations Period excluding any costs related to the initial connection charge or the construction, operation and maintenance of any transformer, electricity sub-station or back-up power. This risk was handled in the contract by stating “Maximum Electricity Consumption” relating to the maximum consumption stated by the private sector in its financial bid.

In the procurement process of this project, the selection of the successful bidder did not depend only on the lowest cost. The fact that the government bears the electricity consumption risk, the government tried to select the bidder with the higher technology offer. Bidders that

submit higher technology solutions in their offers consume less power or electricity. Accordingly, the selection of the bidder was not based on the lower cost, but on the more suitable technology level that will minimize the cost of the electricity risk to the government.

CHAPTER 5 : CONCLUSIONS

5.1 Conclusions

The research undertaken in this study depicts an integrated framework approach for PPP projects in Egypt. In spite of the scale and scope of PPPs, there remain important gaps in scholarly and practitioner understanding of how the concept has been applied. There are important aspects other than financial modeling and risk allocation that were not considered in literature that ensure the success of the PPP process. Accordingly, this thesis presents the integrated approach that considers all aspects and concepts relating to PPP projects. This integrated approach can contribute to the successful implementation of PPP projects. The integrated framework is divided into three main pillars which are; the technical structuring of the project, financial modeling, and structuring of the procurement process. In this thesis, the three pillars were subdivided into a series of steps that structure the integrated framework. Each pillar had its research methodology that was followed by an application on real life cases, and a validation exercise.

The first pillar in the research is the technical structuring of the project. The technical structuring of the project is the first step in the initial assessment of a PPP project. The initial assessment of a PPP project also includes the development of the Public Sector Comparator (PSC). The technical structuring of a PPP project includes structuring of the contractual terms, quantification, and allocation of risk. The results concluded that one of the most important risks in PPPs is the financing risk. In Egypt, this risk is allocated to the government so that PPP projects become affordable and bankable. Moreover, as a risk mitigation strategy the government agreed on refinancing scheme with the banks. This section also concluded that risks that cannot be quantified are considered as deal breakers for the whole PPP process. Regarding the contractual terms, it was concluded that the termination term is one of the most important clauses in the contract. Upon termination due to service provider default, banks will receive 100% of the outstanding debt; however this is not the case in other countries such as the United Kingdom. This section was validated by presenting the PPP Schools project and the Nile River Bus Ferry project. In each case study, the old structure of the project was described with its restructuring to make the project eligible for PPP procurement.

The second pillar of the research is the financial modeling of PPPs. The financial model is considered vital for the success of PPP projects. It is needed to evaluate Value for Money (VFM) as opposed to the normal public procurement method. In this study, a template was developed, applied, and validated on the Salam to 10th of Ramadan LRT project. The design of the model consists of three main parts; assumptions, calculations, and outputs. By applying this design on the Salam to 10th of Ramadan LRT project, the results concluded equity IRR of 15% and Debt Service Coverage Ratio (DSCR) to be more than one (1.01) which is considered acceptable by lenders. The DSCR increased until it reached a value of 19.34 which indicates a fine ability of the project sponsor to repay debt. Sensitivity analysis was conducted on key inputs such as; construction costs, change in revenues (or change in demand), change in operating costs, interest rates (both on local and foreign currencies debt), inflation rate, and foreign exchange rate (FX EGP/USD), and the change in the equity IRR was calculated. Sensitivity analysis results showed the variables with the largest effect on the IRR are the FX rate and change in revenues. Changing the cost of construction from the original value and change in opex also affects the equity IRR.

In light of adopting the detailed front-end process of PPP projects in Egypt, this study demonstrates the value for money analysis process. The value for money (VFM) is considered the core concept of PPP projects. The financial model together with the PSC are required by the government to evaluate the VFM of a PPP project as opposed to the normal public procurement. Consequently, a value for money assessment was conducted both quantitatively and qualitatively on the Wastewater Treatment Plant project in New Cairo. The quantitative assessment compares the cost of the project to government under conventional public procurement and PPP procurement, while the qualitative assessment considers the intangible elements that are not accounted for in the quantitative assessment. The VFM assessment study involves the application and validation of the PSC methodology. The results concluded that the risk-adjusted net present cost to government under the PSC was EGP 1,480 millions, while the risk-adjusted net present cost to government under PPP was EGP 1,042 millions at 12% discount rate. However, the cost to government under both PSC and PPP were also calculated for different discount rates (10%, 11%, 13%, and 14%). Thus, this project yielded a value for money of EGP 438 millions. The qualitative aspects for this project were concluded to be the quality of service,

contract enforcement, institutional capacity, fiscal savings, promotion of competitive markets, and innovation.

