Risk Management for Build, Operate and Transfer Projects within Kuwait

By

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Abstract

Infrastructure projects, based on the Build-Operate-Transfer, (BOT), method, have been of interest to governments of developed and developing countries for some time, resulting in their worldwide use. Using the BOT method enables governments to reallocate risks and rewards to the private sector for larger infrastructure projects throughout the projects' operating life. In order to implement a BOT infrastructure project successfully, one of the essential requirements is to carry out a thorough analysis of risks relating to the project including the social, economic, environmental, political, legal, and the financial aspects. Due to the fact that the type of risk study required for large-scale projects is so sophisticated, and therefore expensive and time consuming, the government, due to lack of expertise and time, often obtains a project viability study from the private sector. This can cause problems in that the private sector may incur financial losses or even bankruptcy, unless the host government guarantees compensation to the losers of the bid. Because all parties have different targets which they wish to achieve from the project, a may conflict arise and cause lengthy negotiations, sometimes lasting for years which often result in the death of the project. The greatest opportunity for a successful outcome for a BOT project is obtained when the extensive efforts and costs involved in the risk study process are shared by all parties. The responsibility of the decision maker is to identify, understand and analyze the many risk factors both, qualitative, (linguistic in nature) and quantitative, that will affect funding, procurement, developing, construction and operation, before proceeding with the build stage of the project. Firstly, it is necessary to evaluate the quantitative Risk Factors subjectively, and list them in order of importance. Secondly, conduct an evaluation of the qualitative factors and since the consideration of qualitative factors is subjective, the decision maker will often limit the number of factors being evaluated possibly resulting in inconsistent results. This study proposes a decision framework, which would be useful in determining the influence of the qualitative Risk Factors on the project management of BOT infrastructure projects. A methodology is provided to enable the identification of interrelationships between the Risk Factors and their influence on the project.

Using Analytical Hierarchy Process (AHP) techniques, which model the relationships between the Risk Factors, a validation of this approach will be sought using a decomposed evaluation method and also information obtained from three existing case studies, (the

Channel Tunnel, Sulaibiya Wastewater Treatment and Reclamation Plant and Marsa Allam Airport). The results of the decomposed approach were compared to experts' holistic evaluations for the same case studies mentioned above. The findings indicate that the decomposed approach showed a strong correlation to the holistic approach. An evaluation of the risks for the Sulaibiya Wastewater Treatment and Reclamation Plant study is provided and suggestions made to highlight risks attached to such a project before it is actually undertaken. Using the decomposed approach enables the decision maker to see the contribution of each risk compared to all of the risks in the total project and will help to determine and subsequently minimize or preventing any risk factors and so considerably improving the risk management of the project.

Keywords

BOT projects, Risk identification, Risk ranking, Risk management, Risk mitigation, Risk framework.

Dedication

This thesis is dedicated to the soul of my beloved Father, Fahad Alazemi, who recently died after a long battle with illness and to my Mother, brothers, and Sisters.

And to my beloved wife, Bothainah and my children, Fahad, Sultan, Amirah, Shaikhah, Abdulwahab, and Aziza. None of this would be possible without your love and inspiration.

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Khalid Alazemi.

List of Publications

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Table of Abbreviations

AHP	Analytical Hierarchy Process
BBO	Buy-Build-Operate
BLOT	Build-Lease-Operate-Transfer
BLT	Build-Lease-Transfer
BOO	Build-Operate-Own
BOOT	Build-Operate-Own-Transfer
BOT	Build-Operate-Transfer
BTO	Build-Transfer-Operate
CGL	Changes in general legislation affect the project
CIDDC	Changes in design during construction
CIDP	Changes in demand of the facility over concession period.
CIEP	Change in economic policies
CIPS	Changes in project specifications
COR	Cost-overrun risks
CR	Consistency Ratio
CSF	Critical Success Factors
DBFO	Design-Build-Finance-Operate
DID	Delays in design approval
DRB	Disputes Resolution board
EDC	Excessive development cost

EIFD	Error in forecasting demands for service
EIO	Error in operation and maintenance cost estimate
ELTP	Expensive and long tendering process
EM	Eigenvalue Method
FDI	Foreign Direct Investment
FRRFP	Failure to receive revenues from principal (end user)
FRF	Failure to raise finance
GCC	Gulf Cooperative Council
GDP	Gross Domestic Product
GFP	Government failure to provide permits
GI	Government instability
IDB	Inter-American Development Bank
IOM	Inappropriate operating methods
KD	Kuwaiti Dinar
KHAC	Kuwait Health Assurance Project
LCCC	Lack of commitment to concession contracts
LE	Lack of expertise
LIM	Lack of independent management
LOE	Lack of experience
LOI	Lack of integrity on the tendering process
MEW	The Ministry of Electricity and Water
MIC	Muthanna Investment Company

MOOT	Modernize-Own-Operate-Transfer
MOT	Ministry of Telecommunication
MTC	Mobile Telecommunication Company
NHA	National Housing Authority
NLS	Non-existence of the legal and regulatory system
OH	Outbreak of hostilities (wars, riots, and terrorism)
PAHC	Kuwait's Public Authority for Housing Care
PIA	Public Investment Authority
PPA	Power Purchase Agreement
PPP	Public private partnership
PRAM	Project Risk Analysis and Management
PRR	Performance related risk
RATT	Risk analysis tools and techniques,
RI	Random Index
ROO	Rehabilitate-Own-Operate
SAB	State Audit Bureau
SD	Standard deviation
SME	Small and Medium Enterprises
SPV	Special Purpose Vehicle
TEC	Touristic Enterprises Company
TML	Transmanche Link
UDC	Utilities Development Company

UGBE	Undeveloped general business environment
UK	United Kingdom
UNIDO	**United Nations Industrial Development Organization**
UOPS	Unavailability of power supply
UOT	Use of technology
UPO	Unavailability and quality of personnel to operate the facility
WTC	Wataniya Telecommunication Company

Chapter 1 Introduction

In recent years, the private sector has been increasingly involved in the provision of public infrastructure on a worldwide scale. A lack of public resources, the political move towards infrastructure deregulation, and the growth in global capital markets have all driven this progress; and governments have looked towards the private sector to fund infrastructure as a direct result of these pressures. This has been especially true in developing countries.

Whilst governments over the last few hundred years have not completely relinquished their obligation of setting up and operating their infrastructure facilities, they have very often relied upon the private sector, both to construct, and operate some public projects. In the 1980's and 1990's, as a consequence of the tightening of governments' budgets, it became unrealistic for the same governments to finance such projects. Globalization directly affected the international economy and many countries embraced privatization. As a result, several countries had to adopt market economies, (Levy 1996).

During the early 1990's, the word "privatization" became commonplace, yet we must define the meaning of this word in context. The term is widely understood when used in relation to events taking place in Africa, Asia, the former Soviet bloc, and South America for example, where industries that were previously owned by the state are sold to private, investors, (Levy, 1996). There does exist, however, another form of privatization referred to as "limited term privatization" or even a "public/private partnership, (PPP)" occurring worldwide today. This type of privatization invests risk capital in the design, financing and operation of a particular project or facility, which is to be used by the public. The project is maintained, and operated, for a defined length of time, during which money is obtained from the users of the facility by a private investment consortium. The project returns to the government, at no cost, when the consortium's time limit of ownership expires. It is expected that, by this time, the consortium will have collected sufficient revenue to recoup its' investment and to realize a profit. For projects involving the supply of water, sanitation and sewage facilities and power plants, as well as roads, dams, canals, urban and interurban rail systems, ports, and airports, it has become apparent to governments that these two types of privatization are often more cost-effective than public sector projects, (Levy, 1996).

The worldwide need for development projects is increasing continuously, especially regarding all forms infrastructure facilities. A discrepancy in the requirement of infrastructure and the ability of countries to meet their development requirements has been caused by population growth and the immense, rapid expansion of global economics. The movement towards privatization, both in developed and developing countries has increasingly involved the private sector in the improvement of the infrastructure as a more popular option. This gradually led to the demise of the monopoly held by the public sector with regards basic infrastructure facilities.

Several significant construction projects were undertaken in various countries during the 1980's when public infrastructure constructions were performed by the public sector only. The private sector has been very heavily involved in the design, funding, construction, and operation of these projects over the last ten years. Therefore, this has led to a large variety of PPP being established; each designed specifically to meet the individual project's requirements.

As a result of the reduction in public funding, governments are relying more on the private sector to improve and develop their infrastructure, mostly because the latter will often be better equipped in the following ways: mobilization of resources; provision of technical and managerial expertise; improved operating efficiency; potential for large scale injection of capital; greater efficiency in using the capital; utilization of rationalization/cost base tariffs for services; and better understanding of customer needs.

According to information provided by the World Bank (1998) since 1990, developing countries with limited incomes have used private sector companies to improve their infrastructure. Also, since 1990, the number of countries with at least one private infrastructure project increased from thirteen to fifty, which is a percentage increase from 20% to more than 80%. In these limited-income countries, the number of private investment projects grew almost every year during the 1990s until in 1997, when it reached a level of $35.1 billion. At the same time, according to Mateen (1999) more than 190 projects were auctioned by 20 companies, -a total investment of $23 billion. The degree to which each party shares the risks, obligations, and advantages of a project will determine the type of public/private partnership. Amongst all of the most common approaches to the public/private partnership, the BOT concession model, together with its several variants, has become the most favoured for the concession of privatization of infrastructure projects. However, the BOT model approach does present some challenges to the private sector in the development of infrastructure due to the complexity of BOT projects and the number of involved parties resulting and the corresponding interconnected contracts required.

In a project such as this, each party has to rely on the performance of its counterpart, and is also dependent on the work of all parties involved in the project according to (Dey, *etal*.2004). Furthermore, the project's lead time is quite lengthy with high associated upfront costs.

The ownership and operation of infrastructure projects by the private sector has also been driven by enhanced efficiency and effectiveness. However, some Governments have raised concerns that the interests of the private sector may conflict with public interests on certain issues. Structuring private participation whilst safeguarding public interests and reaping the benefits of private investments, is the responsibility, in principle, of the respective host government.

The Build Operate Transfer (BOT), scheme and other variations of it, has become the most widespread technique for encouraging investment from the private sector into infrastructure maintenance, operation and provision worldwide, with a particular emphasis on emerging markets. According to the World Bank (2003) 43% of the $720 billion US invested in emerging market private infrastructure between 1990 and 2002 was channeled through the BOT model and its' variants but 55 projects with a total value of US$20.82 billion, were either cancelled or renegotiated during the same time period.

As a result of large capital outlays and the long time scales required to generate returns for investors, BOT infrastructure projects carry an inherent risk. There is an increased probability of problems arising when such long time scales are involved. The relative amount of loss could potentially be huge, given the very large capital outlays required. Therefore the decision to invest in BOT projects is affected to a large extent by the perception of risk as (Walker and Smith 1995) discussed.

Even so, Worldwide, BOT schemes have proved to be a popular method of securing private sector finance. They are viewed as being “off balance sheet” financing for governments, as they do not inhibit the government’s already restricted borrowing capacity. It is popular belief that the private sector will carry the potential risks, which have been transferred from the public sector.

The idea of using BOT is now well recognized, however, the challenge will differ depending the host government, the project type, and the skills required of the managerial and technical teams, (Syed *et al*.2010). For example, building and operating a road based on toll income, or shadow pricing where the government pays the operator based on the actual traffic flows, involves a different type of risk to the construction and operation of a power plant for the concession period. The intention of the government is to procure adequate infrastructure enabling economic activity to grow and thrive. Therefore, from the government’s perspective there is less concern with the acquisition of assets than with the purchasing of services.

1.1 Problem Statement

The majority of countries around the world are leaning towards funding infrastructure with private finance in one form or another. The logic behind this is that the public sector no longer possesses sufficient public funds to afford the entire infrastructure required by a modern economy. In addition, the private sector is considered to be more efficient in developing, constructing, operating and maintaining facilities than is the public sector.

The development of infrastructure facilities in Kuwait has remained the government’s most important priority over the last twenty years. There has been much discussion and evaluation of other methods to develop infrastructure but the government appears to be totally convinced that using public-private-partnerships (PPP), is the preferred method to enable fast and efficient development of its' infrastructure and, as a result, PPP now holds a position of prime importance in the Kuwaiti Government's economic policy.

In Kuwait, the government’s move towards PPP includes reducing, their own involvement in various public sector companies and also increasing the involvement of the private sector in essential industries, which were originally government-funded and government operated.

In September, 1992, the Kuwait Investment Authority (KIA), implemented a three-phase privatization programme, which aimed to reconstruct the economy and reduce the country's dependence on oil for its' income. The first phase drew in new capital to the Kuwait, provided new opportunities for investment and has been a resounding success. It has helped to stimulate and revitalize the economy of Kuwait and government sector companies have been sold for $2.9 billion, (KD 906 million). The second and third phases of the privatization programme seek to bring about the privatization of various services and utilities owned by the state. These include the power, water and telecommunications industries, as well as the Kuwait Airways Corporation, the Kuwait Oil Tanker Company, and the Petrochemical Industries Company, (www.kuwait-info.org).

Kuwait's infrastructure and oil sectors are attracting remarkable levels of private investment at a time of increased population growth and considerable expansion in the country's economy. In 2006, the Bank of Kuwait reported that GDP had increased by more than 6.5% in 2005, partly due to a record level in the price of oil coupled with low inflation. Simultaneously, the overall population of the country is increasing by 8%, and Kuwait is establishing the basic framework for economic diversification, enabling it to attain a competitive edge over the next few decades. The majority of current real estate projects are concentrated on the building of facilities such as housing, hotels and office space and it has been predicted that the construction industry will receive more than $8 billion of private money (IPS 2006).

Abdul-Aziz Al-Kulaib, the Undersecretary of the Ministry of Public Works, has announced that as part of the infrastructure initiative, the Ministry is planning to undertake 500 large-scale projects worth $3 billion over the next few years, ranging from hospitals, sports facilities, motorways and public housing.

BOT projects which together are worth more than $40 billion have been initiated and include the Sabbiya Bridge as well as the Failaka and Bubiyan islands. There is a plan to develop the Bubiyan Island into a free trade zone with an oil depot, a storage area and an area for recreation. To progress the first phase of this project, Kuwait is considering bids for a container port on Bubiyan Island at a cost of $2 billion. The plan to develop Failaka Island as a tourist attraction is a further major multi-billion-dollar project and a small number of companies have pre-qualified to carry out the project using the BOT model. It is estimated that the Sabbiya Bridge project will take a few years to reach completion and is currently still at the bidding stage according to (IPS 2006).

According to IPS (2006) Mr Al-Kuliab, has stated that the number of projects currently being undertaken by the Kuwaiti government, is considered to be the largest ever in Kuwaiti history, both in terms of number of projects and monetary value. However as Al Jawder mentioned in the Al-Raqaba Magazine, in January 2006, that there is currently no designated agency or relevant organization to deal with BOT infrastructure projects in Kuwait. This lack of organization can lead to a loss of control and follow up by the state, as well as proving a major risk in the management of project implementation. Problems also exist in relation to the annulment of contracts for projects initiated in Kuwait on a BOT basis and subsequently, on the recommendations from the Audit Bureau, a number of contracts have been invalidated. For instance, one of the problems faced by BOT projects is the market's lack of long-term financial arrangements. Some financial institutions require BOT projects to present guaranteed mortgages as security for providing the required capital. However, land belonging to the state can never be identified as collateral for public funds. The Kuwaiti State Audit Bureau report in 2006 stated that the lack of legislation and clarity in providing full transparency to companies interested in investing, leads to trepidation amongst some companies about the future, for example the Council of Minister's decision to renew or reject the term for the concession after twenty years.

According to Curran (2008) the Audit Bureau were concerned about the fairness and transparency of the award processes and possible irregularities in their implementation and for this reason, in 2006, they suspended several lucrative BOT projects which had been granted to the private sector by four government bodies, including the Public Authority for Industry, the Public Customs Department, the Touristic Enterprises Company, and the Finance Ministry. The government then appointed a ministerial committee to carry out a review of these projects, and whilst the investigations were taking place, all work on any new Kuwaiti BOT projects stopped until 2008 when, in January, Law No. 7 "seeking to establish and clarify a structure for the BOT model in Kuwait" was passed by parliament, Under this new law, government bodies needed to obtain the approval of a new 'supreme committee', without which it would be impossible to enter into a BOT agreement that involved state-owned land. The committee consists of senior administrators, such as the head of the environmental authority, and is chaired by the Minister of Finance, and includes the Minister of Public Works, and the Minister of Municipality. The purpose of the committee was to reach a legal agreement on BOT policy, to review and issue approvals and to administer a sub-committee with the remit of coordinating all technical aspects of the reviews. Under the new law, the length of BOT projects would be limited to thirty years, after which they would be returned to the State 'without any consideration and compensation'. In some special cases, an extension to forty years may be granted by the committee, but this should be part of the original bid, rather than added later. This law has gone a long way to restore the credibility of the Kuwait's government concerning the BOT policy.

Certain social and political considerations can act as an obstacle to BOT projects being undertaken successfully, especially with regards to foreign investors; an example of this might be the development of Failaka Island.

There are differences in the policies and procedures of the individual Kuwaiti governments Ministries responsible for granting licenses and approvals for BOT infrastructure projects funded by the private sector. Walker and Smith (1995) suggested that all complex BOT projects should be individually analyzed in order to assess the aims of the public and private sectors, and the risks involved,.

The most suitable solution to these problems could most likely vary depending on the country and project concerned. When unexpected problems arise, the success of the BOT project can fall to the decision maker, whose overall judgment is needed in addition to the risk assessment already carried out.

Dey *et al*. (2004) acknowledged that whilst it is important to have transparency in decision making, no set of standards yet exist to provide guidance on disclosure. There are risks associated with all projects, and a high risk factor in a certain area, indicates the probability of a less than successful project outcome, (Ghosh and Jintanapakanont 2004).

In the Gulf States and in Kuwait specifically, researchers and analysts have not considered risk management of BOT infrastructure projects, this is in spite of the huge projects which have been undertaken in the Gulf States. It would be beneficial to carry out a detailed study and an in-depth risk analysis of Kuwaiti BOT infrastructure projects in order to consider the different aspects of BOT infrastructure project risk management. The types of questions which need to be asked are: What is the level of risk involved in the BOT project? And how can the effects of risk factors on BOT projects be avoided or decreased?

Most recently, during the past few years Kuwait’s economy has fallen behind other Gulf countries with a slower growth rate, despite its' strong fiscal balance, highlighting a need for a development plan as the primary source of income is oil and diversification a necessity. In 2010, Kuwait’s parliament approved a new development plan, and upon implementation, Kuwait’s economy would showcase a positive growth supported by infrastructure projects. As promised by the government, the development plan will help transform Kuwait into a major financial hub and trade centre by the year 2035. The initial stages of the plan are estimated to be completed by 2013/2014 with an estimated total cost of KWD 37.0 billion, (US $129.0 billion). However, the implementation of the plan is being held back by political disputes between the government and the general assembly members which have succeeded in slowing down the implementation of the plan, even with the newly elected government in 2011. Many projects, such as the Kuwait Health Assurance Project (KHAC), were supposed to begin in 2011 but were postponed. The anticipated projects, if put into action, will push the economy to a new level. A huge emphasis on investments is essential for Kuwait to become a financial hub in the region, according to Capital Standards, (2011).

The above discussion indicates the lack of research concerned with the current status of Kuwaiti BOT infrastructure projects risk management and the difficulties being faced. These difficulties formulate the problem statement of this research and are summarized as follows:

1. Law 7, 2008 is a legal framework to control BOT systems in Kuwait but it is unpopular with the private sector which makes commencing a BOT infrastructure process a long complicate tedious affair.

2. There is a lack of experts in the BOT infrastructure field.

3. The Government's plan to use public private partnerships for public facilities is unclear.

4. Risks in BOT infrastructure projects are not defined.

5. To date, the BOT infrastructure risk management in Kuwait have not been evaluated.

6. There is a need for the Kuwaiti government to provide a clear long term plan for financial security for the country so as to realize the ambition of Kuwait to become a financial hub in the Gulf region by 2035.

The infrastructure of Kuwait has not kept pace with its' rapid economic growth, leading to a restriction in any further growth and development. The Kuwaiti government's Plans, (2000-2005; 2006-2010) have the development of the necessary infrastructure as a priority. Recently, the Kuwaiti government has put a series of five-year plans in place, which it hopes will solve many of the problems. The enormous amount of infrastructure required cannot all be provided from public funds and there has been some experimentation using overseas private finance. However, various problems have arisen in that, although the state provides the infrastructure, the investors of private capital require adequate profit. This, they often achieve, for example, by road tolls or ensuring a guaranteed return on investment for all power supplies.

The benefits of using BOT, as discussed in Chapter 2, may well provide the necessary solution to the infrastructure projects problem in Kuwait and also the possibility of ensuring the efficiency of public projects. Although the opportunities for BOT infrastructure projects are in existence, not all of these will provide a suitable return on investment. The use of modeling to investigate the risks of each project would be a sensible way forward to consider the extent of possible BOT infrastructure projects and related opportunities for ancillary industries in Kuwait,

It is inevitable that risks are a crucial part of BOT infrastructure projects. These risks are quite complicated because of the high levels of investment, the length of each project and the complex nature of the setting up which is required when all of these risks are combined. The companies involved in the BOT infrastructure projects have responsibility for a wide range of risks during the life of the project, while responsibility for the finance, design, construction and operating risks is assumed by the public sector.

This research will focus on examining the above points, discussing the risks faced in BOT infrastructure projects in Kuwait, prioritizing the risks, and suggesting a framework to manage these risks in the Kuwaiti environment.

1.2 Rationale for the study

The timing of the study on BOT infrastructure projects risk management in Kuwait coincides with the Kuwaiti Government's ambition to encourage more private sector participation. The current move towards privatization would support the growth of infrastructure developments, with less dependency on government funding.

The Kuwaiti government's Five Year Development Plans outline the determination to continue strengthening the private sector's involvement in the development of infrastructure. For example, the three models known as: Build-Operate-Transfer (BOT) Build-Operate-Own (BOO); and Build-Transfer-Operate (BTO) encourage economic activity, increasing opportunities for the private sector. This has the additional benefit of providing employment opportunities and attracting foreign capital.

There is also a lack of information in the published literature of the risks involved in BOT infrastructure projects in Kuwait. There exists a need for data, information, and insight into the opportunities and challenges involved in the risk management of BOT infrastructure projects due to the fact that only a limited amount of research has been carried out in Kuwait relating to risks involved with BOT infrastructure projects. This study will be directed towards understanding the issues and success factors involved of the risks and in risk management of BOT infrastructure projects in Kuwait.

1.2.1 Scope of the study

This thesis investigates the risk of BOT infrastructure projects in Kuwait and considers risk factors which may have either a positive or negative impact. There are currently no records of successfully applied risk allocation principles because both the private sector and the Government are still gaining the necessary experience. Substantial effort, however, has been channelled into identifying the most important factors that affect how BOT is used in Kuwait. This study will concentrate on BOT infrastructure projects risk and will therefore be limited to projects that possess realistic demand projections and have accepted user tariffs. Consequently, the study will be limited to infrastructure-related projects; examples of these could include transport related projects such as roads and bridges, water and desalination, and power plants.

1.3 Research Questions

1. What are the risks that should be considered for BOT infrastructure projects in Kuwait?
2. How can such risks be integrated into a framework that will assist decision makers to take these risks into account and to endeavour to decrease or prevent them?

1.4 The aim of the study

The research aim is to develop a framework that will enable decision makers in the private and public sectors decide how to deal with the risks that affect BOT infrastructure projects in Kuwait and allow decision makers to investigate ways to decrease or prevent them.

1.4.1 Objectives of the Study

1. To develop a better understanding of the basic and essential concepts involved in the BOT infrastructure projects and the characteristics of the risks involved.
2. To identify the most important risk factors involved when implementing BOT infrastructure projects in Kuwait.
3. To categorize and group the various risk factors facing the implementation of BOT infrastructure projects in Kuwait.
4. Using expert opinion, to list each risk factor/group according to its' significance within the BOT infrastructure project.
5. To consider and propose a risk-management framework for BOT projects having evaluated, validated and justified the results so that decision-makers and consultants are more easily able to overcome, or at least minimize, the impact of risk factors on BOT infrastructure projects in Kuwait.

1.5 Guide to the structure of the thesis

Chapter One: Introduction

A comprehensive background to the research is provided and an explanation as to why it is being undertaken. Aims and objectives are also presented. A short summary of each chapter is also presented.

Chapter Two: Review of the literature

This chapter provides an overview of past and current practice relating to the methods used with regards to BOT Infrastructure projects. The BOT model and its' variants are introduced.

It considers how the BOT model has been developed, describes the BOT concept, the reasons for its popularity, and what the challenges are for procurement. Many of the different types of risks relating to the BOT infrastructure project methods are introduced. Examples of both successful and unsuccessful BOT infrastructure projects worldwide are presented. There is an explanation of the economy of Kuwait in general, and the needs and objectives of public private partnerships are also covered. Moreover, the chapter tackles Foreign Direct Investment (FDI) in Kuwait, with particular focus on its' evaluation. Finally, the chapter addresses the challenges facing BOT infrastructures projects in Kuwait, the effectiveness of these projects, and their impact on the economy.

Chapter three: Risk Management Strategy of BOT

This chapter analyses literature relating to risk management. The objectives of this chapter are to provide information regarding Risk leading to risk management, common risk categories, the advantages of risk management, risk assessment, type of risk analysis techniques, the assessment and evaluation of BOT performance. The chapter introduces the method of how to develop a "Risk Management Framework" for any risk in any organization.

Chapter four: Research Methodology

This chapter provides a detailed discussion of the research methods used academically. Following this, it describes the research methodology employed by the researcher and provides information on data collection techniques and data analysis. It also discusses the procedures involved in the collection of data such as questionnaires and literature review. The research methodology is divided into two main stages: "The Framing Stage", and the "BOT Risk Management Framework Stage". The research methods and data collections tools used in each stage are described.

Chapter five: the Framing Stage Questionnaire Result and Data Analysis

This chapter will attempt to evaluate the results from the first questionnaire, identify, analyses and discuss the research findings. A Risk Management Framework was developed using data collected from the expert participants and the same framework was applied to real life projects, i.e. Sulaibiya Waste Water Treatment and reclamation plant in Kuwait, the Channel Tunnel between UK and France, and the Marsa Allam Airport in Egypt.

Chapter Six: BOT Risk Management Framework Result and Discussion

This chapter analyses and discusses the second questionnaire pairwise results and theresearch findings identified and analysed in Chapter five. The chapter also proposes which of the risk factors are the most important and influential between each other within a BOT Risk Management Framework.

Chapter Seven: Model Validation

This chapter presents the evaluation strategy of the BOT Infrastructure project risk management framework so that the application of the BOT Infrastructure project risk management framework can be assessed and demonstrated in order to accomplish the research objectives. This chapter also reports on the case studies carried out using BOT infrastructure projects in Kuwait. The results of expert participants were used to assess the initial BOT Infrastructure project risk management framework and provide valuable information for any organization involved in BOT Infrastructure projects.

Chapter Eight: Conclusions and Recommendations

The conclusions of the research are covered in this chapter, starting with a general overview of the research work undertaken. Then the added value of the research is considered and how the research contributes to existing body of knowledge. Finally, suggestions for further research are given.

Chapter 2 Literature Review of BOT

The strengths and weaknesses of BOT Infrastructure project risks are now critically considered, as well as the literature relating to this research. The purpose of this research is to consider BOT infrastructure Project Risk Management with the objective being to understand the different elements of risk and risk management.

The intention is to develop a framework, which attempts to minimize, or prevent, these risks. This chapter will also introduce the Build Operate Transfer (BOT) its' history and procurement process. The core objective of this chapter is to consider the manner in which the BOT project system has been developed, its' concept, popularity, the risks involved, contract agreements involved, as well as discussing and studying the challenges for its procurement. Furthermore, BOT projects will be discussed in other countries and their successes will also be highlighted and explained and that will lead to the introduction of risk management framework in Kuwait. The general economic state of the Kuwait economy will also be considered as well as the requirements of, and objectives for, using Private Public Partnership (PPP) which can be achieved by; deregulating monopolies, selling various assets or services to the private sector or increasing the competition for existing state monopolies. In addition, the chapter addresses the challenges of BOT projects in Kuwait, the effectiveness of BOT projects in Kuwait, and their impact on the community in Kuwait.

2.1 Introduction

The general idea behind BOT projects is that customers have ownership of the service, while the supplier or manager of the service runs the facility for an agreed period of time before handing the facility over to the host government after a pre-agreed length of time. This time period needs to be sufficiently long to pay off any debts that have accrued by the private company and to provide a reasonable profit to the private company operating the facility. Over recent years, an increasing number of countries have found themselves involved with the BOT approach due to the convenience of not having to raise large amounts of capital to fund the project.

Although the concept has been around for many years, the term ‘BOT’ is relatively new. The main objective is for the private sector to be responsible for developing, operating the infrastructure projects and then transferring the facility, at no cost, back to the government when there concession period is over with a possibility of the same private company still being responsible for future operation of the facility.

When the project is proposed, the government of the host country would define the main objectives and thereafter would see its' role as guarding the public interest. However, the contractor who designs, finances, builds and operates the project will be the private sector or a consortium. The private company has responsibility for the success of the project and all the risks involved at each stage of progress. Usually, the consortium would be given a concession period after which, the contract may either be renewed or its title changed or its' ownership transferred from the private company to the government.

Under normal circumstances, the usual infrastructure services, such as the railway, water, sanitation and power supplies, are delivered as a public service by the government, which would be responsible for the finance, design, building, maintenance and operation of these utilities. However, infrastructures are becoming increasingly expensive and so; many developing countries have difficulty in obtaining resources which will provide an adequate infrastructure service to help sustain a successful economy. In addition to this, many public services are inefficient and, (may be), poorly managed.

The BOT concept was therefore proposed, not simply as a means of releasing funds and thus releasing pressure on the government, but also as a way of improving the quality of service(s). The usual practice in BOT projects is for the private company to supply equity financing of approximately: 10% to 30% of the overall cost and then to seek finance for the balance of the investment. The government usually assists the private company by providing land; and tax relief on the purchase of equipment and materials, as well as tax reduction in the profits from the project (Levy1996).

Due to the very high demands for capital to fund infrastructure projects, conventional financing methods are no longer adequate. Over the last 75 years it has been public sector which has mainly financed infrastructure facilities, whereas previously it fell to the private sector.

One example of this was the railway network in the UK and also the Suez and Panama canals. The Suez Canal was increased by 195 km in 1869 and had a 99 year concession period, (Shirong 1998).

Many governments have undergone a change in attitude over recent years, and have opted for the BOT approach to infrastructure. The first country to use the BOT technique for infrastructure projects was Turkey in 1984 in the construction of power stations; The phrase BOT was introduced by Turkat Ozal, the Turkish prime minister at the time in 1984, (Tiong, 1990; Walker and Smith, 1995; Wahdan, 1995). Ever since, the BOT approach has been greatly in demand worldwide.

McLellan (1996) suggests that the requirements for the new BOT approach have increased extremely quickly and that the reasons for its; popularity should be considered and understood. It is also important to develop theories, methodologies and tools which will ensure the successful increase in the implementation of BOT projects. This rapid worldwide development of the BOT approach is a major concern for many leading international construction companies due to the fact that many countries have different approaches to risk assessment meaning that there is no internationally agreed form of contract and each project is treated individually, (Walker and Smith 1995)

There are many opportunities, and challenges due to the difficulty, involved in BOT infrastructure project procurement. Its' complexity requires a special understanding of the underlying philosophy of BOT and in some countries in particular, special methodologies need to be developed for effective BOT implementation.

2.2 The Evaluation of the BOT Approach

The private sector first became involved in the provision of infrastructure in seventeenth century Europe. At this time there was an increasing demand for long distance travel and transport. The need for infrastructure facilities was very great including canals, and turnpikes, (toll roads), and a great amount of money was required to finance these projects. The governments’ tax systems at that time only serviced heads of state and any possible wars in which they might be involved. This resulted in infrastructure projects being left for individuals to finance and construct. Fortunately, improvements in industrial output due to the industrial revolution, and the resulting revenues enabled governments to fund and support their own infrastructure. However, for special projects, franchises and concessions were adopted, (Shirong 1998).

The BOT approach is particularly relevant for large projects, since the private sector finances, builds and operates a revenue-generating project, which would previously have been undertaken by the public sector.

According to Walker and Smith (1995) there are two main stages for the emergence of the idea of using private finance to build infrastructure. The first of these stages began more than 200 years ago when the concept of the BOT project was first used; and the second is the new wave development stage, which took place in the early 1980's.

The French adopted the BOT concept in the mid-1800's when need for the distribution of water paved the way for the first concession, granted in Paris to the Perrier Brothers in 1782 (Monod 1982). After 1830, the use of concessions spread throughout France and then other European countries such as; Belgium, Germany, Spain and Italy. At this time in Europe, once the infrastructure had been completed the use of concessions then declined in the industrialized countries.

As mentioned previously, the Suez Canal was one of the better-known BOT projects in recent times when the Egyptian government awarded a 99-year concession in 1859 to the Universal Suez Ship Canal Company. The canal was opened on 17th November 1869 and connected the Red Sea to the Mediterranean Sea. The canal extended over 195km, and was overseen by Ferdinand de Lesseps who was tasked by the Universal Suez Ship Canal Company to build and operate the canal. The project was financed using European capital and with the support of Egypt in the form of land donated by the Egyptian government and tax relief on materials and equipment. The agreement was that the consortium should underwrite the whole cost of the design and construction, but the government would receive 15% of the annual profits from the operation of the canal. A further 10% of the profits would be paid annually to the initial shareholders, allowing 75% to accrue, which would then go to the company. The agreement was altered in 1858 to ensure that 80% of the workers were Egyptians. Work began on the canal in 1859 and should have been completed by 1864, at a grossly underestimated cost of £8 million. In 1863 Sir John Hawkshaw, a British engineer re-estimated the cost as £10 million and the year of completion to be four years later in 1868.

By the year 1875, the interest costs to the Egyptian government on the financing of their portion of the project were higher than the gross income of the whole country. The company requested help from the British government who took the title and the responsibility for financing the project.

A further example of BOT projects from the late 60s comes from Hong Kong where the private sector has been very much involved in infrastructure development. Using the BOT concept five tunnels was constructed. The first of these: the Cross Harbour Tunnel was privately financed and was actually the first BOT project in Asia. The project has since been transferred to the post transfer operation phase, (Zhang and Kumaraswamy, 2001; Tiong and Alum, 1997; Tam, 1999; Tiong, 1995). As a result of these projects, experience was gained by the Hong Kong government, such as in adjusting tolls and producing a mechanism for resolving disputes, and resulted in well structured BOT projects.

During the late 1970s and the early part of the 1980's, many major international contracting companies and developing countries considered promoting privately financed, built, owned and operated infrastructure projects using concession contracts. However, there was a downturn in the privatization of public facilities during the mid-twentieth century but, as a result of the popularity and development of infrastructure projects using private funds, more recently many countries have seen an increase in the public private partnership of infrastructure projects in the public sector and the BOT concept is vital to this process of public private partnership (levy, 1996; Walker and Smith, 1995).

Between the late 1800s and the 1970s the industrialized countries tended to fund new infrastructure from fiscal resources or sovereign borrowing. The governments of these countries identified the needs, and implemented the policy using direct ownership or a well controlled franchise arrangement. The developing countries today tend to issue government bonds or obtain direct loans from the International Monetary Fund and/or the Asian Development Bank and/or the World Bank.

Public private partnerships really 'took off' worldwide in the late 1970's, affecting both developed and developing countries. It challenged the traditional approach of establishing infrastructure, encouraging a change to the current policies and setting up new rules. There were two reasons behind the changes.

The first reason being that the additional infrastructure in existence was limited, and could not keep up with economic growth. Walker and Smith (1995) stated that: "Between 1970 and 1991 Britain built an extra 9% of main roads and motorways. During the same period, passenger cars drove 116% more miles; vans and goods vehicles, 75% more. Crowded Britain is not unique. Between 1970 and 1990 America's vehicle miles almost doubled, while the amount of its urban roads rose by just 4%".

This is also true for developing countries, often known as "Newly Industrialized Countries", which have a constantly moving GDP. This also applies to the countries of Southeast Asia and Latin American which suffer from insufficient infrastructure to keep up with the speed of its vast economic expansion. All of these countries face the same problem of their economic growth proceeding faster than the development of the necessary infrastructure, Walker and Smith (1995).

The second reason is that the considerations of health and welfare have become increasingly important due to the increased longevity of the population resulting in a dramatic increase in medical costs, leaving many governments heavily in debt due to the governments' fiscal shortcomings in funding public infrastructure. The idea of public private partnerships, giving the private sector the title to design, build, operate and maintain a particular infrastructure using its' own finance within a predetermined concession period, is an ideal solution to this problem. However massive investment and changes in regulation are needed to initiate and control these major projects respectively.

Privately built and operated toll roads were quite usual in the United States, but public private partnerships really took off there during the 1980's and 1990's when the prisons and schools began to be given concessions. During the recession of the 1970's, companies in the construction industry saw an opportunity to obtain contracts using the BOT approach. This relieved government budgets and since many of the projects were high risk, there were many agreements in which the government allowed the return on investment for the developer to exceed 25 percent. The U.S. government today encourages BOT-related transportation projects, seeing these as a good way to ensure that U.S. companies are more competitive in the global market and actively implements and supports public private partnerships (Walker and Smith 1995).

2.2.1 Nature of Infrastructure Projects

Recently, the attention given to urban regeneration projects has significantly increased. Such initiatives use redevelopment projects to resolve the social and economic problems caused by antiquated buildings and degraded infrastructure, (Kim 2010). However, common infrastructure projects such as power, water and sewerage, telecommunications and transport facilities possess a number of characteristics: they lack portability, are rarely convertible to other uses and it can be difficult to reverse any investment made in them. The majority of the infrastructure projects require large investment capital, are single-asset investments and develop over a long period of time; they also have long periods of payback. However, they do provide important services, which would usually fall to the public sector and they generally operate as monopolies. The nature of infrastructure projects makes them responsive to public opinion and political pressure. Contrary to other types of foreign direct investment, most infrastructure projects only generate local currency, but the dividends and loan repayments are paid in foreign currency. The process of building infrastructure facilities is also complex and very risky.

2.3 Definition of BOT Approach

BOT should not be thought of as a legal term, but instead as an economic and a financial concept. As defined by Tiong (1995a): "it is the granting of a concession by the Government to a private promoter, known as the concessionaire, who is responsible for financing, construction, operation and maintenance of a facility over the concession period before finally transferring the fully operational facility to the Government at no cost".

In any BOT scheme the concession company finances, designs, constructs, operates and maintains a particular project or facility for an agreed length of time. This should be long enough to pay off all debts and provide a reasonable profit to the equity investors. After the specified time, the facility passes, at no cost, to the public authority or to the government, (Walker and Smith, 1995; Wilburn and Thomas, 1994; Shen *et al.*, 2002; Askar and Gab-Allah, 2002).

2.4 Variants of BOT Projects.

There are various other formats of the BOT method, dependant on the ownership of the infrastructure facilities and equipment. There are also different type of business relationships that can exist between the private and public sectors and also different levels of risk held by each party. All the different BOT formats involve a type of a public/private partnership, and each of them will have specific roles and risks as far as the involved parties are concerned. For a well structured BOT project, the government, or local authority, will nominate the project and decide on the range of work and design requirements, performance and maintenance that may need to be adapted to the particular objectives of the country. Next, the government will choose the private sponsor/contractor after some negotiation to arrive at a suitable price for both parties. In this manner, the government either has strategic control over the operation of the project or gains control after the concession period, (which is not the case with full privatization).

These variations on the design-and-build model offer differences that enable developers to address particular contractual needs of a certain project and tailor the approach accordingly, so the use of any of these models would be suitable for Kuwait under the appropriate circumstances. It is the design-and-build model overall that is useful, and it is catching on quickly in the Middle East as it has elsewhere around the world. It is becoming increasingly employed in Dubai, for example, where its' potential for reducing costs, a much quicker completion and occupation rate, and the removal of the usual liability gap by means of a straightforward method of procurement is gaining greater notice and favour, (Sell 2007). Dubai Festival City, for example, is being built by Al Futtaim Carillion entirely under a design-and-build contract, (Sell 2007). Al Futtaim Carillion's operations director, Simon Buttery, has noted that in certain projects in which the client wishes to be sure of the cost and is also to pass risk on to the contractor at as an early stage as possible, then design and build would be the best choice because the intention is to take on responsibility for the design and then to manage it throughout the lifetime of the project (Sell 2007). Buttery added that advantages include the ability to provide benefits much earlier to the client, (Sell 2007). Buttery notes that 90% of the U.K's projects are of the design-and-build type, which has become increasingly popular in Dubai. However, there is an important caveat, as pointed out by (Sell 2007). In a traditional contract, the client maintains more control over the designers, therefore for particular projects, such as the construction of a large mosque, for example, a traditional contract would be preferable. Apart from projects such as this, which require close control, any of the different variations of BOT projects would be a possible option. Description of different BOT models follows.

2.4.1 Build/Operate/Transfer (BOT) Contracts

The private company builds a facility to the specifications agreed with the host government; the private company then operates the facility for a specified amount of time under a concession agreement with the host government, and then transfers the facility over to the host government at the end of the concession period. In most cases, the private company will also provide some, or all, of the finance, so the length of the concession must be sufficient to enable the private company to make profit on its investment. At the end of the concession, the host government can take over operation of the facility, or allow the original private company to continue to operate the facility, or award a new contract private company. The private company, during the concession, will have the right to operate the facility and gain profit from it and cover its cost. The ownership of this facility will be transferred to the government at a later stage, the facility should be maintained in a good operating conditions so it can function well after handing it to the government, (e.g. the Channel Tunnel, France and the UK) (levy 1996).

2.4.2 Build/Operate/Own/Transfer (BOOT)

BOOT, as a term, refers to Build/Operate/Own/Transfer, this is linked with projects that involve a private company being required to finance, build, operate and maintain an infrastructure facility based on terms agreed in a contract. This private company keeps the right to return all expenses that are paid by users and the ownership continues with the private company until specified period of concession and then transferred to the public sector. (Walker and Smith, 1995; UNIDO, 1996).

2.4.3 Build/Own/Operate (BOO)

The BOO term refers to Build/Own/Operate. In such projects, the government provides an infrastructure facility to the private company which is required to design, finance, build and operate a project. The Ownership of such facility will stay with the private company. Different to the BOOT projects, the BOO contractor is not required to transfer ownership of the project back to the government and, at the end of the concession period. The concession is renewed if not, then the host government is compensated for its shares in the project. In different versions the concession is granted to the private company; however the host government gains a share of the revenues of the project in return. In such position the host government keeps the right to supervise the manner in which the facility operates but the actual management operation stays in the hands of the private company, (e.g. Taweelah A2, Abu Dhabi), (Levy 1996).

2.4.4 Build/Lease/Operate/Transfer (BLOT)

Projects that involve BLOT allow the private contractor to lease the facility's tangible assets for a specific time (Walker and Smith 1995).

2.4.5 Build/Lease/Transfer (BLT)

When involved in BLT projects, a private company builds a facility and then transfers its' ownership to the host government. At a later stage, the government hands back the facility to the private company in return for revenues for an agreed time period. Different from BOT projects, the host government is made the owner from the beginning instead of when the concession has ended (Walker and Smith, 1995; UNIDO, 1996).