Last but not least is the final pillar of the integrated framework which is structuring of the procurement process. The proper handling of procurement activities is considered crucial to the success of the PPP project. Accordingly, this section of study is a qualitative assessment of the selection and the evaluation criteria of bidders. It was concluded that a single bid may be accepted if other qualified bidders have failed technically and it appears that the bid was made in the bidder's belief that there would be a good level of competition. Moreover, the bid price shall be within 20% of the price expected by government. The weighing criteria for technical and financial offers for PPP proposals are explained according to the PPP Central Unit in Egypt and compared to the procurement law 89. The results showed that the technical offer of PPP projects has to take higher weight or percentage than the financial offer based on the degree of sophistication (technically) of the project. The technical offer weighs 70% while the financial offer weighs the remaining 30%. Moreover, the bid with the highest point value is selected assuming the maximum or optimum value is 1. The concept of customizing the procurement process was validated by the New Cairo Wastewater Treatment Plant project. The procurement model of the WWTP concludes that the selection of the bidder was not based on the lowest cost, but on the most suitable technology level bid that will minimize the consumption of electricity, thus reduce electricity costs to the government.

Finally, the implementation of these three pillars can wrap up the idea of the integrated framework approach that aims at ensuring the success of PPP projects. This framework was intended for governmental use; however it can be used by the different stakeholders involved in the process.

References

- Akintoye, Akintola, Matthias Beck, and Cliff Hardcastle. *Public-Private Partnerships: Managing Risks and Opportunities*. Oxford, UK: Blackwell Science, 2003. *Wiley Online Library*. Wiley Online Library, 25 Feb. 2008.
- Asenova, Darinka, and Matthias Beck. "A Financial Perspective on Risk Management in Public Private Partnership." *Public-Private Partnerships: Managing Risks and Opportunities*. Oxford, UK: Blackwell Science, 2003. *Wiley Online Library*. Wiley Online Library, 25 Feb. 2008.
- Australia. Australian Government. Department of Infrastructure and Regional Development. *National Public Private Partnership Guidelines: Volume (4) Public Sector Comparator*. Australian Government, 2013.
- Burger, Philippe. "Public-Private Partnerships: Affordability, Risk Sharing and Value for Money." OECD Meeting. Rabat. May 2008.
- Burger, Philippe, and Ian Hawkesworth. "How To Attain Value for Money: Comparing PPP and Traditional Infrastructure Public Procurement." *OECD Journal on Budgeting* 1 (2011): 1-50.
- Chan, Joseph H.L, Daniel W.M Chan, Albert P.C Chan, Patrick T.I Lam, and John F.Y Yeung. "Developing a Fuzzy Risk Assessment Model for Guaranteed Maximum." *Journal of Facilities Management (JFM)* 9.1 (2011): 34-51.
- Chan, Albert P.C, and Esther Cheung. *Public Private Partnerships in International Construction*. Routledge, 2014. *Routledge*. Technology and Engineering, Jan. 2014.
- Chang, L. and Chen, P. (2001). "BOT Financial Model: Taiwan High Speed Rail Case." *J. Constr. Eng. Manage.*, 10.1061/(ASCE)0733-9364(2001)127:3(214), 214-222.
- Chinyio, Ezekiel, and Alasdair Fergusson. "A Construction Perspective on Risk Management in Public Private Partnership." *Public-Private Partnerships: Managing Risks and Opportunities*. Oxford, UK: Blackwell Science, 2003. *Wiley Online Library*. Wiley Online Library, 25 Feb. 2008.
- Cruz, Carlos Oliveira, and Rui Cunha Marques. "Public Sector Comparator." *Infrastructure Public Private Partnerships: Decision, Management, and Development*. Verlag Berlin Heidelberg: Springer, 2013.
- Egypt. Ministry of Finance. PPP Central Unit. *The National Program for Public Private Partnership*. Cairo: PPP Central Unit, 2009.

- El Fathali, Hassan. *Private Partner Selection and Bankability Assessment of PPP in Infrastructure Projects*. Thesis. Concordia University, Montreal, Canada, September 2015. Quebec, Montreal: Spectrum Library Concordia.
- European Commission. *Guidelines for Successful Public Private Partnerships*. 2003.
- European Investment Bank (EIB). *How to Prepare, Procure, and Deliver PPP Projects*. European Investment Bank, 2015. *The Epec PPP Guide*.
- Grout, Paul A. *Value-for-money Measurement in Public Private Partnerships*. Rep. 2nd ed. Vol. 10. European Investment Bank (EIB), 2005.
- Hardcastle, C., et al. "Critical success factors for PPP/PFI projects in the UK construction industry: A factor analysis approach." *Construction management and economics* 23.5 (2005): 459-471.
- Hovy, Pauline. *Risk Allocation in Public-Private Partnerships: Maximizing value for money*. International Institute for Sustainable Development (IISD), Aug. 2015.
- Ismail, Kharizam, Roshana Takim, and Abdul Hadi Nawawi. "The Evaluation Criteria of Value for Money (VFM) of Public Private." *ResearchGate* 5 (2011).
- Ke, Yongjian, ShouQing Wang, et al. "Preferred risk allocation in China's public-private partnership (PPP) projects." *Elsevier Ltd.* 28.5 (2010): 482-492.
- Kerali, Henry. "Public sector comparator for highway PPP projects." *Online Presentation. World Bank*. Retrieved from <http://siteresources.worldbank.org/INTTRANSPORT/Resources/336291-1122908670104/1504838-1151587673078/PSCforHighwayPPPProjects-v2.pdf> on 8.23 (2006): 09.
- Khan, M. Fouzul Kabir, and Robert J. Parra. *Financing Large Projects (Using Project Finance Techniques and Practices)*. Singapore: Prentice Hall Pearson Education, 2003.
- Kong, Yong Hee. "Different Models of PPP." Retrieved from *Public-Private Infrastructure Advisory Facility (PPIAF)*: [http://www.ppiaf.org/sites/ppiaf.org/files/documents/toolkits/Cross-Border-Infrastructure-Toolkit/Cross-Border%20Compilation%20ver 2009](http://www.ppiaf.org/sites/ppiaf.org/files/documents/toolkits/Cross-Border-Infrastructure-Toolkit/Cross-Border%20Compilation%20ver%202009) (2007).
- Kurniawan, Fredy, Sri Wiwoho Mudjanarko, and Stephen Ogunlana. "Best Practice for Financial Models of PPP Projects." *The 5th International Conference of Euro Asia Civil Engineering Forum (EACEF-5)* (2015): 124-32. *Elsevier*.
- Laing, Ian, Partner, and Pinsent Masons. "Introduction to Public Private Partnerships; Where and How to Select Investments." 2011.