2.4.6 Design/Build/Finance/Operate (DBFO) Contracts

Under a DBFO contract agreement with the host government, the private company sets up a project in line with the technical terms and specifications determined by the host government. The private company finances the facility and thereafter passes it with all the machinery and the required equipment to the government. In a DBFO contract, the host government receives a specified percentage of the revenue, rather than ownership of the project at the end of the concession period, (Levy 1996). .

2.4.7 Modernize/Own/Operate/Transfer (MOOT) Contracts

Contracts that involve MOOT require the private company to construct a "state of the art" facility using the most advanced and up to date international standards. In return, the private company owns, manages and operates the project and all revenues are kept by the investor until the end of the concession period when the ownership of the facility transfers to the host government, (Walker and Smith, 1995; UNIDO, 1996).

2.4.8 Rehabilitate/Own/Operate (ROO) Contracts

After agreement with the host government the private company finances renovation and rehabilitation of a facility. This process could consider either the renovation of high-tech equipment and machines or a building. In this project the private company undertakes, manages and operates the project, however the private company in return takes over ownership of the project and receives operation revenues but the private company has to pay the government a certain amount of money for the privilege. This is a popular contract with host governments who plan to renovate and redevelop facilities, (Walker and Smith, 1995; UNIDO, 1996).

2.4.9 Buy/Build/Operate (BBO)

This arrangement is applied when a public facility is handed to a private company which will work on renovating and expanding it. The facility is then owned by the private company which may choose to add new facilities and upgrade it, the host government's role in this case is to supervise the project and defend the public interest by ensuring good quality service. This is achieved by an agreement on certain terms by both parties, (Walker and Smith, 1995; UNIDO, 1996).

2.4.10 Build-Transfer-Operate (BTO)

The BTO arrangement is made of two major stages. In the First stage, the private company is required to finance and build a facility, and when it is completed the private company transfers ownership of the facility to the government. These steps are taken mainly to control liability issues and in certain cases lessen public concerns. After handing the facility to the host government, the private sector then leases it back for a long period during which time the private company has the right to operate and recover all costs and make reasonable profit, -an example of such operation was conducted by Telecom Asia Communication Network in Thailand, (Levy 1996).

2.5 The Principal Participant in BOT Concession Projects

The BOT projects that are undertaken by the private sector contain many risks and uncertainties, (Songer *et al*. 1997). The BOT projects are generally large-scale projects of infrastructure facilities and the transaction costs on average come between 5 to 10% of the overall project cost, (Klein *et al*. 1996). Although BOT methods can be used in any sector of the economy the most prevalent use is in telecommunications, power plants and transportation, (Tam, 1999; Wang and Tiong, 2000).

There are no two BOT projects that could be considered identical, each one is unique, as projects in Australia are not treated the same as projects in Kuwait Contractors have to take into consideration environmental, cultural and governmental differences. The rules of procurement may be similar, but the process and the way of financing, designing and constructing the facilities may be completely different. Many parties are involved in the BOT project,s e.g. the project sponsor, investor, financing bodies, engineering design consultants, construction contractor, specialist contractors as well as operating and maintenance companies. In addition the BOT contractual structure could vary from other projects to fit the distinction and the uniqueness of a specific project, as detailed above.

In any BOT scheme the finance, design, construction, operation and maintenance of a public facility are agreed for a specific period of time, which should be adequate to return the debt and to offer a good return to the investors. After this time, ownership of the facility transfers back to the government or any public authority which was signatory to the agreement, without charge, (Walker and Smith, 1995; Wilburn and Thomas 1994).

According to Wilburn and Thomas (1994), each BOT project could involve different parties and a different number of them, typically involved in BOT projects are: the host government, private company/consortium, the financiers and finally the project users. Generally, there are nine parties may have direct involvement in the project company these parties are the government, other public bodies, contractors, lenders, project sponsors, suppliers, equity investors, credit re-enforcers, and finally the customers (Rose 1997) Figure 2.1 shows the structure of a typical BOT project.

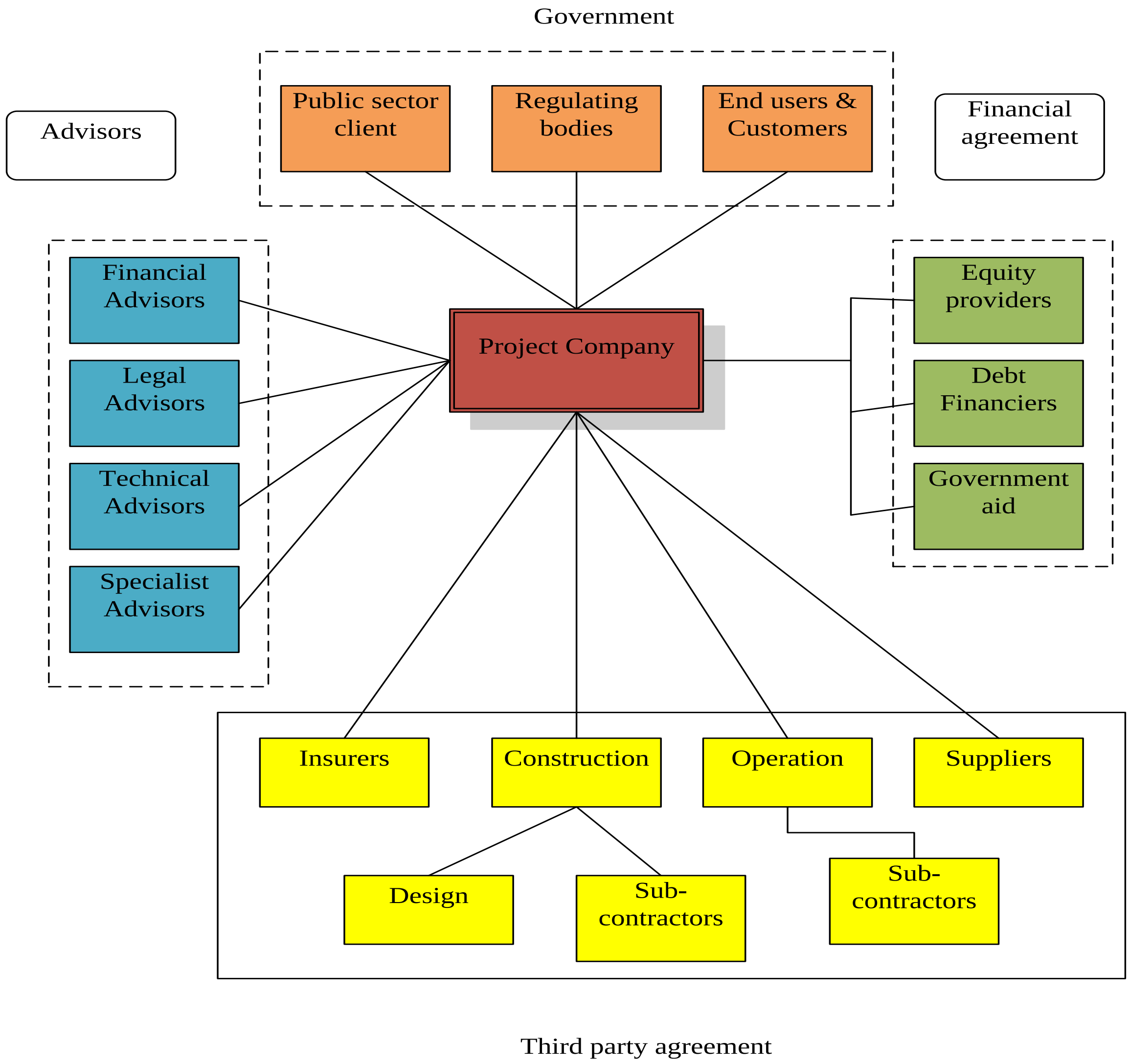

Figure 2-1 Generic Project set-up Source: Leiringer (2003)

2.5.1 The Public Sector or the Host Government

Pahlman (1996), stated in any BOT project, the most important party will be either the host government or the public sector because it requires the particular facility and will be the last owners of it. The host government will have to authorize the project and ensure that it meets the suitable legislation, following on; the public sector will need to arrange a concession agreement with a private sector company. The terms and the expectations of the government will need to be highlighted as well as the private sector's demands which both need to be agreed upon.

It is therefore apparent that the BOT approach requires the host government support, which depends how large and complex is the project under consideration, and also on the economic conditions within the country. Host government support is essential in developing countries and may involve legislative, regulatory, administrative and financial support.

Pahlman (1996), stated that the private investors are very often hesitant in taking on a project unless the host government can meet all necessary guarantees, such as ensuring investment grants, land grants, low interest rates on loans, special tax exemption and responsibility for any public or environmental difficulties which might be encountered up to and after the completion of the project.

2.5.2 Private Sponsors (Project Company)

The private sponsors or the project company, (private sector), in a BOT project are the second most important party. If the BOT project is taken on by the private sector, it will normally be a complex organization that contains one or a number of large international construction or engineering companies, equipment suppliers, lending bodies, insurance companies, equity investors, as well as a firm that posses the experience of operating and maintaining the project in hand. To control for all these parties a consortium may be formed which includes the various bodies mentioned above, (Augenblick and Custer 1990) as well as a major international engineering and construction company including one or more suppliers of the necessary equipments. An example of this is the consortium which built the Channel Tunnel project; this consortium included ten major contractors from the UK and France, (Tiong 1995). There are other parties that are involved in a BOT project, these parties are:

2.5.3 Suppliers

Normally the suppliers are private companies who have the job of supplying the materials and equipment that is needed for the project. A contract is signed to transfer the risk in supplying raw materials, (lack of it), to the supplier company, (Shirong 1998).

2.5.4 Investors

The investors are the party that may consist of suppliers, constructors, vendors, major financial institutions and individual shareholders. The private sector provides the finance of for the project and so the investors may include commercial banks, constructors, and operators. Also, multilateral development banks as well as regional development banks offer funds for the BOT projects. The investors may provide equity in order to finance the project; the total amount is generally determined by the debt/equity required by lenders. Equity is the type of capital that ranks lowest in BOT projects therefore, according to (Estache and Strong 2000) the claims of the investors are of secondary consideration to those who are financing the project. As a result the equity suppliers carry the highest risk of loss resulting from an unsuccessful project. However the debt financers protect their loans against the project assets.

2.5.5 Users/Off-takers

Organizations which use a facility are known as the users or off-takers. Often, when building a road, for example, income might be generated by means of tolls, which then go straight to the facility. It is unlikely that an Off-take Contract will apply in these circumstances. The profit produced by the particular facility depends on the economic situation prevailing in the country at the time. A problem could arise if the private sector infrastructure supplier intends to recover their initial investment from tariffs paid by people using the facility, and then finding that the lack of use results in reduced revenues and perhaps even termination of the project.

2.5.6 Contractors

Contractors are generally drawn from individual and private construction companies or from joint business enterprises specializing in construction. Contractors often form a part of the project company and their involvement is generally welcomed by all parties concerned with the project. The involvement of the contractors in any project at the initial stages is also intended to make sure that the project is executed effectively and efficiently. It is the responsibility of the contractor to hire subcontractors, consultants and suppliers, and the main contractor would usually have a share in the company project.

2.5.7 Operators

Operators are generally taken from specialized operating companies that are designed to provide maintenance and operation for a specific facility. The operator is considered one of the parties that form the concession; all operators offer maintenance and continuous services as well as managing the operational phases of the facility throughout the concession time.

The operators form an important part in running and operating the facility, this involves having knowledge in financing, designing and programming, all of which are crucial for a successful facility. Often the operation companies are supported by the host government to ensure the effectiveness of the facilities, as the host government in many cases finally becomes the owner of the facility.

2.5.8 Lenders

The debt/equity ratios for various projects will differ, but a popular strategy is to use as much debt as the available cash flow from the project will allow, in order providing good profit for the investors. Of course, a low percentage of equity financing will lead to increased risk to the project and also to the investors' profits. It is therefore important to maintain a good balance between debt and equity, (Schaufelberger and Wipadapisut 2003). The largest part of the finance for the project is usually provided by loans and the lenders will normally be credit agencies, syndicates of commercial banks or niche banks and pension providers. It is usual practice for one lender to take the lead role for the lending consortium and reach an agreement with the promoter. No contractual ties exist between the lenders and the construction itself. The finance will usually be of the "limited resource" type where the banks option for repayment of the loan is restricted to the project company and the assets and contracts related to the specific project.

Equity providers

The BOT projects are generally funded using both debt and equity. Usually, the equity finance is an injection of risk capital into the project and such equity/shareholders could consist of suppliers, constructors, major financial institutions, private shareholders and operators. The equity suppliers are rewarded with profits when, and if, the project makes a profit or there is no return otherwise. Only 10–30% of the complete project costs are funded by equity while debt financing covers the remaining 70–90%, (Levy 1996). The finances that are provided by equity is explained as an indication for the commitment of the promoter organization to the project in demand, and it also forms the early cash inflow to the project and it normally recovered last when all debts are cleared.

2.6 Contractual agreements in BOT projects

The BOT projects involve many complex and difficult contractual agreements. According to Menheere and Pollalis (1996) there is the possibility of as many as 300 different contracting bodies involved in a BOT project, but there are six major contracts in the BOT project involving the main parties, i.e. the concession contract, financial agreements, construction contract in addition to the operation and maintenance service contract. It could be a daunting task bringing all these parties together, it could consume time and on occasions other parties pass the risks on others. The main agreements in the BOT project are described below.

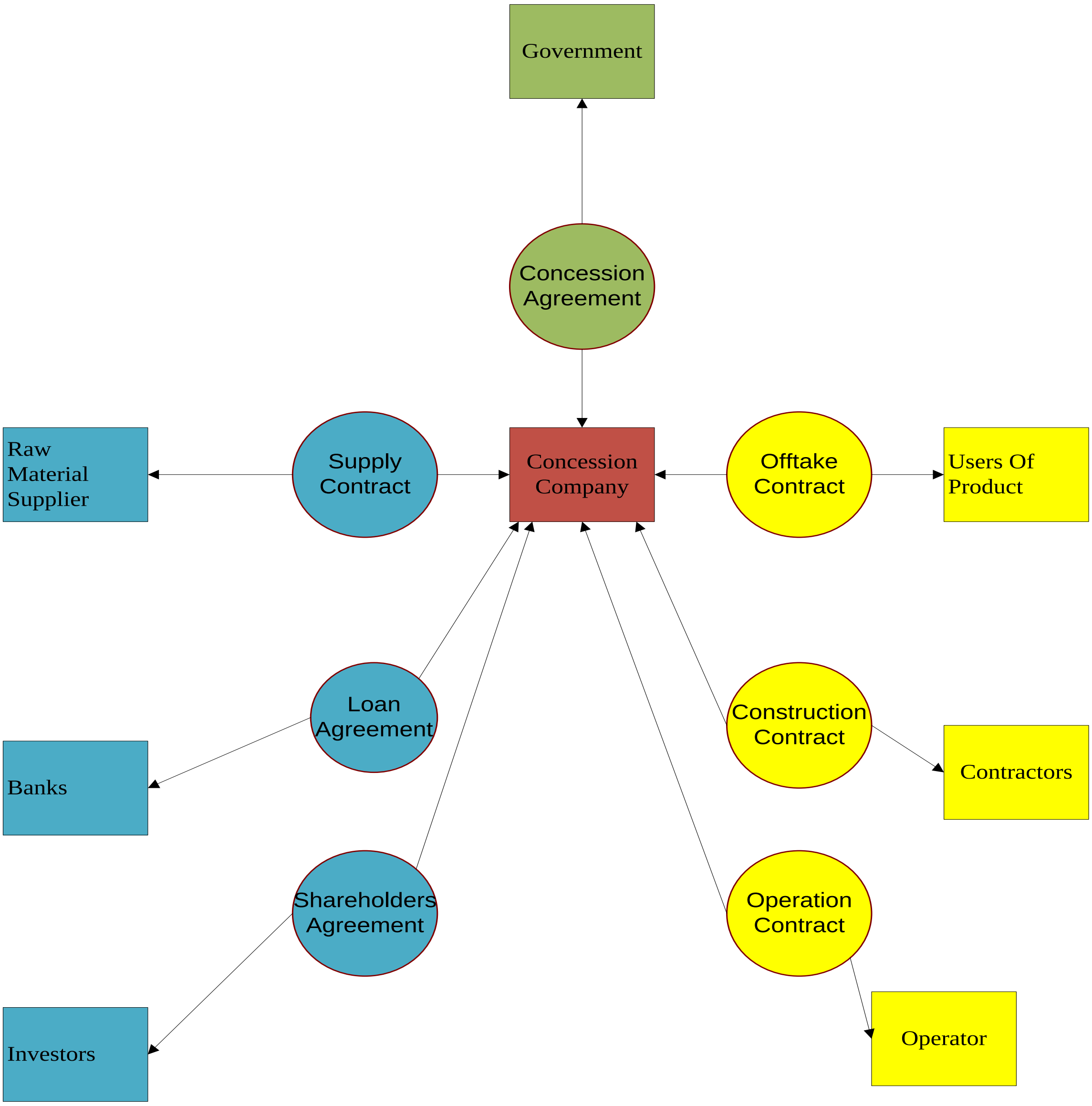

Figure 2-2 BOT Contractual Agreement Source: Ngee et al, (1997)

2.6.1 Concession Agreement

The concession agreement is between the concessionaire and the host and is considered to be the most important one in a BOT project because it establishes the feasibility and profitability of the project from a commercial point of view, (Ngee *et al*.1997). When defining the concession contract, (Leiringer 2006) described it essentially as a business contract which also includes responsibility for construction. This contract is concerned with issues from the initial designing stage until the completion stage of the project. According to Levy (1996) this contract includes the expectation and needs of the host, sets the concession period and the manner in which the project is to be transferred to the host government at the end of the concession.

2.6.2 Loan Agreement

This agreement involves only the Bank or the lender and the concessionaire. All the necessary finance is raised from commercial and international banks to the concessionaire, and is the main financial source for the BOT project. Lenders provide finance based on equity, which indicates the level of commitment of the concession company. Lenders also finance BOT projects based on their estimated revenue generating capacity.

2.6.3 Construction Contract

According to Menheere and Pollalis (1996) a construction contract is agreed between the contractor and the project company, and may be either a fixed price turnkey or a design-build contract; indicating the importance of the contractor in the construction of the project. BOT contractual arrangements include one main contract to include both the design and construction of the project.

A number of risks are involved in BOT projects which include cost-related factors, (e.g. going over the construction cost), factors related to performance, (e.g. not meeting the quality criteria), as well as factors in relation to time, (e.g. the inability to complete the project on time). An individual point of responsibility within the fixed-price contract minimizes the risk elements presented in the BOT project. Furthermore, in certain types of projects, for example power plants usually require close design/construction coordination which result in shorter construction periods because the turnkey contract allow for a fast-track approach for completion, therefore the fixed price turnkey contract reduces the risks that are associated with timing, cost and quantity of the project.

2.6.4 Operation and Maintenance Contract

This contract is between the operator and concession company. In fact the success of the BOT project is very dependent on the operation phase because its success is strongly related to the project’s ability to generate revenue. The operation phase of BOT projects requires high attention and a big management challenge. This agreement normally covers the entire concession period because of the contribution that the operator has in the designing and constructing phases (Unido 1996).

There is a higher level of interdependency between the contracts; they all are related with each other and together they shape the design, construction and operation of the BOT project as well as describing the risks and responsibilities involved. It is essential to make sure that there is transparency to show all the risks and responsibilities to all parties.

2.6.5 USERS/Off-Take Agreement

This type of agreement is made between the concessionaire and the host Government, in which services such as electricity and water are bought at a pre-determined price, thus enabling the concessionaire to generate a revenue, such as in the Chinese Shajio 'B' project, where the Government bought the minimum quantity of electricity on the basis of take and pay, at a fixed price to be paid to Hopewell Holdings Inc which was the Concessionaire (Tiong 1990).

2.7 BOT practice

According to Neil Roger (1999) a study conducted by the World Bank, revealed that, for the developing countries in East Asia, the investment requirements ranged from 1.2 to 1.5 trillion US dollars. Between the years 1990 and 1997, investment in infrastructure projects using private participation, grew drastically from about 16 billion to 120 billion US dollars, but then declined to approximately 95 billion US dollars by 1998, following the financial downturn that hit Asia halfway through 1997. Therefore, due to the success of BOT projects worldwide, it appears that the BOT method will be suitable for use in Kuwait. Many countries worldwide have adopted the BOT method for the development of public facilities and infrastructure projects ever since its formal introduction by the Prime Minister of Turkey. Both local government policy and financial organization policy have been developed with the main aim of encouraging the private sector's involvement in BOT projects. In fact, the Vietnamese government encouraged the private sector to adopt major BOT projects, according to (Curl 1994) and also the government of the Philippines permitted the private sector to be involved in power development projects replacing the monopoly held by the National Power Corporation Hiroaki, (1995).

Dias and Ioannou (1995) point out that, in the USA, budget shortages have limited the access to federal grants for public facility projects, while changes in the tax rate and laws and limits on debt capacity, enforced by law as well as political considerations, have restricted the ability of the states and governments to finance construction by means of bond issues. Some of the major financial organizations led by the World Bank have encouraged the adoption of the BOT method by the private sector. This is due to the fact that private finance reduces the need for government finance required for public projects. Since public facilities previously undertaken by the government have been constructed by the private sector, the IDB, (Inter-American Development Bank), has discovered that there is an urgent need for long-term finance to fund private-sector operations, which in turn has led to the creation of the Private Sector Development in 1994.

The BOT method, although ideally suited for use in developing countries, has also been used for important projects in more prosperous countries. Two examples of this, given by (Wilburn and Thomas, 1994) are the Channel Tunnel, linking England with France, and France's Orly Airport Transit Link.

The government of the UK declared its' private finance plan in 1992 and following this in November 1994, Kenneth Clarke, as Chancellor of the Exchequer, made a declaration supporting and encouraging the use of private finance. This helped to allay the suspicions of investors and contractors' concerning this new approach. As cited in Hornagold (1995) the chancellor stated that: "We need to take the private finance message to the heart of all decision making in government I am announcing today that in future the Treasury will not approve any capital projects unless private finance options have been explored".

Private finance has been used is in various transportation projects such as the £2.7 billion Channel Tunnel Rail Link between England and France and the rail connection to Heathrow airport costing £320 million..

Figure 2.4 indicates that the use of the BOT method spread quickly around the world between 1984 and 1995. So and Shin (1995) stated that the total value of privatization came to 357 billion US dollars and the value for new investment projects exceeded 308 billion US dollars. Private investment in infrastructure projects totaled about 60 billion US dollars per year. Table 2.2 gives the ten main infrastructure investment projects up to October 1995.

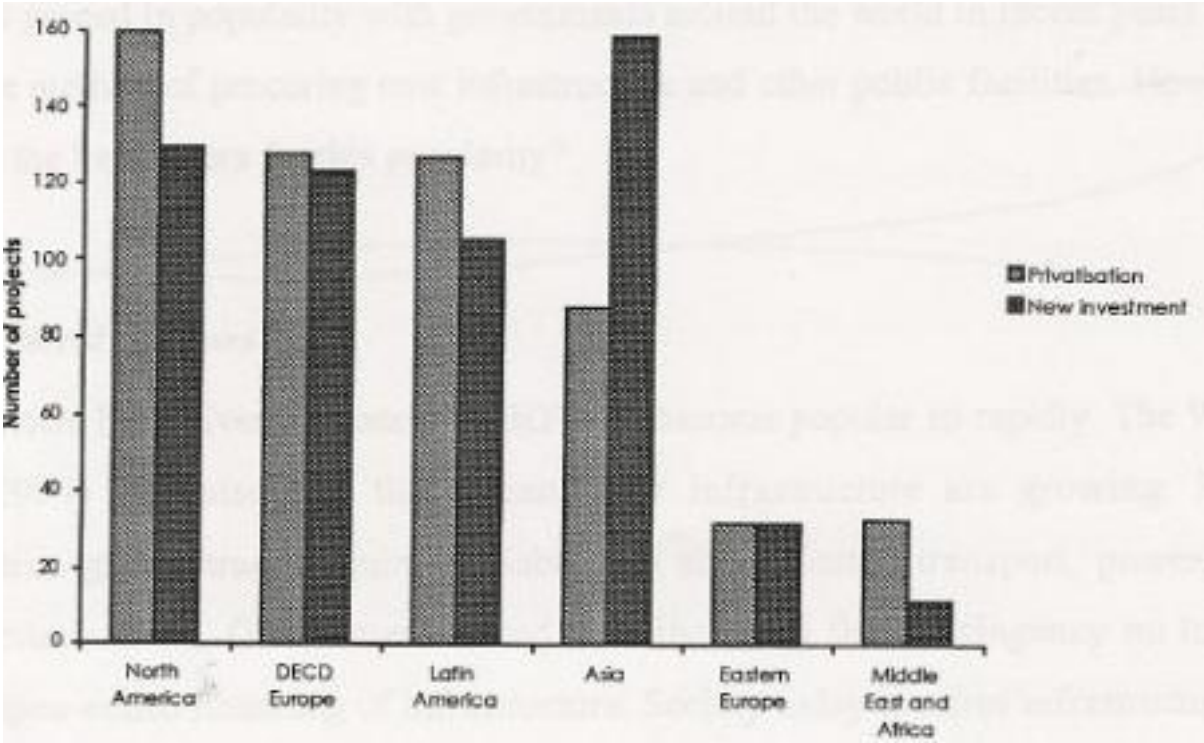

Figure 2-3 - Private participation in infrastructure from 1984 – Sept. 1995

Location	Project	Type of contract	Cost (US$ million)
France/ UK	The Channel Tunnel	BOT, 65 years	19,000
Taiwan	Taipei mass rapid transit system	BOT	17,000
Japan	Kansai International Airport	BOT	15,000
Europe	Concert Pan-European Telecom Services	BOO	5,300
Argentina	Buenos Aires water and sewer services	BOT, 30 years	4,000
Thailand	Telecom Asia communication network	BTO,25 years	4,000
China	Daya Bay nuclear power plant, phase 1	BOO	3,700
Malaysia	North-south toll Expressway	BOT, 30 years	3,400
Mexico	Petacalco coal-fired power plant	BOT	3,000
Thailand	Bangkok Elevated Road and Train System	BOT, 30 Years	2,981

Table 2-1 Source: So and Shin, 1995

According to the World Bank (1997), in the financial year of 1997, private investors enjoyed a staggering US$ 8,899 million in lending from the World Bank.

2.8 The Importance of BOT

Although one of the fundamentals for the continuation and sustainability of economic growth is investment in infrastructure, BOT has acquired a reputation with governments internationally in recent years, and is perceived as an attractive mean of developing new infrastructure and other public facilities, World Bank has stated, that since 1990, the number of lower income countries encouraging the private sectors to participate in infrastructure is on the increase.

Between 1990 and 1999, the lower-income countries with a minimum of one private project for infrastructure has grown from 20% to over 80%, with fifty countries.

The increase in private investment participation for the lower-income countries' projects has almost happened every year during the period from 1990 to 1997, when it has peaked with 35.1 billion US Dollars (Houskamp and Tynan 2000).

Many reasons were given by many researchers for the cause of BOT becoming quickly popular. Augenblick and Custer (1990) gave four core reasons for the cause of the current popularity of BOT within the majority of the developing countries. The first reason given is the vast growth in infrastructure needs, secondly, the lower capacity for borrowing and the decline in budgetary resources, thirdly, the competitiveness of business internationally, and lastly the growth of the private sector and the it's social acceptance.

The Concept of BOT has become highly adopted by both developed and the developing countries an has been supported by various international institutions world, (Shen *et al*., 1996); Chen and Messner 2005; Ahadzi and Bowles 2004). In developing countries, i.e. Asia, BOT projects have become increasingly popular. These include the 1200MW Hab River project in Pakistan, the 700 MW Shajiao-B power station in China, and the 300MW coal-fired project in the Philippines (Levy, 1996; Walker & Smith, 1995; Wang & Tiong, 2000; Xing & Wu, 2003).

According to Treasury reports, exploring new opportunities leading to development of profitable ventures is the source of encouragement and motivation for the private sector innovation through research in new ideas, which will improve value service, and the achievement of better delivery flexibility to quality standards, HM Treasury, (2000).

HM Treasury also reports on the performance of the projects procured under PFI as being satisfactory on the whole, while the delivery of the services follow or improve on the contract targets. Therefore, Government policies favour the BOT type of projects because it attracts money, expertise and the technology of the private sector, and cuts down the financial burden on the government.

Haley (1992), further describes the importance of BOT by:

- The 15-20 highest indebted countries in the developing world have missed out on the growth during the 1980s decade and many encountering inflation and debt burdens, which require them to adopt a tough approach when planning fiscal spending.

- Both pragmatic and ideological powers in developing countries have discovered that the state led development programs from 1960s and 1970s decades, have –in simple term- not worked, and a modern look at the role of the state has provided new options for private sector led development.
- For some countries, the limitations on ownership and operations might only be overcome, (in the medium term), with BOT techniques, despite a higher willingness to tap the private sectors and seek new technologies abroad.
- The debt crisis closed off capital flows to third world countries and has reduced spending on major public sector projects. This, together with higher competition in the construction sector of the industry to acquire large contracts, has usually forced the main contractors into the place of investor just to gain the business.
- Even with the debt crisis aside, industry competition in construction has had a prominent role for the contractor in projects finance and arrangement of more complete services such as turnkey project with management contract.

Financial institutions such as Banks and pension funds are on the search for new financial products and larger market share, which leads them towards infrastructure industry projects Chang and Chen, (2001). The BOT approach is very attractive to banks because of the higher margins which can be earned over more traditional projects Tiong, (1995). Three vital factors have been identified that will enhance the popularity of BOT worldwide

- The need for industry of infrastructure.

- The shortage of governmental funding.

- The incompetence of government financed projects.

The core reason for BOT projects is to share the financial risks amongst different groups while, at the same time, protecting national interests of the host government and, at the same time, reducing its' role in the development or infrastructure, (Forouzbakhsh *et al.* 2007). What makes the BOT approach more attractive is that the government's investment in infrastructure projects is minimal but large sums of money can be invested over a long period.

Therefore, BOT projects are the safest way to ensure that private sector investments are under the control of the host government.

Furthermore, when BOT projects are conducted in developing countries, via foreign investors from developed countries, the shortage in advanced technology as well as availability of management skills in developing countries becomes another essential issue, (Walker and Smith, 1995).

Government-led projects tend to have less technical capacity available and are less able to adopt the latest technologies than the private sector and this implies that the development of BOT projects would therefore be helpful for the development of Kuwait's infrastructure.

One particular BOT developer of chemical, petroleum and power projects is Al-Kharafi National Company which is involved in the industrial and commercial sectors, including schools, hospitals, airports, water treatment and distribution networks, as well as operation and maintenance, and facilities management. The production development director for the company, Dr. Ibrahim Al-Ghusain, outlined the advantages of public–private partnerships and noted that "The owner gets a quality service while the private sector may be more efficient and will provide better quality service and faster service", Al-Khaled, 'Karafi National (2008). Al-Ghusain further stated that "people wonder about the government of Kuwait, as the government can afford to finance and build infrastructure projects by itself and they question as to why the government contracts out BOT projects" Al-Khaled, 'Karafi National Company, (2008). He reasoned that leaders of large-scale projects should rely on the experience and expertise of others since with BOT projects, the end-users will have a high quality service because of the competition, Al-Khaled, Karafi National Company (2008).

The use of the BOT process in Kuwait to improve its various infrastructures should have a positive effect. After the railways and road network has been improved, the transport of raw materials and final products will be faster and better. Increased speed of transport will provide a competitive advantage. After opening the Sulaibiya Water Waste Plant, water does not need to be imported from elsewhere, which was expensive, and this provides the country with more opportunities to manufacture goods which use water in the manufacturing process. Good roads links to the rail and ports are essential for a developing country to progress.

2.8.1 The obligation for infrastructure

The absence of suitable infrastructure can be a vast economic and social burden on a country as noted by Dunkerley (1995). The advantages of public investment in infrastructure are many, as this can play a critical role in business investment and contribution to economic growth, as well as providing employment and, in the long term, making the country internationally competitive. During the first decade of this millennium, the world economy was expected to grow at a rate of 2.7% per annum. According to Fay and Yepes (2003) this growth has resulted in a greater demand for infrastructure services. The global economy is a very competitive environment and it is necessary to have more effective infrastructure facilities to promote success. The alternative effect will be the suppression of growth, increasing costs, a lack of competitiveness and a reduction in the quality of life for the population. Harries (2003), suggested that a PPP programme will permit buildings and provisions to be developed for particular services, which would not otherwise be possible since the public sector cannot pay for both development and operational costs over a long period of time.

2.8.2 The shortage of government funding

A BOT project can only be carried out successfully when sufficient finance is available, so acquiring capital is one of the most important concerns of the Build Operate Transfer project delivery method. When infrastructure projects were initiated, financed, and managed in a traditional way by the host government, the main concerns were based on political, social, and economic growth goals, and the rate of the financial or commercial return was not considered (Tiong, 1995; Chang and Chen, 2001).

Finance was provided by the government who also underwrote the risk. The supply and development of the project would be contracted out by the state agency or enterprise to the private sector. The finance in this process was provided by host government tax revenues and borrowings guaranteed by the state, such as official development loans or commercial financing.

2.8.3 Inefficiency of projects financed by government

Apart from a shortage of resources for funding, some governments understand that they are not always as effective in using resources, or as cost-aware as the private sector in running certain types of public facilities and infrastructure (Dias and Ioannou 1996).

The governments of most developing countries finance own and run all infrastructure development. The success, or failure, of the infrastructure depends mainly on the host government performance and records indicate that performance has been below standard in most instances. The World Bank, (1994), notes that infrastructure investment has often been wrongly allocated with insufficient being allotted to maintenance and more to new investment. There has also been too little money allocated to vital services and too much to projects with a lower priority. Technical inefficiency and waste has hampered the delivery of services. There has been only small investment and rescue plans have not attempted to meet the various demands of different user groups, or considered the environment effects.

(Guster 1993) in extensive research, highlighted the low level of efficiency in the operation and performance of utilities in developing countries. In developing countries, the average thermal efficiencies of utilities are 30% lower and the distribution and transmission losses are higher than those in industrial countries. Qinlin (1994) noted that the total loses by state enterprises in Brazil in 1982 were valued at 17 billion US dollars. Dunkerley (1995) also cited the example of China, where about a third of the government’s investment used during the 1970's was lost as a result of inefficient performance.

2.8.4 Transfer of Management and Advanced Technological Skills

The transfer of technology involves the transfer of hardware and software technology as well as information, knowledge, experience or skills and also the education, training and development of these skills. To undertake BOT successfully, the transfer of advanced technological and management skills is required between the developing and developed countries. Most developing countries lack the technology and experience in management skills, compared to developed countries. They are required to introduce new technologies which support the development of small and medium sized enterprises, (SME), and to promote links between local institutions and international enterprises. BOT projects offer the host country current technology and to have their labour force trained on its' use. Local capability may be motivated further by long term agreements with the private sector, (Harries 2003). On one hand, developing countries are willing to acquire the advanced technology and management expertise from developed countries, and on the other hand, developed countries are eager to "trade" their sufficiently advanced technology and their expertise in management skills to those developing countries. This benefit may also excite technological progress in other sectors of the economy as a result of hands on experience.

2.9 The challenges for BOT

While BOT is creating opportunities in the developed and developing countries, the opportunities for revenue and profit are not easy. Comparing BOT with the fully public approach, the responsibilities and the risks are high in a BOT project. The problem becomes the abundance of projects that are now accessible to investors, but there is a lack of bankable projects that show adequate returns for the private sector. It has been argued

A barrier to success in BOT projects is their complexity, length of the negotiations and documentation, the cost of preparing the documents for the bid, the negotiators lack of skill and experience, and the need to organize the efforts of many different parties, (Drye 1994).

2.9.1 The time, size and cost of BOT

The scale of most BOT projects is large. Basically, this is not because most infrastructure projects are inclined to be large, but that the BOT approach is mainly appropriate for large scale projects. A key example is the US $19 billion investment in Channel Tunnel project. It is commonly acknowledged that the PFI initiative applied to miniature contracts is too, risky, costly, complex, and certainly too early (Shirong 1998).

Financing and operating measures make BOT projects more expensive. As well as the initial large investment required in infrastructure, private borrowers will be paying higher interest rates to their lenders and will require higher discount rates for equity. Finance is not only necessary for the construction phase, but also through the pre-design phase and for the duration of operation phases when demands for cash flow may be considerable. The cost of unsuccessful effort can also be high where legal, design, and site investigation fees have to be paid, even when the bid does not succeed, (Shirong 1998). The cost of success in winning projects can be high, for instance, Kumagai Gumi has been reported to spend the equivalent of about US $5 million in pre-design costs for a Thailand toll road project, (Augenblick and Custer 1990). Johnson (1996) has suggested that BOT is only suited to high value projects, and the minimum possible value is within the region of eight and ten million pounds sterling.

BOT projects run through a reasonably long duration, within which the private sector undertakes all the responsibilities of planning, finance, design, development and management. The causes for the long duration include the scale of projects, the variety of its phases, the length of the operation phase, the political measures and procedures, and the associated problems of ever extended planning timetables. Most BOT infrastructure projects have a concession time period of twenty to thirty years or at times more, such as the Channel Tunnel which lasted 65 years.

It should be noted that the length of the pre-construction stage tends to be longer. It is approximated that in the USA, large public facility projects now take up to 15 years, compared to about 2-3 years a generation ago. Also in the UK, the present trunk-road procedures take an average of 13 years before the work starts on the site. In Frankfurt, Germany, long delays were experienced in planning and constructing a new runway. Approval for this project took 17 years, (Stevens 1993).

2.9.2 The complexity of BOT procurement

The complexity of procuring BOT can be demonstrated by comparing it with the "fully-public" approach. The public sector, through the last 100 years, has been very traditional and all its measures and procedures have been formed to cope with accountability and transparency from the public. This was the main type of procurement for government to accomplish public projects with separating design from implementation. The finance was supplied from the public fund and the contractors were required to bid on a design and specification. The work was measured again upon completion and the contractors were paid either on a fluctuating fee or value fluctuations were added in the tender price. The approach has worked well, but the separation of design from implementation, has proven inefficient for the procurement process, (Shirong 1998).

The concept of BOT is primarily different in the private sector who takes the responsibility of financing, designing, constructing, and operating risks, however there are changes in responsibilities, contractual relationship, working and organizational relationships and project management methods. Also the adversarial approach to solve problems is not appropriate anymore as all the parties have to live with the long term consequences of their actions.

According to Shirong (1998), the private sector needs to share all the responsibilities that were normally taken by the public sector. The private sector also has acted in a number of roles throughout the project and can be more sensitive to normal risks. An example of this is shown during the early stages of the project where the private sector will act as a promoter to achieve approval for the project amongst shareholders and the general public as well as acquiring the finances. The private sector will act in the role of a general contractor, in the implementation phase, in order to arrange the design and the construction work, the private sector acts also as the main leader in operating and maintaining the facility.

Furthermore, one key difference between the fully-public approach and BOT is in the relationships between the parties involved in the contract. In the conventional approach, the public sector, which acts as both the client and the implementation body of the project, directly signs contracts with two kinds of parties; one is the financial bodies which lend to the public sector, like banks or other financial institutions; the other is the service provider bodies which constructs the facility or service to the public sector, such as project designers, construction contractors and material suppliers (Haley, 1992; Shirong, 1998). The most important economic aim of the financial bodies is to achieve their economic return by the interest charged, while the service supplying bodies make their profits through providing the services, primarily through design and construction. The public sector runs the facility following its completion. Under the arrangement of BOT, the public sector has one contractual relationship with the private sector (project contractor), and reassigns the traditional responsibilities and risks to the private sector (project contractor). This project contractor forms an extra contractual level. Under the conventional approach the capital expenses are partly financed by the government budget allocation and lending, whereas the BOT approach is usually financed by a mixture of debt and equity. There is another contractual relationship, often called the off-take contract. This is one of two approaches used practically for revenues, i.e., for collecting revenue from the end users. The two types of revenue can be either contract-tied (i.e. the off-take contract), or market-tied, that is revenue for services which are directly delivered to the consumer, i.e. tolls from roads. Contract-tied revenues are fees for services which are not directly delivered to a particular customer, but by an agency which operates a service network. The last will have to underwrite a minimum level of delivery, i.e., supplying electricity to a distributor group. In comparison with contract-tied revenues the market-tied revenues involve higher risk on the project contracting company, (Haley 1992).

2.10 Risk in BOT projects

Projects involving the building of infrastructure have a higher risk element because the capital costs are usually high, there is often a long lead time and the resulting assets do not usually have an alternative use. Therefore, when evaluating infrastructure projects, which are privately promoted, it is necessary to identify, analyze, and allocate the different risks. The risks involved in BOT projects are two-fold. First, there are risks involved with the start-up procedure, (financial and technical studies), and also construction and operational risks due to the nature of BOT approach; and secondly, being large-scale projects, there are also regulatory, political and economical risks involved, (Ebrahimnejad, *et al*. 2010). According to Tiong (1995, 1997) there are high risk levels associated with BOT projects for the negotiators and decision makers in both the private and public sectors who will need to carry out a careful analysis and then manage these risks. However, as pointed out by Ozdogann and Birgonul (2000) the private sector and the government do not share the same set of principles covering the risks associated with BOT projects, and so, according to Tiong, (1995c) the promoter who wins the concession is more likely to be the one who carries the risk and offers suitable guarantees.

According to Gunn (2005) risks and ambiguity will be present in all construction projects and tend to involve the three main project management restrictions of time, quality and budget. Risks have been classified into three categories by (Lessard and Miller 2001). These are: 1) risks originating from revenue and financial markets, classed as 'Market-related' risks; 2). 'Completion' risks, involving the technical designs and/or technology used, the cost of construction and time delays, and any other operational problems; 3) the 'institutional risks' which come from legislation and regulations, or possibly local environmental groups opposed to the project, or even government bodies themselves, leading to renegotiation of contracts.

The many risks involved in construction are increased considerably in BOT projects, due to the complex combination of various issues, such as design, construction, operation and finance. The risks themselves are more complex than for conventional projects because of the higher number of parties and agreements concerned. The working environment is so different in BOT projects, that a change of attitude is needed in both the private and public sectors regarding the risks involved. While the private sector is informed that risks inherent to the project are assigned to the appropriate party, in fact governments often try to transfer as much risk as possible to them. In a BOT project, throughout the development stages of planning, design, construction and operation, the risks will change.

There are two types of risk, according to Merna and Smith (1996), which are either 'elemental' or 'global'. "Elemental Risks" are connected with the finance, construction, operation and revenue generation sections of the project, while "Global Risks" include commercial, political, legal and environmental risks and are usually assigned through the project contract. The main categories of risk in BOT projects have been identified by (Marcus *et al.* 2002; Tarek & Luh-Maan 2002 and Dey *et al.* 2002), as economic, political, legal, construction, financial and operating risks. According to Baloi and Price (2003), the risks also need to be categorized as static / dynamic, individual / corporate, internal / external, positive / negative, acceptable / objectionable and insurable/uninsurable. For this reason government assurance is extremely important in BOT projects. The more easily observed risks are: economic, political, financial and related risks. Various examples are given below.

2.10.1 Country or General Risks (Regulatory and Political Risk)

Every country has a different set of general risks, which are those associated with the macro-environmental aspects of the particular country. These would include the legal system, the prevailing economic conditions, the political environment, taxation, the legal system, or changes in the currency exchange rate. Because these risks may severely affect the concession agreement and the cash flow throughout the lifetime of the project, it is crucial to that they should be identified before the development of the project and this is particularly important in the developing countries.