- Li, Bing, and Akintola Akintoye. "An Overview of Public-Private Partnership." *Public-Private Partnerships: Managing Risks and Opportunities*. Oxford, UK: Blackwell Science, 2003. *Wiley Online Library*. Wiley Online Library, 25 Feb. 2008.
- Li, Bing, A. Akintoye, P.J Edwards, and C. Hardcastle. "Perceptions of Positive and Negative Factors." *Engineering, Construction and Architectural Management* 12.2 (2005): 125-48. *Emerald Insight*.
- Macgillivray, John. "Project Finance and PPP Models." *Project Planning and Management Ltd* (2010).
- Melbourne Victoria Australia. Partnerships Victoria. Department of Treasury and Finance. *Public Sector Comparator - Technical Note*. Melbourne: Partnerships Victoria, 2001. 1-104.
- Roehrich, Jans K., Michael A. Lewis, and Gerard George. "Are public - private partnerships a healthy option? A systematic literature review." *Social Science and Medicine* 113 (2014): 110-19. *Elsevier*.
- Salman, Ahmed, Mirosław Skibniewski, and Ismail Basha. "BOT Viability Model for Large-Scale Infrastructure Projects." *Journal Construction Engineering and Management* 133.1 (2007): 50-63. *ASCE*.
- Schaufelberger, John E., and Isr Wipadapisut. "Alternate financing strategies for build-operate-transfer projects." *American Society of Civil Engineers (ASCE)*. 129.2 (2003): 205-213.
- Shen, Li-Yin , Andrew Platten, and X.P Dengc. "Role of public private partnerships to manage risks in public sector projects in Hong Kong." *the International Journal of Project Management*. 24.7 (2006): 587-594.
- Swan, Jonathan. *Practical Financial Modeling: A Guide to Current Practice*. 2nd ed: CIMA, 2008. *Elsevier*.
- Tang, LiYaning, Qiping Shen, and Eddie Cheng. "A review of studies on Public-Private Partnership projects in the construction industry." *Elsevier Ltd*. 28.7 (2010): 683-694.
- Thomson, Campbell, and Judith Goodwill. *Evaluation of PPP Projects Financed by the EIB*. European Investment Bank (EIB), 2005.
- Turhani, Altin, and Ali Turhani. "Financial Model of a PPP Project." *Journal of Modern Accounting and Auditing* 7th ser. 8.1548-6583 (2012): 975-82.
- United Nations Economic Commission for Europe. *Guide Book on Promoting Good Governance in Public Private Partnerships*. Publication no. 08.11.E.1. New York and Geneva: United Nations, 2008.

Victoria. Partnerships Victoria. Department of Treasury and Finance. *Public Sector Comparator - Supplementary Technical Note*. Partnerships Victoria, 2003. 1-91.

Western Australia. Government of Western Australia. Department of Treasury. *Public Sector Comparator Policy: Additional Policy Guidance*. Vol. 4: Government of Western Australia, 2011. 1-22.

Xu, Yelin, John F.Y Yeung, et al. "Developing a risk assessment model for PPP projects in China-A fuzzy synthetic evaluation approach." *Elsevier*. 19.7 (2010): 929-943.

Yun, Sungmin, Seung Heon Han, et al. "Capital structure optimization for build-operate-transfer (BOT) projects using a stochastic and multi-objective approach." *National Research Council of Canada*. 36.5 (2009): 777-790.

Zou, Patrick X.W., Shouqing Wang, and Dongping Fang. "A Life-cycle Risk Management Framework for." *Journal of Financial Management of Property and Construction* 13.2 (2008): 123-42. *Emerald Insight*.