As noted by Schaufelberger (2005), the risks can be broken down into financial risks, political risks, and legal risks. It was Wells (1998), who defined political risk as a 'threat to profitability due to forces external to a project, which involves some sort of governmental action or inaction'. Since many economic and political phenomena are interdependent, it is quite difficult to determine exactly what form political risk will take. (Moran, 1998), differentiates political risk from commercial doubts resulting from changes in the economic conditions. He felt however, that this difference may be tenuous due to government action or inaction. The definition of political risk by (Wells 1998) given above, can cause changes to the economic conditions. In view of this, Howell (1998) thought that insurance might give a good indication of the events covered by political risk. According to Tinsley (2000) most insurance companies covering political risk will include the following events: currency convertibility and transfer; war and insurrection/civil disturbance; nationalization and expropriation; terrorism and vandalism; or wilful violation of contract. Country risks are very dependent on the political and macro-economic stability, which include political, regulatory and legal risks. Political risk involves the possibility of government actions, which may jeopardize a project and this can occur at the local, central or provincial levels of government. Some of the key political risks, according to (Wang *et al.* 1999) include amendments to the law, a delay in approval, expropriation and corruption. Failure to maintain law and order may also lead to the damage of privately owned infrastructure. In developing countries, one of the main risks to investors, according to (Wells 1999) is expropriation, where the government may decide to nationalize the assets? Country risk also involves the possibility of business loss incurred by the lender and promoter of the private infrastructure project due to factors controlled by the government, rather than by the lender and promoter themselves. Country risks, both of the political and regulatory type can adversely affect private infrastructure projects because they can change the local economic, political and social conditions, resulting in a situation in which the promoters are unable to construct and operate the project and are therefore unable to retain their investment. The various risks are summarized below.

- Instability of the government;
- Low level of commitment to public private partnerships or concession contracts;
- Expropriation by the government;

- Nationalisation;
- Hostile outbreaks, (riots, wars or terrorist activity);
- Government interference in the management and operation of the facility (including tariff levels);
- No regulatory or legal system which would insure contracts or provide a method of solving disputes;
- Changes in the policy, (royalties and tax law);
- Changes to the laws affecting standard use of technology required in the development of the project and also its operation and maintenance;
- Failure of the government to provide the necessary project permits required for development, operation and maintenance.
- Changes to the legislation regarding the policy affecting the repatriation of funds;
- Amendments to the general legislation (such as regional or national law, corporate law, or commercial law).

In developing countries, the political risk is quite high for BOT projects. It is greater in developing countries because of the possibility of a sudden change in government, which could end the project altogether or cause companies to declare bankruptcy resulting from a political decision.

Political risks are affected by the political environment which exists in the particular country. The risks fall into two categories: instability risks and sovereign risks. The former relates to the revision or abandonment of contracts and also any damage or harm occurring to property or injury of human resources from riots or terrorism. According to Lang (1998) sovereign risks cover several different areas of government interference, including restrictions on the freedom to operate, increase in taxes or other fines, assets being expropriated by the government and prevention of profits being transferred internationally.

Tam (1999) suggests that companies in the private sector operating in developing countries, which are particularly prone to these risks, should ensure that they are protected. It may be difficult to invest in any project due to the lack of rules which regulate competition in the market place or which ensure that investments are protected.

2.10.2 Economic risks

When a country may be unable to generate enough foreign exchange to meet the main interest payments on its external debt is known as its economic risk. It depends on the total amount of the external debt, the debt repayment plan, and the country’s financial risk. The interest payments are determined by the interest rate and the extent of the debt, the loan repayment plan will determine the amount and timing of the principal repayments. However, it is the overall performance of the economy that determines the country’s ability to meet all of its debt obligations.

The financial stability of a country is therefore a key factor in determining the associated risks. If the economy is stable, this will help to reduce changes to the market demand and also the supply of raw materials, which would affect the development and operation, and therefore the profitability, of the projects. The private sector carries a very high risk as it needs to obtain the necessary equipment and materials on time and also to ensure that the facilities are operating effectively and efficiently and providing sufficient revenue. The BOT approach usually ensures that there is a precise agreement concerning rates of return and user’s fees before the project has even been developed. This is difficult for the private sector, since it might not be viable to accept the risks linked with an extended development process in a continuously changing economic environment Dias and Ioannou, (1995).

Since BOT projects have to repay debt by means of their operating revenue, and lenders have no other guarantee, (off-sheet financing), a costly private sector bankruptcy becomes much more likely.

2.10.3 Financial Risk

Wang *et al.* (2000) describe financial risk as the difficulty in obtaining finance, the high cost of financing or being unable to obtain finance in time. Since BOT projects depend to a very large extent on financial support from private or public investment and lenders during the development stage, their success depends heavily on the concessionaire having a strong financial capability, (Zhang 2005). Lam and Chow (1999) suggest that the level of support provided relies on an accurate assessment of the concession company's capacity for repayment over a long period.

There are other risk classifications and these were listed by (Charoenpornpatiana, 1998), as: static or dynamic, fundamental or particular, speculative or pure, private source or government source, non-financial or financial, measurable or non-measurable. (Tiong, 1990), considered the BOT project financial risks to be market, evaluation, input, ownership, currency and return.

The largest of all these risks is obviously fluctuations in currency value, as pointed out by Moran (1990). It is often the case that providers involved in private infrastructure invest their capital at the very beginning of the project, with the intention of recovering the investment later, either by revenue obtained from the facility, or by selling the facility to the government. However, if currency rates are falling during the construction of the project, an occurrence which is all too frequent in developing countries, the facility may be devalued quickly and the foreign private constructors will lose their capital investment Moran (1990).

Most of the revenues will be in the currency of the country where the facility is being developed, while finance is mainly obtained in foreign currencies. Any minor fluctuations in the exchange rate may have to be borne by the firm undertaking the project, however, costs arising from larger fluctuations can be dealt with either by government agreements or by privileged pricing arrangements for the use of the infrastructure utility Hoffman, (1989).

The capability of a country to create sufficient foreign exchange to cover the external debt interest and principal repayments is known as its financial risk. The whole amount of the external debt needs to be taken into account including, the debt repayment plan and also the country's economic and financial risk. The size of the debt and the interest payments will determine the size of the interest payments, and the amount and timing of the principal repayments will depend on the debt repayment plan. The country cannot meet its debt commitments unless the overall macroeconomic performance is good.

2.10.4 Social/ Environmental Risk

Problems have arisen due to the fact that investment decisions in private sector infrastructure have previously been taken based on finance or the economic situation prevailing at the time.

However, there are other issues to consider involving social justice and the environment. The development of the project may lead to displacement of habitats, job losses, or possible effects on environment health due to air pollution. Taking the power sector as an example, the construction of dams to generate power, which would increase economic growth and productivity within the local community can also lead to inundation or destruction of farming and fishing ecosystems, forcing the local people from their homes which might be affected by flooding Dias and Ioannou, (1995).

2.10.5 Technological Risk

The main technological risks concerned with the building, operation, and maintenance of a particular project are a shortage of local technical expertise, especially in the area of safety and quality testing. There might also be a lack of expertise in the legal and financial aspects of a convoluted contract structure which could cause problems.

There may also be further problems caused to private firms by a lack of knowledge regarding work practices, procurement project systems, and access to building materials and cultural values and customs. Insufficient local knowledge may result in the design of a project for which no local materials are available and the cost of importing them may be very expensive.

Foreign investors may also find it difficult to employ reliable local subcontractors and partners in the local environment. A particular form of technology may also be economically unfeasible or the regulations and standards regarding its use may be changed.

This type of risk occurs mainly with projects where new technologies have not been deemed appropriate or economically viable during the development stage. This risk is held by project investors through their capital involvement Tiong (1990).

2.10.6 Operating Risk

Operating risk arises from costs in operating the facility being higher than anticipated during the planning of the project and inadequate revenue being received after its completion.

There are two elements to revenue risk: price risk and demand risk. The price risk is the realistic amount that can be charged for the services, and this may be decided by other competing projects or the granting authorities. The demand risk is doubt concerning the actual demand for the products or services on completion of the project.

Several risks which might be encountered during the operating phase of BOT project have been discussed by Tiong (1990) and he lists these as: the supply of raw material, performance / technical, market, maintenance / operational and foreign exchange.

However, (Beidleman 1990) sees the risks connected with a BOT project operating phase as: performance, liability, cost overrun, off-take and equity resale. (Woodward, 1992), on the other hand, thought that demand, toll / tariff, training and development were the important risk attributes for a BOT project operating phase.

The Operating Risk is the possible inability of the project to meet the expected performance targets. These might include a failure to supply the minimum service quality or quantity, such as water or electricity, for a fixed period. As Taylor (1998), points out, the operation stage of BOT projects demands a great deal of management and requires detailed attention.

2.10.7 Construction risks

These risks involve going over budget and delays possible delays to the completion plans. Construction problems may be caused by poor management, technical difficulties, or a mixture of both. If income from a completed project is needed to recover investment, then any delays in the completion deadlines will delay the realization of this income. Cost overruns will also affect the profitability of the project. Tiong (1990) suggests that cost overrun, completion delay, force majeure, infrastructure and political risks are the main BOT project risk attributes at the construction stage. However Beidleman (1990) identifies these as: cost overrun, completion delays, political and performance risks.

2.10.8 Force Majeure Risk

Dias and Ioannou, (1995) stated that, some risks are outside the control of the Government and project investors. Events such as natural disasters and wars are known as Force Majeure risk. Besides the force majeure, or Acts of God, those risks are related to physical damage or bodily harm as a result of natural calamities such as earthquake, landslide, tornado, hurricane, fire and flood are random and are out of the control of project investors. They can be classified as having low chance of happening however with significant consequences. The investing companies should find ways to limit this risk. The Governments and private companies should include fair clauses to provide a relief against this type of risk in the Concession Agreement.

2.10.9 Market Risk

This risk occurs during the operation of the project as it hard to estimate the level of users, for example, projects in road transport face the uncertainty or risk that the traffic level or users of the road are not high enough to earn the expected revenue. The BOT projects rely on a constant revenue flow from the operation stage of the project. The answer for the market risk is to adjust the identification of the project and the need for the public facility. A sufficient traffic forecast should be done to examine the future traffic levels. In other cases, power plants, the Government offers guarantees of minimum revenues to private sector through the Power Purchase Agreement (PPA) for example in the Shajio Power Plant, the Chinese Government accepted to buy a minimum quantity of electricity, (Tiong 1990).

2.10.10 Cost Overrun/Delay Risk

The BOT projects are highly vulnerable to cost overruns and long delays. To avoid this risk the private sector enters with the contractor in a fixed turnkey contract that addresses this risk and then the risk goes to the contractor who should be in a position to control Dias and Ioannou, (1995).

2.10.11Legal risks

This risk is related to the host country's amendments in the legal system during the project period. The BOT project success is dependent on finance arrangements and contract agreements undertaken to support the project. Therefore any host country legislation changes on environment regulations, tax codes, import restrictions, corporate regulations, and labor regulations might challenge the long-term feasibility of a BOT project Dias and Ioannou, (1995).

2.10.12Revenue Risks

It signifies the exposure faced by investors and lenders caused by the future economic conditions, uncertainties of the host country and the realistic demands for the project that affect its viability. There are several factors contributing to this exposure according to Dias and Ioannou, (1995). Include:

Economic

- Economic policies changes
- Fluctuations in exchange rate
- Foreign currency convertibility
- Interest rate variation
- Inflation

Demand

- Error in prediction of demands for service
- Variation in demand of the facility or product over concession period due to economic recessions, competing facilities, etc.
- Accurateness of demand with the existing products or facilities
- Growth forecasts and demand reliability
- Competing facilities battling for tariff
- Social suitability of user pay policy
- Low historical service pricing
- Failure to earn revenues from principal (end user)

2.10.13 Promoting Risks

- Lack of expertise
- Shortage of independent management
- Lack of experienced labour
- Negotiation skills
- Weak financing
- Failure to allocate risks to suitable management
- Failure to specify effective functions for the promoting team members

2.10.14 Procurement Risks

Several projects proposed during the 1980's by many governments did not advance to the procurement phase leaving many potential promoters concerned about the true advantages of pursuing infrastructure projects. Promoters risks of these types of projects

- Long tendering and expensive process
- Changes to the project specifications
- Lack of information reliability during the tendering process
- Impracticable expectations of the principal due to lack of experience and experts
- Concession granting delays
- Innovative ideas not being adopted by the principal
- Protection of intellectual rights

2.10.15 Development Risks

- Inadequate standards and specifications
- Incompatible existing services and facilities
- Incomplete scope of the design
- Delays approving the design
- Short design period
- Change in design during construction
- Excessive cost of development
- Use of technology unfit for the economy or structure of host country.

2.11 Important factors for the success of BOT projects

Rockart (1982), defined critical success factors, (CSF's), as "those few key areas of activity wherein favorable results are necessary for a particular manager to achieve their own goals, in that limited number of areas where 'things must go right"'. Rowlison (1999) cited in Jefferies *et al.* (2002) recognizes that critical success factors require constant attention and operate during the life of the project'. They consist of specific issues which must be maintained for cooperation to occur in an effective and efficient way.

BOT projects have been considered by many authors, who have suggested particular factors which they believe to be vital to their success. Tam (1999) researched the reasons for successes and failures behind application of BOT in Asia. Tam concluded that in the case a BOT project is property managed, this results in a win-win scenario and both parties can benefit. However, a failure of a BOT project will cause losses and discourage investors from investing in any similar projects and eventually from investing in the country itself. Tam credited failure to the factors of the shortage of competition and lack of transparency in the process of selecting the concessionaire, and by the government generously allowing "safety nets" to the concessionaire, low equity to debt ratio, inefficient processes and management mistakes of the concessionaire, repeated strong public opposition and change of ownership of the concession company during short period.

Change in the ownership of the concession company is not an uncommon problem; majority of members of the Special Purpose Vehicle (SPV) are not investment companies, but trading companies who use the BOT framework as a means to create projects and workload, instead of a long term investment vehicle. Therefore, when long term financing replaces short term loans, it gives opportunity to set investments at a profit to the secondary market. Likewise, when the project has reached a stable income cash flow state, it offers a prospect for selling the investment in the project at a profit and increases gains. It is crucial that project sponsors are aware of this when selecting a bidder, as now the project sponsors will be dealing with new investors during the life of the project. Many BOT projects have contract clauses which stipulate that the SPV members cannot put up their own investment for sale before a specific period after project completion, and the facility enters the occupancy phase. The World Bank has presented reasons for delays in many partnered infrastructure projects ; unclear government objectives and commitment, broad gap between private and public sector expectations, complexity of decision making, inadequately defined sector policies, poor regulatory/legal structure, bad risk management, inadequate local capital markets, low integrity of government policies, inadequate mechanisms to attract private sources for long-term finance at reasonable rates, poor competition, and lack of transparency .

(Tiong, 1996), specified six critical success factors, CSFs, (valid project identification through entrepreneurship and leadership, of advantages technical solution, strength of consortium, differentiation of the financial package, and differentiation on guarantees), which, if given continued and special attention by the promoters, will increase probability of a successful outcome.

Research was carried out by Jefferies *et al.* (2002) on the way in which public clients can obtain and successfully run Build-Own-Operate-Transfer (BOOT) projects. Jefferies has used a case study of an Australian sports stadium project and specified the critical success factors, CSFs as: wealth of experience; strong consortium with a considerable expertise; good reputation and high profile; an effective process of approval to help stakeholders by providing an agreed time frame; and finally the methods of finance and innovation achieved by the consortium

Qiao *et al.* (2001) considered eight independent critical success factors, CSFs, in BOT projects which had been conducted in China, these critical success factors, CSF's consist of: accurate identification of the product, a stable economic and political situation, acceptable toll tariff levels attractive financial package, reasonable risk allocation, management control, a good choice of appropriate subcontractors, and the necessary transfer of technology. On the other hand, (Li *et al.* 2004), showed three factors to be of greatest importance when developing successful UK PFI/PPP projects. These are: a strong private consortium, a good financial market and appropriate allocation of the risks.

The next section will present some of the successful and unsuccessful BOT projects in a number of countries, this will show why and how these projects worked and the problems occurred in the process:

2.12 BOT Projects Worldwide.

Successful BOT projects will be discussed, together with unsuccessful projects, identifying good practice and the major causes of failure. The BOT projects that have been successful had a keen focus on the BOT programme goals by all parties concerned, with clearly defined and agreed responsibilities.

2.12.1 Unsuccessful BOT Projects

Unfortunately, many projects in Asia have not achieved their aims. This may be due to governments taking on project expenses and risks, or projects being abandoned altogether. There are usually four main categories of problem: an initial lack of agreement between the government and society concerning the use of Public Private Partnerships in projects within the public sector; the inability of the government to identify basic aims and reasons for the use of Public Private Partnerships in the projects; the government's inclination to obtain a consensus with investors, while failing to carry out the necessary detailed research or identifying a clear, competitive process for project bidding; and finally the willingness of governments to share costs and risks usually borne by the sponsors within the private sector.

2.12.1.1 Pakistan's Hub Power Project

In 1985, the first BOT project undertaken in Pakistan commenced was the construction of a 1,300 megawatt oil-fired power generation project costing 1.8 billion US dollars. It was encouraged by strong support from the World Bank. However, the environment was hardly conducive for such a large project since the country suffered from constant political instability, and was very weak financially. There was also an inadequate legal system to resolve problems and disputes. According to Handley (1997) the continuous conflicts were symptomatic of the lack of consensus regarding the project's objectives, and the way in which these were to be achieved, resulted in a nine-year delay before the start of the concession. Consequently, the first of the four power generation units were not put into operation until the middle of 1996.

Over the last twenty-five years, the political climate in Pakistan has remained a hurdle to initiating BOT infrastructure projects. Difficulties include, as well as Political instability, a long tendering process, law and order enforcement and terrorism.

Due to long delays and the high environmental risks involved, the government of Pakistan absorbed most of the risk from the Hub Power BOT project. The government had taken out a $582 million US loan from the World Bank to finance the project and also had to take considerable participation equity as well as guaranteeing power off-take agreements and fuel supplies, and also providing protection against the risk of any fluctuations in the foreign exchange rates. The Pakistani government was also directly accountable to the World Bank and to the foreign government agency's financial obligations to the project. According to Handley (1997) these together comprised 70% of the total cost of the project, while the total investments from the private sector were very limited.

A question often asked about the Hub Power Project is whether, had it been smaller, it would have been developed more rapidly. The best answer that can be given is: probably -so long as there was an associated reduction in the complexity as this, after all, was Pakistan's first BOT infrastructure project.

2.12.1.2 Malaysia's Power Project

A similar problem existed for Malaysia BOT projects, where power generation projects were also constructed within a weak industrial framework. In 1992 the government gave a number of concessions to various sponsors, and the monopoly power of the state, Tenaga Negara Bhd., signed power purchase contracts with each of them. Although this considerably sped up the construction of the power generation facility, the government had instructed Tenaga to pay private plant-gate producers prices that were about the same as Tenaga's sales to the public. This meant that the profitable Tenaga Company was providing private power to customers free of charge, yet had to pay the private concessionaires for more than Tenaga's own costs of production. When the capacity to produce national power far outran requirements in 1995, this became a major problem, due to growth by both Tenaga and the producers. As noted by Walker and Smith (1995) Tenaga had an excess power supply and also an obligation to buy the independent producers' supplies of the power, so had to lessen the supply of power from its plants, which further reduced its own profits and caused serious conflicts.

2.12.1.3 Indonesia's Toll Road Project

In 1995 in Jakarta, Indonesia, a number of urban toll roads were constructed using the BOT concept. The government offered nineteen sections of proposed toll roads across Java. However, the government's failure to address two main issues has made the deals and the projects' environment commercially unattractive.

The main obstacle to success was the government's inability to enforce the user-pays basis on which the agreement was based. The setting of the tolls and any increases were the legal right of the Indonesian President, and the government was of the opinion that, although an increase might be pledged in principle, it could not be guaranteed by the contract. This did not cause a problem for private Jakarta toll roads, since they were constructed by companies managed and owned by President Suharto's children who easily obtained approval for increases in the toll whenever they requested them, with the exception of one request in 1995, which was countered by a very rare public attack on the Indonesian parliament, resulting in a long delay before the increase was finally approved. This is a very good example of the political nature of the setting of toll rates.

For this reason, the British company, Trafalgar House, spent the six years, (1988 to 1994), negotiating a concession contract for a Java country toll road. This resulted in Trafalgar's acceptance of the President's record of support for existing concessions, and enabled the financing of the project. However, the six years spent on negotiation was more than the time it would have taken to construct the road.

As noted by Handley (1997) a further issue challenging the ability of the government to create commercially feasible concessions for sections of the cross-Java highway is their insistence that all land acquisitions should be funded by the sponsors, but that the acquired land will belong to the state. Since land acquisition is a lengthy and somewhat unpredictable process, potential private investors in Jakarta considered the risks to be much too high for their involvement.

2.12.1.4 India's Power Project

In 1996, negotiations for construction of the 1,000 megawatt Cogentrix, power project costing 1.1 billion US dollars, in Mangalore were delayed by four years, partly due to public resistance and bureaucratic infighting, and also to the government's constant efforts to renegotiate the price and other specifications. Having initially defined the price and specifications, and acquired agreement from the sponsors, the government 'moved the goalposts' by creating tougher requirements. It continually gave, and then withdrew, the offer of crucial guarantees regarding payments for the sale of power. This problem illustrates a lack of agreement within the government regarding the aim of a BOT project, which was to simply obtain power generation capacity, privately financed and at a sensible price. Further negotiations revealed a new concern regarding the acceptable profitability level for concession holders. As Handley (1997) points out, this was a deviation from the main purpose of the use of the BOT model in the production of a power supply.

2.12.1.5 Malaysia's North-South Highway Project

In Malaysia, the first successfully completed BOT privatization project was the 1,000 km North to South Highway, which runs down the western side of the Malay peninsula from the Thai border in the north to Singapore in the south and links many of the country's newly industrialized areas. The primary reasons were an apparently viable and growing revenue stream together with a government willing for development which made this project ideal for BOT. Three hundred and fifty kilometers had already been constructed by the government by 1985, but the project had come to a standstill due to the downturn in the economy, with some fifty five kilometers still under construction. After considerable negotiation, complicated by political bickering, meant that the concession agreement was not signed until 1988 for which the managing company was Projek Lebuhraya Utara Selatan PLUS was selected.

However, despite the successful construction of the highway, the government finally picked up much of the costs. The BOT contractor was to complete the road, after almost half the had been completed by a state-owned company at a cost of three billion ringgit, ($1 billion US). Although there was open bidding for the project in 1985, it was granted to the third placed bidder rather than the highest bidder, because this company had connections with the ruling political party, even though the two higher bidders had provided better terms for the total cost of construction, the requirements for finance from government and also the required concession period and toll rate, ensuring that the original terms of reference focused on the primary aims of the BOT process.

The resulting legal dispute mentioned above delayed the final signing of the contract by two years, until March 1988, within which time it would have been possible for the government itself to have made significant progress in the development of the road. Another serious problem was arranging finance, which took extra time since international banks were reluctant to fund a limited-recourse BOT company. The government therefore supplied a subsided loan of 1,650 million ringgit, ($522 million US) which amounted to about half of the predicted costs. The road was finally completed in 1993, at a cost of 6,000 million ringgit, ($1.9 billion US), for the part constructed by PLUS, far higher than estimated. Therefore according to Handley (1997) the government had established the need to continue its' involvement in the finance and subsidy for PLUS, including an unplanned toll increase in order to assist the financing of the project.

2.12.1.6 Indonesia's Power Project

The 1988 power project in Indonesia began on a private basis involving secret negotiations that produced a number of false starts. This was because the companies involved in the negotiations at the outset were changed for commercial and political reasons. The name of the power project was the Paiton project and the sponsors were changed twice, until, in 1992, there were serious negotiations with the Mission Energy Corporation, Paiton's major sponsor. The Paiton project experienced a very long gestation phase but also contracted at a high power price. As Tiong (1995) states the main result was a seven-year delay before the commencement of an urgently needed power plant. The Paiton power BOT project proved very costly and involved high risk, so it was not considered by Indonesian private sponsors or by Indonesian commercial banks. For this reason the project was considered by foreign government institutions. The total financial package was $1.9 billion US and, of this, $900 million US were provided by the Export-Import Bank, and a further $200 million US were received from the Overseas Private Investment Corporation in the USA. The commercial banks actually provided only $274 million US of the total and the foreign governmental institutions covered the insurance loan. This high level of involvement by foreign governments put the onus for success on the Indonesian government.

According to Walker and Smith (1995) short-term equity risks were taken out on the project by the sponsors, and it was apparently agreed that Mission Energy of the United States, the main investor, would recover most of its equity by means of fees which it would charge for project management, including a large payment at the commissioning of the plant. A further main stakeholder, the provider of the power plant itself, was sponsored by United States Exim Bank credits, ensuring a low risk on equipment sales. The main fuel provider to Paiton, a relative of the President, was in fact the key Indonesian partner, (the third main shareholder). When the plant was commissioned, the plan was to float the company on the stock exchange in order to reduce the sponsor's risk. The result of this was that, by the time the plant was operational, the main sponsors would have almost covered all their equity exposure risk. Also, the main burden of risk would be on local governments and foreign financial institutions which, in the event of default, would be forced to rely on the Indonesian government to meet the losses.

The Indonesian government failed to remain focused on the goal of the project which was to obtain the cheapest and most efficient supply of electric power for the country. The Indonesian government insisted that Paiton built additional facilities not in the original contract, use specific contractors and to purchase equipment from certain designated companies. In meeting these requirements Paiton was prevented from pursuing the most efficient development/construction of the plant thus forcing it to increase capital costs by an estimated $200 million US. The result was that to make the project commercially viable, for a BOT, project, the electricity prices had to be set at an uncompetitively high level, further making the concessions and financing negotiations more difficult.

2.12.1.7 The Channel Tunnel

In 1984, France & England, decided to commence the construction of the Channel Tunnel with each country being responsible for the section of the project located on its' own land according to their geographical terminals. The contracting organization, Transmanche Link, (TML), (made up of five French contractors and five British contractors), won the contract and Eurotunnel was declared the owner of the 55-year concession in 1986.

The basic problems that contributed to the delay in starting construction of the Channel Tunnel were that the lending institutions had a general distrust of contractors, which was not aided by the contractors lack of strong representation in the initial stages of the project and led to a "gap" in communication and understanding between the construction group and the financial bankers.

The construction companies did not acquire sufficient design criteria on which to base a realistic budget due to the exclusion of qualified experts in some disciplines and the lack of cooperation from both the English and French governments, when strong direction was required, just compounded the problems.

The funding for the project was: $2.3 Billion (TML $71.58 million, 40 Banks $313.74 million, French Bank $663 million, another investors $1.252 billion) with a debt of $12.6 Billion, giving a Total cost of $ 14.9 billion).

The two governments accepted only the legal risks and will pay for the overrun in operating costs due to the changes in legislations whereas TML had taken on all the other types of project risks

Regarding management disputes, only three large claims were presented by the contractor. The first claim involved unforeseen subsurface conditions, the second claim dealt with a request for an increase in the lump sum portion of the contract related to the U.K terminal building and other surface structures, and the third claim involved the cost of fixed equipment-such as the ventilation and electrical work.

The first and second claims were settled. But in the third claim, the contractors wanted to increase the fixed equipment budget by $1.071 billion US. The Disputes Resolution board, (DRB), determined that the owner, (Eurotunnel), is to advance $85 million per month to TML.

The Channel Tunnel was opened for traffic on 6th May, 1994 and it was not until April 2008 that the first profit, ($1.6 million US), was recorded for the whole of 2007, after debt restructuring from €9.2 billion Euros to €4.2 billion. (Ahmed, 2003; BBC, 2008).

2.12.2 Successful BOT projects

2.12.2.1 Eastern Harbor Crossing – Hong Kong

Handley (1997) reports on a successful BOT project, which was the second tunnel under the eastern harbor in Hong Kong. It was built by a BOT project method with a concession period of 30 years duration and was similar to other BOT projects in that the contract did not include a return on investment target. The government had already acquired experience of managing BOT projects previously and equity was decreased to 7.5% for the project. The Executive council, which considers the average rate of return on investment in the region, was to decide the toll rates and any future increases. However, with the advance of democracy, decisions on the toll increase were often delayed by elected members of the legislative council, whose main concern was their constituents' interests. After the tunnel had been officially opened in 1989, it was decided to postpone requests for toll rises until 1997 because Hong Kong would be handed over to the People's Republic of China. Fortunately, there was an arbitration statement included within the BOT agreement and after referring it to arbitration in 1998, a toll increase for the franchisee was successfully obtained. This emphasizes the need for an equitable and established legal system for BOT projects. Despite this, toll rates have still proved to be problematic for this project. Although the design and development of the project were carried out on time and within budget, the traffic predictions were overestimated and the suggestion of increasing the toll rates was not approved by government legislation. There was also unwillingness for increases because of the political effect.

2.12.2.2 Western Harbor crossing – Hong Kong

This Hong Kong project began in 1993 and ended in 1997. The tunnel was finished early and within the specified budget. However, for this BOT project, a new contract condition was included and the government, not being a shareholder, was unable to supervise operations. It had been the practice in previous BOT arrangements for the toll rates, the periods of toll adjustment, and their level to be agreed between the government and the sponsors and to be authorized by the legislative council. The only factor taken into consideration for each toll rise should be the rate of return on investment. However, the problem with this is that the legislative council is mainly concerned with serving the public, but the tunnel shareholders are motivated solely by profit resulting in a lack of agreement between them on many occasions. An example of this concern are the negotiations of the toll rise on the Tate's Cairn

Tunnel, (Hong Kong), and the Eastern Harbour Crossing, (Hong Kong), which dragged on for several years and therefore placed investors at risk. When Hong Kong regained its sovereignty in 1997, the government's negotiating power was undermined and it was compelled to agree to an arrangement of an alternative toll rise. The new BOT agreement defines the maximum and minimum annual income, as well as the amount of toll rise and the time periods of toll adjustment. In order to collect the excess annual income which can then be fed back into the project and thus delay or prevent a toll rise, a government-operated toll stabilizing fund was created. The advantage of which is that, if the annual income falls within the range between the maximum and minimum, any toll rise would be based on an automatic toll modification mechanism thus preventing any influence of government on business decisions.

It is therefore possible, as noted by (Walker and Smith, 1995), for a practical agreement to protect investors' interests while also providing a competitive rate when the facility is used under appropriate tendering procedures. It can also, perhaps most importantly, protect against the secret influence of politicians in the running of the business.

2.12.2.3 Dartford Bridge, Kent UK.

It became apparent to the UK government that an additional crossing over the River Thames was needed in the early eighties. The route through the existing Dartford Tunnel was straining to maintain a smooth flow of traffic, as it was originally designed for 65,000 vehicles per day and by 1991, over a 100,000 vehicles were using the tunnel per day with queues of over 5 kilometers in both directions. By 1986, a deal was signed between the Department of Transport and a consortium led by Trafalgar House for a bridge with an estimated cost of £184 million Sterling. The deal followed an extensive period of discussion and indecision. From the original eight contract companies, three were short-listed, (Trafalgar House, Mowlem and Balfour Beatty), all three proposed a tunnel solution, however, Trafalgar house also proposed an alternative cable stayed bridge option and it was this option which eventually won the day. There were allegations by one of the unsuccessful bidders that the Department of Transport had changed the rules a week, or so, before the deadline to make the bridge option more feasible.

The new bridge will double the capacity of the existing crossing to 130,000 vehicles per day. [This project was particularly important as is set the scene for further BOT infrastructure projects in the UK, i.e. The second River Severn Crossing and the Birmingham North Relief Road]. Construction started in August 1988, and the bridge was opened to traffic in October 1991, on time and within budget.

The concession was unique in that not only did the private company operate the bridge but also the existing tunnels for the period of the concession, including paying off the debt of £55 million Sterling carried by the Kent and Essex County Councils. The agreement also has a provision for a variable concession period for the bridge with the maximum set at twenty years but the tunnels will be handed back to the government as soon as the debt charges and costs have been recovered. However, the costs for construction and maintenance had been recovered by 2003 but the government has not yet stated any intentions to remove the tolls and has in fact been increasing the tolls regularly over the last few years in the present economic climate. The Dartford Bridge must represent one of the best potential BOT infrastructure successes.

2.13 Discussion of Successful and "Unsuccessful" projects

The "unsuccessful" projects are considered to be "unsuccessful" not because the project was not built and completed but because of the difficulties encountered during the different project stages which resulted in delays, (in years) and cost over runs, (in $ billions).

Unsuccessful BOT projects have a high impact on the host country's credibility, economy and development. Hence, a transparent legal framework, attentive to risk management, should be developed to manage all stages of the BOT project cycle.

Comparing successful BOT against unsuccessful projects clearly shows the importance of the realization of an agreement between all involved parties that leading to a clear and stable legal structure. Therefore, a well prepared project assessment bid that provides sensible equity to debt ratios and reasonable cost estimates is crucial for the project and to maintain confidence with all parties concerned; -otherwise the private investors may consider the BOT infrastructure project to be unduly risky.

BOT Projects in Kuwait have had many of the difficulties described in the above projects with some investors submitting high offers without realistically considering the risks. The main obstacles facing any new BOT Infrastructure project is the stability of the Kuwaiti government and transparency in the financial and tendering processes and Law 7 of 2008 was introduced to address the need for transparency during the tendering process and awarding stages of the project, and was to ensure that companies complied fully with the Law, (Alduaij 2010). This indicates the serious intention of the Kuwaiti government to implement privatization policy and to involve the private sector in the implementation and development of projects and services.

Other possible delays, including the change in design, are due to the workforce going on strike because of the onerous working conditions, low wages and long working hours.

2.14 Public Private Partnerships and the Kuwaiti Government Approach towards B. O. T Projects

In the West, it seems that private sector organizations perform more efficiently than those in the public sector Most countries count amongst their objectives, less government control over the economy, the need to attract foreign technology and expertise and more efficiency and greater competition. This also applies to Kuwait, but there is a pressing need to encourage an increase in activity in the economy and to attract local capital. This would hopefully result in greater efficiency in the provision of services in Kuwait, and would also benefit all of Kuwait since government spending would be used more effectively.

Kuwait's government's first official step towards public private partnerships began shortly after the liberation of the country from Saddam Hussein's regime'. Although this was Government's first official step, the Kuwait Investment Authority, (KIA), had already commenced a huge sale of Government shareholdings of 48 companies in 1986 on the behalf of the Kuwaiti Government. On 1st September 1991, the Government decided during a cabinet meeting to encourage the private sector to participate in constructional development Kuwaiti Government Cabinet meeting No 25/1991 hence, the Government sent out general directions to carry out this goa1 Kuwaiti Government Cabinet decision No. 5/17. Subsequently, in October, 1991, the cabinet decided to form a special committee to prepare a general study on public private partnerships; Kuwaiti Government Cabinet decision No. 4 on 20th Oct 1991. The Government was very keen to set and implement a public private partnership plan as soon as possible. The objective of this plan was to achieve essential improvements in the performance of the public service sector. Some of the improvements fundamentally needed as proclaimed by the Government were the reduction of the financial and administrative burden, enhancement of the performance and productivity of manpower, creating new sources of income and the implementation of new technology Al-Otaibi,(2008).

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2.14.1 Economic Overview

The economy of Kuwait is a free and open economy, based mainly on crude oil production and is one of the most prosperous in the world.

According to Al-Ghunaim (2007), although today oil and oil products are the main economic source, at one time Kuwait’s economy depended upon nomadic farming, fishing, seafaring, boat-building and, in particular, pearl diving.

Once the huge oil reserves in Kuwait was discovered, oil and the industry connected with it, became its main source of revenue. These large reserves of crude oil make Kuwait one of the richest countries in the world with the highest annual per capita income. Its gross domestic product, (GDP), is about $43.7 billion, which grows at a rate of 5% per annum and the economy is based on petroleum, which makes up 90% of its total exports.

Almost 7.8% of the world’s crude oil reserves, about 104 billion barrels, are in Kuwait and it also has 21.2% of the GCC crude oil reserves. This is the next largest to Saudi Arabia, among the GCC countries. If the current rate of production, about 2.613 million barrels per day, continues, the oil stocks should last for about 109 years. Petroleum accounts for 95% of export earnings, 50% of GDP and provides 80% of government revenue. Due to the climate, agricultural development is limited and so, apart from fish, most food is imported Almost 75% of the drinking water has to be imported.

During the years 2003–2008 the global demand for oil enabled the economy of Kuwait to move forward and build budget and trade surpluses, as well as foreign reserves. A decline followed in 2009 as oil prices fell and production was reduced.

2.14.2 Overview of the Macro economy

Growth

Between 2007 and 2008 the nominal GDP of Kuwait increased by 41.5% from US $111.76 billion to US$158.09 billion. This was due mainly to strong oil prices and the high volume of oil exports as well as increased foreign investment.

It was predicted that the GDP would decline by -32.8% to $106.21 billion in 2009 and then increase again by 14.1% to $121.2 billion in 2010. In fact the GDP increased by 6.3% in 2008 compared with 2.5% growth in 2007. There was then a predicted decrease of -1.1% in 2009. However further growth of 2.4% was predicted for 2010.

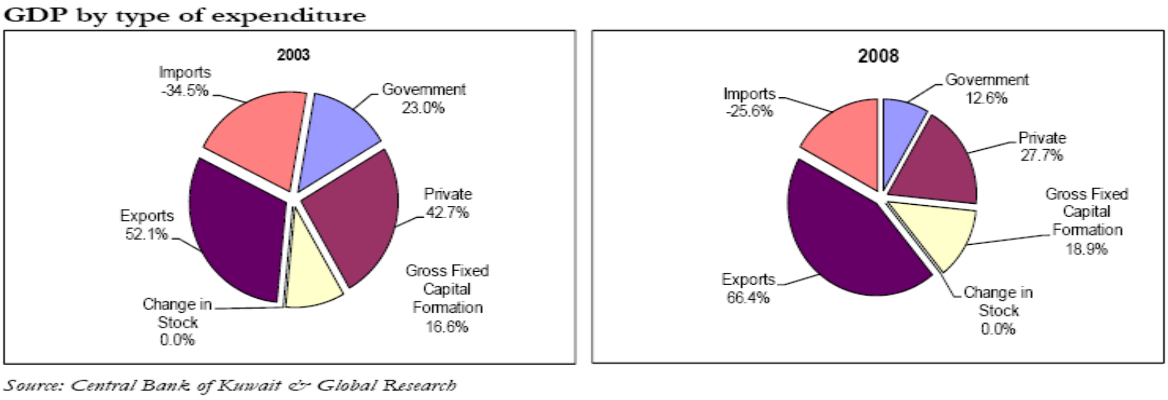


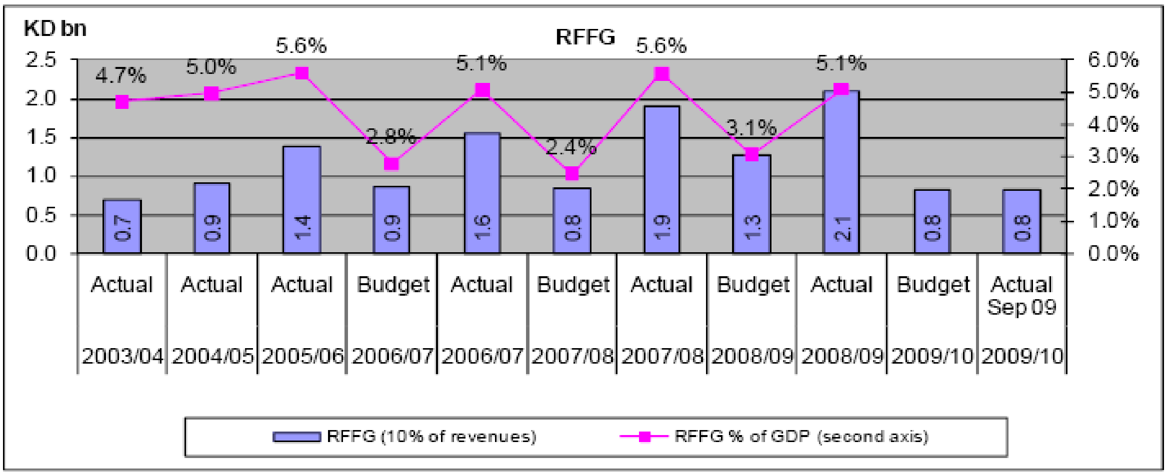
Figure 2-4 Inflation

During the years 2000– 2004, the inflation rate within the Kuwait economy remained low within the range 0.8% – 1.6%. However, this was followed by an increase. As the result of a salary increase for employees in Kuwait as well as a fluctuation in currency and an increasing demand for food and housing, consumer price inflation increased to 10.5% in 2008 an increase of 5% over 2007. In May 2007, it was decided to de-peg the Kuwaiti Dinar from the US Dollar and re-peg it to a group of currencies. A decline in inflation to 6% in 2009 and 4.8% in 2010 was predicted.

2.14.3 Fiscal Position

Following a global boom in the oil industry, the fiscal surplus stood at 32% of GDP in 2008 compared to a surplus of 29.3% of GDP in 2007. This, coupled with strong oil resulted in large budget surpluses. The surplus was predicted to plunge sharply to 2.3% in 2009 and to 3.5% of GDP in 2010. In order to provide funds in the future when oil revenue will not be available, there is a law which states that 10% of the Kuwait income must be placed in a special reserve fund.

Reserve Fund for Future Generation transfers over years



Source: Central Bank of Kuwait, Ministry of Finance & Global Research

To understand the reasoning behind the Kuwaiti Government's decision to enter into private public partnerships, it is necessary to review the history of the public sector in Kuwait. This will reveal people's increasing dependency on Government, (especially in the field of providing public services), since the discovery of oil. However, first it is necessary to define "privatization" as a proper definition of privatization would help to better develop an understanding about the discussion carried out on the course of this study.

Most recently, the rise in world oil prices in 2011 is reviving the country's economic growth. The budget revenue has increased by 20%, which has led to higher budget expenditures, particularly wage increases for many public sector employees. Little has been done to diversify the economy, partly due to this positive fiscal situation, and also because of the poor business climate and the acrimonious relationship that presently exists between the National Assembly and the executive branch, which has obstructed economic reforms. In 2010, Kuwait passed an economic development plan that pledges to spend up to $130 billion over five years to diversify the economy away from oil, attract more investment, and boost private sector participation in the economy.

2.14.4 Defining Privatization

Privatization became a familiar term during the early 1990's, but its' meaning can be more easily understood with reference to events taking place in the former Soviet bloc, South America, Africa, and/or Asia, where previously state-owned industries were sold to private investors. However, there is a type of privatization, known as limited term privatization or a public/private partnership (PPP). This kind of privatization involves the investment of risk capital, which is used in the operation and maintenance, as well as the design and finance, of a particular project that can be used by the public for an agreed period of time. During this time, a consortium from the private sector collects revenue from the members of the public who use the facility. At the end of the time of ownership, the consortium returns the facility to the host government, having collected enough funds to realize a profit on their original investment. Host governments agree that it is usually the private sector which produces a more cost-effective product than can be achieved by the public sector .This is particularly noticeable in projects such as power plants, piped water supplies, sanitation and sewage works, rail systems, roads, dams, canals, ports, and airports, (Levy 1996).

In addition, privatization has become a global phenomenon, but the meaning of this term is not always fully understood. It is worth noting that privatization has different meanings in terms of what privatization programs can and have been used to do, nonetheless, privatization can be defined by illustrating both a narrow and a broader meaning of the term. The more restricted sense, privatization suggests that the transfer of control is permanent perhaps resulting from the transfer of ownership from a public agency to one or more private parties or, perhaps from a capital increase where the public-sector shareholders have waived their subscription rights. The broader definition of enterprise-level privatization however, refers to measures resulting in a short-term transfer to the private sector of activities which had previously been managed by a public agency, (Guislain 1998). Accordingly, privatization could therefore mean any of the following:

1. The provision of services or facilities by the private sector which would usually be seen as the responsibility of the public sector.
2. Moving the production of goods and services from the public to the private sector.
3. Moving the delivery of Government management and services or transferring governmental roles or assets, to the private sector.

4. To improve the lack of incentive and initiative in public organizations and to make them more efficient by exposing them to private market incentives.
5. Involving the private sector in the delivery of public services and in the management of Government (Higgins 2008).

Privatization is the transfer to the private sector of tasks and responsibilities including the control of costs and revenues. Menheere and Pottatis (1996) refer to privatization as a process in which the delivery of goods and service, usually administrated by the government, is shifted to the private sector. Privatization is divided into three areas: the setting of government services, the subcontracting of government services to private undertakers, and the subcontracting of financing and developing public facilities.

From these definitions, it can be seen that, as well as transferring ownership from the public to the private sector, privatization includes a number of additional operations such as: subcontracting (in which a private company is contracted to deliver public services such as waste collection) or meter reading and billing (e.g., water or electricity).

Depending on whether management contracts are performance-based there may be no transfer or ownership or control, but just a temporary transfer of management responsibility. In the case when there is an option to buy included within the lease of state owned equipment, assets or enterprises, then the operation may be considered as a divesture.

This would include lease-and operate contracts within the infrastructure. Lastly, BOT, (Build, Operate, and Transfer), contracts, as a new way of concession, are one means of privatization but have the effect of a monopoly. Thus, as seen above in a broader sense, privatization could involve any permanent or temporary transfer to a private party of the ownership or management of some public agency. Naturally, each of these actions has to follow a unique legal procedure. For example, transferring the ownership of a public agency in general requires a superior procedure where the consent of both the Government and Parliament is required. This would involve the passing of a law as in Kuwait, the UK and France.

Replacing Government management with a private one requires a less restrictive procedure. The usual procedure in this case is that the Government contracts out. However, in some cases like Kuwait, for example, concessions and monopolies, require Parliament consent, hence, a special law must be approve. Whatever was the case may be, it is vital to emphasize that any procedures of transference should be legally feasible.

Some parts of the public sector such as: the police, the armed forces, and public `powers', (i. e. statuary, judiciary and executive powers in some legal systems), could not practicably be privatized either because of the vital role it represents. For example, (John Vickers and George Yarrow, 1985), argued that: "the net benefit of transferring the ownership of a company from public to private hands is often ambiguous, and is unlikely to be very great. Although private ownership may result in more dynamic energetic management, there is a danger that those energies will not be directed in the public interest when market powers can be exploited".

The danger is greater still when economies of scale are considerable and when barriers for entry are high. However, one might disagree and argue that there may be a room for privatizing nearly all state functions. In conclusion it seems that, (Bob Watt, 2008) is correct when he proposes that:

The determination of whether an industry is to be `privatized' or `nationalized' is not simple. It has to be determined against a range of factors. These include the consideration of several aspects which consist of: the resource itself, the method of production, the amount of control over how the resource is to be exploited, the type of working conditions in the industry, (health and safety, labour standards, environmental standards); and, the level of Government control of strategic management.

2.14.5 History of the Public Sector

In Kuwait, the public sector consist of more than fifty ministries, corporations and public authorities which all of the Government's affairs. It is important to note that since the discovery of oil in Kuwait in 1934, and subsequent oil production from the Burgan field from the 1940s, the Government controlled the primary means of providing people with all of their fundamental needs. This included: free health-care, housing, free education, power, transportation, marriage bonuses, and employment, and pensions. In fact, nearly all the public services were supplied and provided by Government's state owned utilities. It is vital to understand that many of these services were either free or provided at a lower rate than the actual cost. Additionally, there is no real taxation system that applies to the citizens of

Kuwait. The prosperity that everyone assumed could be seen as a reallocation of wealth, (i.e. the oil wealth), however, this situation created an ethos of total reliance and necessitated some trust in the Government. Moreover, there was consensus that the Government was the guardian of the public interest and therefore obliged to provide all the public's needs. This raises the question of how long a Government can sustain this process and how efficient the public service sector can be?

2.14.6 Funding and Maintaining the Public Sector.

Although, within the Middle East, Kuwait has become one of the richest countries, over time it country has faced many crises which have prevented it from accomplishing many promising developments. Two of these crises were the Financial Crises of 1976 and 1982. These crises were brought about by illegal transactions in the Financial Market, (Souq Al-Manakh or Kuwaiti Bourse), which led to a major collapse of the Kuwaiti stock market. In fact, the Government had to intervene and hundreds of millions of dollars were spent recovering the market Al-Sultan, (1989). In the autumn of 1979, Kuwait's neighbors Iran and Iraq began an aggressive eight-year war. During that critical time there were fears that Iran was planning to conquer the whole region, therefore, Kuwait and some other Gulf countries' felt necessary to support Iraq. The Kuwaiti Government's financial contribution during the conflict was at least one billion dollars. Ironically, in August 1990, Iraqi troops invaded Kuwait destroying much of its infrastructure, stealing public and private properties and burning over 700 oil wells, Al-Ghunaim, (1995).

Iraqi forces caused extensive damage to the environment as well. After the conflict, Kuwait was in total chaos and reconstruction of Kuwait's infrastructure and recovery of the environment was challenging, Al-Faqeer, (1992). In addition to these crises, there are some alarming facts concerning the Government's increases in manpower and Government subsidies. For example, each year the Government pays more than 51% of its income from oil in labour costs. Secondly, the Government subsidizes many Kuwaiti goods and services. For instance, in 1994 the Government subsidized 89% of Kuwait’s electricity, and 71 % of local telephone services. However, by far the greater part of the Government's subsidies are for the commodities of water and electricity, yet the Government pays 5.5 million KD ($16.5 million US), annually to subsidize food and building infrastructure costs Privatisation Team Kuwait, (1996).

Generally speaking, the public sector in Kuwait is run by public management (i.e. public servants), and governed by traditional public measures. There are of course, Government enterprises with a commercial nature that are governed by private law and subject to private law jurisdiction. Although the public sector in Kuwait is three times the size of the private sector, it lacks efficiency and competence. The reason behind this is the multiple goals pursued by the Government. These goals are as follows:

1. Ensuring national security. promoting social security (i.e. via maximizing employment, providing public services at low cost),
2. Promoting regional development (i.e. infrastructure, transportation, telecommunication, promoting the economy, (etc...)),
3. Government's monopoly policy towards state owned enterprises associated with strong system of subsidization.

With the absence of competitive incentives, the whole operation is measured by quantity and not by quality. Moreover, since the Government subsidizes nearly all of Kuwait's goods and services, the entire process is generally unprofitable. It seems fairly certain that the Government could not sustain this process for long which is why it was decided to adopt a privatization plan in order to hand some of the public services over to private ownership which would also have the capability to fulfil the government's obligations and promote the provisions of the public services Ghattas, (2005). However, there are many methods of privatization some of which could be successfully applied to one country that may not necessarily work in another. The success or failure of any particular privatization method is subject to the unique social, economic, legal and political composition of each country. Hence, each country should avoid a `one-size-fits-all' approach to privatization by assessing its' unique needs and by adopting a privatization programme that is most likely to succeed within that construct. Therefore, it is of great importance at this point to provide a proper definition of privatization in Kuwait.

2.14.6.1 What can Privatization Offer the Kuwaiti Government?

The Kuwaiti Government is planning to adopt privatization measures to solve a number of serious problems and to achieve a number of important benefits. The most important measures are as follows:

2.14.6.2 *The reduction of the state financial and administrative burden:*

Much effort, time and money has been expended by the Kuwaiti Government in running and maintaining the whole of the public sector. The Government argues that many of public services can be carried out privately and so intends to implement privatization in order to use the money saved to carry out other fundamental projects such as post-Iraqi invasion reconstruction, environmental restoration and more importantly, establishing social programmes to rehabilitate society from the devastating impact of the Iraqi invasion. Additionally, Government funds are required for economic and infrastructure development, Privatisation Directorate Kuwait, (2005).

2.14.6.3 *Creating new sources of income:*

The Government argues that it would be able to impose fees and taxes on companies in order to increase the national revenue. Perhaps the Kuwaiti Government is looking at the high financial revenues obtained in different parts of the world after adopting privatization programmes, -especially in East Asia and in the Pacific. For example, between (1990-1999) privatization led to a high level of redistribution of wealth primarily in Malaysia, (43%), and Indonesia, (26%). It is worth noting that despite the slowdown in the pace of privatization due to the 1997 Asian crises, the total revenue have increased remarkably from US$0.38 billion in 1990 to US$2.55billion in 1999, Boubakri and Cosset,(2004).

2.14.6.4 *Enhancement of the performance and productivity of manpower:*

Privatization programs could also provide a good opportunity for improvement in the performance and productivity of manpower. Due to the competitive environment that privatization may offer, national employees would have an opportunity to receive better training and supervision from multinational companies. For example, in terms of performance a study conducted by Boubakri and Cosset (2011) showed significant performance improvements for seventy-nine newly privatized firms from twenty-one countries. The authors documented a higher increase in performance as measured by profitability, efficiency, output and investment.

2.14.6.5 Privatization would help to improve the quality of services and simplify the procedures for accessing services:

New techniques can be implemented as technological and multidimensional capabilities can be used. More importantly, Government routine, bureaucracy and complicated procedures could be eradicated. Simpler procedures could be adopted allowing easy access to public services and facilities. The experiences of the Mobile Telecommunication Company (MTC), (now known as Zain), was the Middle East's first mobile phone company. MTC was established in Kuwait in 1983 as a monopoly with Government holding shares of 24.8%. The company later expanded its' major operations to more than nineteen Middle Eastern and African countries, MTC Report Feb, (2006). The Wataniva Telecommunication Company, (WTC), Kuwait's first privately owned Phone Company which was launched in December 1999, are examples of the improvement in quality in telecommunication services in Kuwait as the competition between two major companies using advanced technology led to better service, lower prices and created more job opportunities.

2.14.6.6 Investors

A large amount of national capital has been invested outside Kuwait. For example, approximately $50 billion US has been invested in different parts of the world, due mainly to the insecure investment environment in Kuwait. Kuwait is not exporter of capital. Implementing privatization programs would create many generous and profitable opportunities which would attract many local and foreign investors providing more and better opportunities to participate in the Kuwaiti economy Privatisation Team Kuwait, (1996).

2.14.6.7 International markets

It is argued that privatization encourages national companies to compete in international markets in order to gain and obtain the required proficiency. In this respect national companies will be pushed to a higher level of efficiency in order compete with international companies Privatisation Team Kuwait, (1996).

2.14.6.8 Helps to create new job opportunities

It is also argued that privatization may attract national and international companies which could offer real job opportunities and lift off some of the burden from the Government side Privatisation Team Kuwait, (1996). These are some of the most important goals the Kuwaiti

Government is seeking to achieve through privatization. Nonetheless, although most technical assessments of the outcome of privatization are generally positive, public perceptions of privatization, especially in transitional and developing economics, are generally negative, Birdsall and Nellis, (2002). Kuwait is no exception as the public perception of privatization is not encouraging. The dominant role of the Kuwaiti Government over the public-service sector and the people's total reliance on Government to provide these services at subsidized prices tends to make people very reluctant to consider any other type of program that would take away these privileges from them.

2.14.6.9 Status of the Private Sector

Within Kuwait the private sector is mainly made up of finance, insurance, construction, fishing, agriculture, automobile and business equipment imports, hotels, restaurants and retail outlets. In addition, the private sector has developed some BOT projects, including housing provision for the National Housing Authority, (NHA). Other projects were carried out on the same basis for the Touristic Enterprises Company, (TEC) the Directorate General of Civil Aviation, a waste water treatment reclamation plant for Ministry of Public Works, and a petrochemical plant. Some areas of the private sector have grown rapidly over recent years. These areas include Internet services and mobile phone companies. Despite this growth, the public sector still dominates over the relatively small private sector. In fact the GDP of the private sector is about one-third that of the public sector. This dominance of the public sector, according to a survey by the Kuwait University and the World Bank is the main obstacle to the introduction of Small and Medium Enterprises, (SMEs), Webster, (2002).

2.14.6.10 BOT Law in Kuwait

The BOT method has been increasingly used in Kuwait to finance power, real estate and transport projects as well as for infrastructure. The models on which it had already been tested were projects such as the Sharq and Marina Mall retail/marina developments, the Sulaibiya Waste Water Treatment and Reclamation Plant and the Salmiya Market. However, by the end of 2006, the government departments Audit Bureau had raised concerns about the fairness of methods of awarding BOT contracts and also concerning certain irregularities in the way they were implemented and so any further BOT projects were suspended. To resolve this problem, a ministerial committee, the Audit Bureau, was formed with the purpose of reviewing all BOT projects granted to the private sector by four of the main government bodies: the Finance Ministry, the Public Customs Department, the Touristic Enterprises Company and the Public Authority for Industry. While the committee carried out their reviews, all work on new BOT projects was suspended. Resulting from the problems that the State Audit Bureau identified in its report, Law No. 7 of 2008 was passed in January of that year. It was known as the 'BOT and its purpose was to formulate a structure for the Kuwait BOT model. The law prevented any government body from entering into a BOT agreement involving state-owned land unless they had first obtained the prior approval of a 'supreme committee' which would be chaired by the Minister of Finance and would include certain other ministers, including the Minister of Public Works and the Minister of Municipality as well as senior administrators, such as the head of the environmental authority. The purpose of the committee was to establish BOT policy and then review and issue approvals. It also was responsible for administering a technical sub-committee whose remit was to co-ordinate the technical aspects of all reviews. Within the new law, BOT projects were to be limited to duration of 30 years, after which they would be handed back to the State "without any consideration and compensation". For certain special cases, this lifespan may be extended to 40 years but this had to be planned in advance and contained in the original documentation rather than as an extension to the original plans during operation. A year before the return of the project to the government, bids for the management contract of the particular asset could be invited but would be limited to a period of up to 10 years.

The project would be compelled to use a Kuwaiti joint stock company in which 40% of the shares would have to be offered in public auction either to companies approved by the supreme committee or listed on the securities market. A further 50% would be offered for public subscription to Kuwaiti citizens. The final 10% would be sold to the company implementing the project. Further regulations supporting the new law have not yet been issued, but they will be concerned with the tendering and advertisement processes to be followed and also the method in which financial compensation would be provided to investors.

2.15 Mega Projects in Kuwait from 2010 to 2014

2.15.1.1 Overview of the Five-Year Plan

After the beginning of the recession, which began in 2008, there was a call to revive the economy of Kuwait and, in an historic event, the Kuwaiti national assembly approved their first plan since 1986 and this was a development plan up to the year 2013/14. Within the plan, 1,100 projects (including many Mega Projects) were approved with spending estimated at KD37bn, (US$125bn), and including both oil and non-oil projects. Some of these projects are shown in below:

Project Name	Estimated Value (KD)
Shadadiyah University Campus	1,597 B
Silk City	25 B
Khairan Residential City	1,828,863
Kuwait International Airport Expansion Plan- New Passenger Terminal Two	212 M
Kuwait International Airport Expansion – Infrastructure	150 M
National Rail Network and a Metro system	4 M
Jaber Al-Ahmad Al-Sabah Bridge	750 M
Bubiyan Island Development	345 M
Failaka Island Development	120 M
Renovation and beautification of downtown Kuwait	20 M
Develop and beautification of Sulaibikhat Beach	35 M
Al-Zour south gas turbine power plant conversion	211 M
Establishing combined cycle gas turbine power plant at Subiya	684 M
Shuaiba North Power & Desalination Plant	366 M
North Al Zour Desalination Plant in Kuwait	1.430 M
Al-Zour south power plant conversion	170 M

For the year 2010/2011, spending in Kuwait has been announced to be about 16 billion Kuwaiti dinars, ($55.6 billion). The 2010/2011 budget was based on an oil price of $43 per barrel. This amount included investment to increase natural gas and oil production, but also to decease the dependence on oil by turning Kuwait into a regional trade and financial hub through sustaining economic development, economic diversification and GDP growth. The involvement of the private sector would be through BOT projects, due to the Kuwaiti law regarding property development and the government support would encourage the banking sector to support the schemes. This, together with the monetary policy, will have the effect of increasing liquidity. Although current BOT projects extend over 20 years. , the government plans to increase flexibility in this area by including many Mega Projects within the next five years. These include: A major container harbour and a 25km causeway Railway and metro system, a new business hub (Silk City) at an estimated cost of US$77bn, increased spending on infrastructure, new cities and services, especially education and health. There are also plans to spend in the vicinity of KD25bn on oil sector investments. Many of these projects fall within the guidelines of the Kuwaiti Law No7/2008. As previously stated the term is currently 30 years but can be increased to 40 years for specially approved cases as long as they do not exceed KD250 million in values. The project, as previously mentioned, then freely reverts to the government, the private company having benefited from the revenue during the period of operation. The advantage to the government is that there will be no extra spending and also there is the benefit of using the greater skills of the private sector to plan and deliver projects which are profitable. It differs from full nationalization or privatization, by ensuring that the government retains long-term control of large projects.

On 15 February 2010, the Deputy Prime Minister, Sheikh Ahmad Al-Fahd Al-Sabah put out to tender $8.7 billion for new development projects up to the following April including a port expansion, a bridge, three new housing communities, and a hospital . He had previously indicated that, due to the country's growing need for housing, 70,000 new homes were to be built by 2015. This scheme would help in the recovery following on from the global financial crisis and will be carried out by Kuwait's Public Authority for Housing Care, (PAHC).

It is clear that the private sector will be heavily involved in Kuwait’s development plans, due to the list of imminent multi-billion dollar projects which include a US $50 billion, (KWD 13.6 billion), oil sector financial investment plan, the $75 billion City of Silk Development and an $8 billion rail system project. In conclusion, it is apparent that, although the commercial principles behind certain aspects, (such as the shareholding split for the Special Purpose Vehicles), are not entirely clear, the BOT law provides an impetus to the stagnated Kuwaiti BOT industry. The market is eagerly awaiting the publication of the soon to be issued regulations which, with the new law, should give a real boost to the BOT market.

2.16 Conclusion of the literature review

The research objectives, (as presented in Section 1.5), were as follows:

1. To develop a better understanding of the basic and essential concepts involved in the BOT infrastructure projects and the characteristics of the risks involved.
2. To identify the most important risk factors involved when implementing BOT infrastructure projects in Kuwait.
3. To categorize and group the various risk factors facing the implementation of BOT infrastructure projects in Kuwait.
4. Using expert opinion, to list each risk factor/group according to its' significance within the BOT infrastructure project.
5. To consider and propose a risk-management framework for BOT projects having evaluated, validated and justified the results so that decision-makers and consultants are more easily able to overcome, or at least minimize, the impact of risk factors on BOT infrastructure projects in Kuwait.

This chapter has reviewed the relevant literature relating to the research objectives. It has also considered the reasons behind the behavior of BOT projects.

However, in order to study the practices of BOT projects risk management and to develop a framework which would assist the public and private sectors to overcome, or at least minimize, the impact of risk factors on BOT projects in Kuwait, it is necessary to differentiate between them according to the different forms of uncertainty and to categorize them into clearly defined groups. Each of these research objectives will be investigated in the next chapter. The initial plan to accomplish the refined objectives will be achieved by constructing the framework model stages in order to cover the BOT Projects risk management decision-making processes. Due to energy shortages, a poor transportation network and an insufficient water supply, the economic growth of Kuwait has been held back and the infrastructure sector has grown more slowly than in other developing countries. BOT systems are the way forward to ensure Kuwait's future economic growth and development.. Despite the great opportunities for private investors, the market conditions and differences in the legal systems for infrastructure business in Kuwait still involves a great many risks and problems. Private investors therefore need to ensure that the critical risks are identified and managed when investing in Kuwait's BOT infrastructure projects.

BOT schemes are also very effective ways to raise money for future infrastructure projects. And to allow for the entry of new investors to new Kuwaiti markets. However, there is some reluctance to become involved in BOT projects due to their short history and in fact the principles of BOT may not be understood or well received by private investors or even by the Kuwait government representatives. The culture, market and legal systems are different in Kuwait and so the traditional mechanisms for project risk allocation which are available in other countries, may not be suitable in Kuwait, even though the opportunities for investment are great. For successful BOT schemes operation, both the private and public sectors need to identify and attempt to find solutions to avoid the potential risks. This research is intended to identify and evaluate the critical risks connected with the Kuwaiti BOT infrastructure scheme and to produce a framework with guidelines for avoiding, or at least minimizing, their impact on BOT projects in Kuwait, -to which all parties involved in BOT infrastructure projects can refer.

The following are the main results obtained from the literature review:

1. When financing infrastructure projects, the BOT method, as an alternative to the usual approach of using budgetary resources or sovereign borrowing has many potential advantages.
2. To achieve a successful project outcome, various elements involved in BOT projects including: the Project Company, the government, suppliers, lenders, contractors, purchasers, etc all need to work together.

3. The two main risk categories for BOT projects are specific project risks, which can be controlled by the sponsors, and country risks which are associated with the economic, political and legal environment, which cannot be controlled by the project sponsors.
4. Risk management is essential for the success of BOT projects and any specific risk should be carried by those best able to deal with it regarding cost, influence and control.

The research objectives were refined as follows:

1. To discover and explain the key problems connected with Kuwaiti BOT infrastructure projects.
2. To categorise the risks in BOT infrastructure projects within Kuwait into clearly defined groups.
3. To develop a clear technique for evaluating and scanning risks in BOT infrastructure projects within Kuwait.
4. To propose a risk management framework for a BOT infrastructure project to evaluate, validate and justify the results in order to assist consultants and decision-makers in evaluating the possibility of overcoming, or at least minimising, the impact of risk factors on BOT projects in Kuwait.

2.17 Chapter Summary

This literature review has placed the research in context in relation to the relevant fields in terms of theories, methods and tools. The research covers the area of BOT projects and, more specifically, BOT infrastructure projects. The review presented in this chapter has shown that in the literature on the BOT infrastructure project, many risk factors. The BOT concept began during the 1700s and 1800s and has now been tailored for use in modern times. A number of different terms, which are associated with BOT, are also applied in practice with the common trait of PPP (public-private partnership).

The private sector is the driving force behind the BOT scheme. The organizer of any BOT project, is a privately based company regardless of the type of organization involved, i.e., the investor, lender, contractor, supplier, consultant, etc. The public sector, which will usually be the host government or its' agency, plays a vital role in the BOT project by behaving as the preliminary catalyst and designing the framework, which describes how the project will proceed.

Although many factors could be defined, there are three main ones, which cause the public sector to favour the BOT approach. These are: the lack of government funding, the need for infrastructure, and the inefficiency of projects financed by the government. The shortage of advanced technology and management expertise in the developing countries offers a combination of "supply" and "demand" which is needed by both the public sector of the developing countries and also the private investment sectors of the developed countries, respectively. While the popularity of BOT has provided great opportunities for the public and private sectors, the project is quite a challenge to implement successfully due to its complexity and the problem with procuring such projects, which are usually of large magnitude, long duration and high cost.

The method of procurement involves a complex contractual relationship, increased responsibilities, and a closer relationship between participants and, compared with the traditional approach, higher management skills. One of the greatest challenges in a BOT project is the ability to deal with potential risks, which might sometimes be considerable due to the nature of the project including its' size, the high cost of bidding, it's long duration, and the complex and difficult methods of procurement. Although some of the potential risks can be controlled by using appropriate allocation procedures, the difficulty arises from the uncontrollable risks which must be monitored and carefully managed. The uncontrollable risks are related to a country's financial, economic and political situation as well as the strength of the market. These types of risk are constantly present in developing countries.

Unfortunately, the failure of BOT projects has a high impact on the development and economy of the host country. For this reason, a clear legal framework which covers risk management must be planned in order to manage each stage of the BOT project. It is useful to compare "successful" BOT projects with "unsuccessful" to understand the importance of reaching an agreement with all parties involved, by means of a clear and stable legislative framework within the host country. In order to maintain the confidence of all concerned parties, a well organized evaluation project bid is required, which offers sound debt to equity ratios, a suitable design, reasonable income, and realistic cost forecasts. In addition, this chapter provides a general background concerning privatization and the political, economic, and legal climate which prevails in Kuwait. Therefore, in a broader sense, privatization might involve any permanent or temporary transfer of ownership or management of a public commodity or agency to the private sector. This would also include the following operations: a) subcontracting, (whereby a private company delivers public services, such as the collection of waste, reading and billing of water or electricity meters); b) management contracts; c) the lease of state-owned enterprises, equipment or assets, including lease- and-operate in the infrastructure sectors; and d) concessions, in addition to BOT contracts, (used for the privatization of an infrastructure project which is a monopoly).

This chapter has also discussed the state of the public sector, which is quite large in size, the problems associated with this sector and the reasoning behind the government's privatization plan. It was illustrated that the public sector in Kuwait is the dominant sector and runs the government's affairs. It comprises over 50 ministries, public authorities and corporations. It was apparent that the main objectives behind the privatization plan, as emphasized by the Kuwaiti Government, were the reduction of the state financial and administrative burden, enhancement of the performance and productivity of manpower, the creation of new sources of income, and the implementation of new technology.

The economic, political and legal climate within the state of Kuwait was also examined in depth in this chapter.

Risk Management Strategy in BOT projects will be introduced and discussed in the next chapter.

Chapter 3 Literature Review of Risk Management Strategy in BOT

The understanding and management of risks involved in projects, particularly large engineering initiatives, can be challenging. According to Smith and Gavin (1998) risk occurs in all walks of life and one of the particular areas susceptible to risk is the construction industry. The problem in this area is that the risks may be unpredictable, although some will be more easily identified than others. The solutions required may be quite straightforward, while others often can prove to be controversial.

This chapter looks at the risk management process in connection with the BOT infrastructure projects. The process includes: risk identification, analysis and response. A professional review of the importance of risk identification and its' context is then presented. The types of risk involved and their definition are also reviewed and an explanation of the meaning of risk management systems, as well as the systematic steps involved in risk management, are given. Also details of a logical tool which identifies, analyzes and models the risks involved in an appropriate way are included.

3.1 Introduction

This research is concerned with the identification and review of the main risk variables connected with BOT infrastructure projects in Kuwait, it also evaluates these risks and investigates the mitigation measures required in order to develop a framework, which would be appropriate to use by all the parties involved in BOT projects.

According to Gunn (2005), risk management is all-important to the success of BOT projects. There are many different types of risk and uncertainty involved in every construction project, however small. These may be: technical, economical, legal, etc., but all ultimately involve an organization in financial risk. The risks pertaining to BOT projects are more complicated than when using traditional methods, where the design is separate from the construction, -and the client is responsible for the project.

This is not only due to the long duration, high investment and complicated methods of procurement, but also because all of these risks are combined. The private companies involved in the project assume responsibility for a whole range of risks during the life-cycle of the project and also the private companies take responsibility for financial, design, construction and operating risks.

The three main areas of risk generally centre on the project management constraints of time, quality and budget.

Dey and Ogunlana (2004) believe that one of the main reasons for the failure of BOT projects is poor risk management. It is important to understand the background of BOT projects as well as the risk management tools and techniques which are available. Applying these tools depends on a number of different factors and these include the policy requirements of the organization, the nature of the project itself, the resource availability and the project management strategy including the attitude of the project management team to risk taking. Considering public infrastructure development in Asia, using BOT projects, as many as about 30% have resulted in unsatisfactory outcomes (Schaufelberger 2005).

When undertaking these projects, the private sector incurs considerable risks, which must be understood and managed to realize a successful outcome. Ghosh and Jintanapakanont, (2004) emphasize the need for effective management of key risk factors for the successful implementation of large complex infrastructure projects.

For particularly complex projects, such as BOT projects, Hall and Hulett (2002) suggest that the number of parties and different agreements involved constitutes an increased source of risk and the risks will change throughout the life of the project starting from the planning stage through to design, and operation.

Harmon e*t al*. (2001) noted that complex construction projects are all high-risk as they involving many parties, all with different priorities and interests, thereby producing a high potential for conflict.

Thomas *et al*. (2006) observed that private infrastructure BOT projects have a risk profile which is quite complex and risk management plays a large part in the success or failure of the BOT project. Therefore, during the analysis stage of the project, qualitative factors, which have a strong influence on the outcome of the project, must be considered. This research will provide a risk management framework for BOT infrastructure projects.

3.2 Definition of Risk

According to Raftery *et al*. (1994) risk means different things to different people depending on their viewpoint, attitudes and experience and therefore can be quite subjective. Whilst designers, engineers and contractors view risk from a technological point of view, developers and lenders will consider the financial and economical risks. However, environmentalists, chemical engineers and health professionals, will look at the risk from an environmental point of view and consider the safety aspects. It is therefore difficult to measure risk due to its' abstract nature.

The Chambers Dictionary definition of 'risk' is: 'hazard, danger, chance of loss or injury, the degree of probability of loss; to incur the chance of unfortunate outcomes". This type of definition indicates the difficulty in using the term 'risk' as it also means the probability or chance of a specific outcome or occurrence, the nature of an outcome, or its cause. In his paper 'Against Risk', Dowie (1999) argues that the term 'risk' should be dispensed with altogether. Dowie considers that the term 'risk' is itself a hindrance to improved decision and policy making. The ambiguous use of the word persistently puts at risk the distinction between two important tasks: Firstly, to discover and process the appropriate value judgments, and secondly, to identify and evaluate the relevant evidence.

In his article entitled: 'Risk, Uncertainty, and Profit', Frank Knight outlined the distinction between risk and uncertainty as follows.

'... Uncertainty must be taken in a sense radically distinct from the familiar notion of Risk, from which it has never been properly separated. ... The essential fact is that "risk" means in some cases a quantity susceptible of measurement, while at other times it is something distinctly not of this character; and there are far-reaching and crucial differences in the bearings of the phenomena depending on which of the two is really present and operating. ... It will appear that a measurable uncertainty, or "risk", as we shall use the term, is so far different from an un-measurable one that it is not in effect an uncertainty at all", (*Frank Knight 1921).*

The Oxford Advanced Learners Dictionary states that risk is the: 'chance of failure or the possibility of meeting danger or of suffering harm or loss'. For construction projects, risk is the likelihood of a detrimental event affecting the project.

According to Merriam Webster, risk is:

1. The possibility of injury or loss.
2. A person or thing which causes or implies a hazard.
3. The possibility of loss or perils to the content of a contract of insurance; also: a) the degree of probability of this type of loss; b) a thing or person causing a specific hazard to an insurer; c) an insurance hazard deriving from a particular source or cause.

Harold Kerzner (2001) suggests that risk measures the probability and consequence of failing to achieve a specified goal for a particular project. In general terms, risk is concerned with the idea of uncertainty. For any given event there are two primary components of risk:

- The probability, (or chance), of the occurrence of the event.
- The impact of the occurrence of the event, (or the amount at stake).

For any event, the risk is defined as a function of the likelihood and the impact; so

Risk = f (Likelihood, Impact)

Generally, risk increases as either the likelihood or impact increases. Risk management requires the consideration of both the likelihood and impact.

Future events, (or outcomes), which are positive are called opportunities, while risks are negative, (or unfavorable), events.

A source of danger is the reason for the risk, which is termed the hazard. Some hazards can be largely avoided by discovering them and taking action to overcome them. So a further definition of risk can be denoted by:

Risk= f (Hazard, safeguard)

In this equation the risk decreases with safeguard but increases with hazard. It is apparent, therefore, that the project should be well managed in order to endeavor to find all possible hazards and identify the safeguards which will overcome them, thus reducing the risk to an acceptable level, Harold Kerzner, (2001).

Risk involves a possible negative outcome affecting a value or an asset, arising from a current process or possibly a future event. However, in professional risk assessments, the probability of a particular event occurring is considered together with the impact that the event would have under a variety of different circumstances.

In some cases, the consideration of risk may not only to avoid adverse outcomes. In finance and game theory, for example, risk measures a change in the possible outcomes. One example of an investment which reduces risk is insurance as, in this case, the person taking out insurance pays an agreed sum, which affords protection from a possible much greater loss. However, an example of a risk-increasing investment is gambling as, in this case, money is risked for a potentially large return, or the possibility of total loss. The lottery is therefore a very risky investment, involving as it does a small chance of a huge return, but a high chance of total loss. However a low-risk course of action would be investing money in a bank with a stipulated interest rate, which provides a guaranteed small increase.

Risk measurement can be a very difficult undertaking as it is related to the different losses expected due to the probability of the occurrence of a risky event. There are different definitions relating to specific applications and contexts in which the risk occurs. The greater the loss, and the greater the likelihood of the event occurring which would produce it, the greater the risk. Some failure cannot be foreseen and loss of human life is the ultimate loss as it cannot be replaced.

In scenario analysis, it is important to distinguish 'risk' from 'threat.' A very serious event, which has a very low probability of occurring, is known as a 'threat'. If the threatened event has never occurred before, it can be assigned a probability during risk assessment as there may be no effective preventive measure available that would decrease the probability or impact of the possible future event. In order to understand the difference between 'risk' and 'threat', consider the principles of caution so that threats are reduced by fitting them in a collection of well-defined risks which are considered at the very beginning of any experiment or innovation.

The obvious question now arises: 'What is Risk?' and understanding it, will be the first step. According to Webster's dictionary, risk is 'the possibility of loss.' resulting from our inability to know the future.

The language of probability enables us to quantify risk. A risk profile is a probability distribution, which illustrates risks by envisaging a whole series of possible outcomes and the probability with which they might occur;

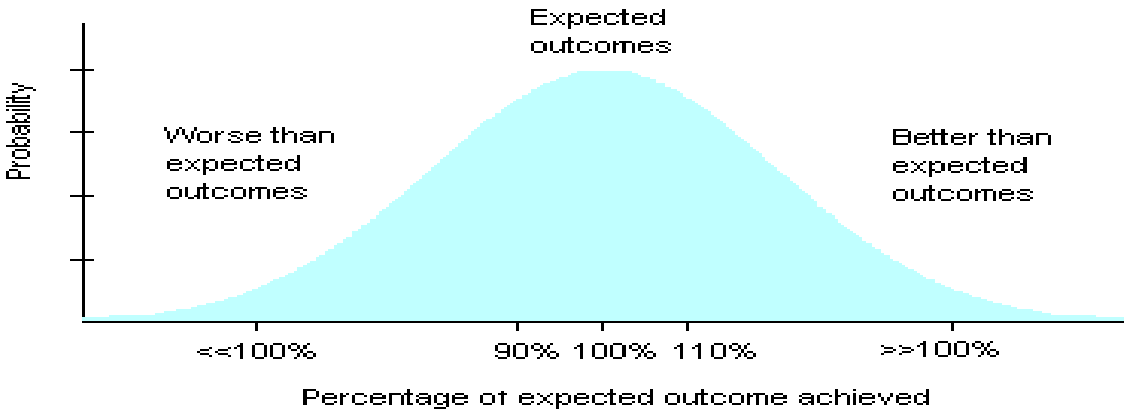


Figure 3-1 Risk probability versus percentage of expected outcome Kerzner, H., (1995).

During the mid 17^{th} century the word 'risk' entered into the English language. This dictionary definition may satisfy the notion scientists have when considering risk, but is too narrow for the general consideration of risk taking. Risk and risk taking, which together form the basis of risk management, need to be seen from a multidisciplinary perspective. Yates and Stone (1992) have considered the different elements which form the building blocks of risk construction and Kogan and Wallach (1964) explain how psychologists have examined the way in which there is a correlation between personality and risk. Various researchers have examined the risks relating to specific areas, such as in: economics (Knight 1921) sociology (Heimer 1988) and management (Sitkin and Pablo, 1992).

There are many areas of risk associated with different disciplines, as there is uncertainty involved in some, or all, aspects relating to the available knowledge. The different areas may be: technological, which will include issues associated with construction, design and performance of the project; socio-political, which can involve market uncertainties, both political and country-related according to Kennedy (1991) and environmental, which involve issues relating to the possible influence on the ecosystems or surroundings. There are also organizational issues, which are related to internal structures and relationships within the project and may also involve the stakeholder's uncertainty in identifying risk measures and thresholds and the change in these over time. Financial issues are related to the financing of the project and other costs and revenue. Economic issues include a wide range of uncertainties including influences on a global scale, such as changes in inflation and the exchange rate.

Despite the many definitions of uncertainty and risk, in most of the literature these are both recognized as a major consideration in all areas within large engineering. This study reiterates the advantages of considering risk by namely involving technological, socio-political, environmental, organizational, economic and financial uncertainties.

When considering the risks involved in engineering projects, various authors have given their own perspectives. Perry and Hayes (1985b) felt that distinctions between risk and uncertainty, and between pure risk and speculative risk, may not really be necessary and could, in fact, be unhelpful, while Erikson and O'Connor (1979) considered risk to be an exposure to possible economic loss or gain as a consequence of involvement in the construction process. Cooper and Chapman (1987) defined risk as exposure to the possibility of financial or economic loss or gain, physical damage or injury, or delay, resulting from the uncertainty connected with the pursuit of a particular course of action. However, Wideman (1986) thought that project risk was the chance of the objectives of the project being adversely affected by certain occurrences. However, Jaafari and Schub, (1990), defined risk as the presence of actual or potential constraints which might obstruct the performance of the project, and cause its complete or partial failure during construction, commissioning or operation. Bunni, (1990), endorsed the definition of risk given by British Standard No. 4778, which defines it as the combined effect of the probability of occurrence of an undesirable event, and the magnitude of that event.

Al-Bahar and Crandall, (1990), felt that there was no consistent use of the word 'risk' and noted that most definitions focused only on the downside of the risks, such as loss or damage, rather than the upside, such as profits or gains. They suggested instead that uncertainty would better represent the probability that an event would occur (as a certain event has no uncertainty) and they considered risk as the chance occurrence of events which could either favorably or adversely affect the project objectives resulting from uncertainty.

In two publications, Lopes, (1981, 1983), described risk as a situation where a decision is taken, which has consequences dependent on the results of possible future events which themselves have known probabilities. When these probabilities are inexact or unknown, the decisions are considered to involve uncertainty.

Fraser, (1979), thought that due to our familiarity with risk in everyday life, many people believe that they know what it means. However, a big risk may mean quite different things to different people. It could mean that existing plans might be upset by an unforeseen event, or there is a high degree of uncertainty as to whether or not an adverse event will occur, or perhaps that the event is very likely to occur, or that a large amount of money may be involved in the adverse outcome. For this reason, some feel that considering risk only in terms of probabilities and outcomes is inadequate and may lead to misunderstanding.

A distinction was made between hazard and risk by Hohenemser *et al*. (1985), where hazards are defined as threats to human beings and the things which they value and risks are defined as quantitative measures of the consequences of a hazard expressed as conditional probabilities of experiencing harm.

Rayner, (1987), proposed that the concept of risk would be a method of classification for a series of complex relationships and interactions between man and nature and also between different people. He felt that we have become unaware of the complicated and multifaceted phenomenon that constitutes risk. Although there may be agreement that, for engineering and similar projects, risk consists of the probability of an adverse event and the magnitude of its' consequences, but this may be insufficient for the broader, more intractable, level of risk management. Hence, Rayner, (1987), pointed out the need for a widely encompassing definition which includes purely societal concerns about equity from the risk-management perspective, (i.e. allocation amongst stakeholders), on the one hand, and purely engineering-type concerns about probability and magnitude from a technical perspective, on the other.

Regarding risk from a managerial point of view, MacCrimmon and Wehrung, (1986), considered risk as having three components: the chance of a loss, the size of the loss, and the exposure to the loss, where the degree of risk was seen as directly proportional to the chances and size of the loss, and to the degree of exposure. Shogren, (1990), defined risk more simply based on two elements: probability and severity. Boodman, (1987), however, claimed that most senior corporate managers have little understanding of the basic components of risk, and most are unable to define the term adequately.

March and Shapira, (1987), noted that in classical decision theory, risk is often perceived as reflecting a change in the distribution of various possible outcomes, their likelihoods, and their subjective values but they commented that finding a satisfactory empirical definition of risk within this framework has proved rather difficult. They suggested that a theoretical definition of risk may considerably differ from the ways defined by human decision-makers, since the risk in the same situation can be seen by different individuals in very different ways (Kahneman and Tversky 1982a).

It can be seen from (Al-Bahar and Crandall 1990) that in the field of construction, it has been quite common practice to consider risk in terms of consequences and probabilities and to think of uncertainty only in terms of probabilities. However, such a restricted perspective may result in some project participants having difficulty in perceiving the broader, qualitative context of many important project risks. If the project is particularly large-scale, for example, the risk may be considered as mainly financial, which can be quantitatively easily understood. There will be some stakeholders, however, who regard risk as resulting in adverse social or environmental effects, and this can be very difficult to quantify and also difficult to represent with a clear perspective. The definition employed in this thesis recognizes the various meanings of risk and its' relative importance to the various participant perspectives. For this reason, the thesis mainly focuses on the application of risk in BOT Infrastructure projects.

3.3 Strategy Definitions and Meanings

As there are several similarities between strategy in the military and in business, it has been quite easy to adapt the concept as used in the military, to the business context. In business, as in the military, strategy is needed to bridge the gap between policy and tactics. Fred Nickols, (2006), suggested that strategy and tactics together bridge the gap between ends and means.

Porter, (1996), put forward that strategy is about competitive *position*, and the need to differentiate yourself from other competitors, in the eyes of your customers. It is important to use a mixture of various activities which differ from the ones used by competitors in order to produce better value.

To summarise, Henry Mintzberg, (1994), listed four of the most common ways in which people define "strategy":

1. Strategy is a plan, a means of getting from here to there.
2. Strategy is a pattern of actions over time; for example, a company that regularly markets very expensive products is using a "high end" strategy.
3. Strategy is position; that is, it reflects decisions to offer particular products or services in particular markets.
4. Strategy is perspective, that is, vision and direction.

Kenneth Andrews (1980) provided the following definition of strategy:

'*Corporate strategy* is the pattern of decisions in a company that determines and reveals its' objectives, purposes, or goals, produces the principal policies and plans for achieving those goals, and defines the range of business the company is to pursue, the kind of economic and human organization it is or intends to be, and the nature of the economic and non-economic contribution it intends to make to its shareholders, employees, customers, and communities.'

3.4 Understanding risk management

To ensure good performance, it is essential to consider risk. This is true whether it affects the management of a company, or a project or the provision of service for a customer. The main concern for risk management is the way in which the risk is quantified and dealt with. There are many techniques, which have been developed in response to this requirement. However, as science and technology have developed, the business environment in certain areas has become considerably more complex, requiring decision-makers to pay more attention to risks. Almost all kinds of human decision-making activities contain risk elements, requiring decision makers to devise ways of dealing with the risks, resulting in a risk- management plan.

Risk management has been around in some form for a considerable time and is a system which has the aim of identifying and quantifying every potential risk affecting a project so that good decisions can be made to manage them. Risk management is not the same as insurance and *all* risks cannot be removed from the project. Its' whole aim is the efficient management of risks. The client will carry certain risks himself and this fact should be acknowledged by both the project manager and the client himself. When estimating the time and cost of the project, this residual risk must be considered. The system of risk management can be quite effective and may need large amounts of data, but it should be practical, reasonable and cost-effective. It requires good judgment, common sense, analysis, and experience and the willingness to recognize the risk. To manage risky projects effectively will require a quick, realistic prediction concerning future expectations and positive decision-making for alternative courses of action. The lack of an appropriate risk management system coupled with inflexible attitudes and improper procedures has led to many public projects being unsuccessful.

Thomson and Perry, (1992), noted that risk management occurs most often in private sector projects. However, it is important that the public sector also carry out risk management. In particular, it is essential that politicians and governments consider the issue, and examine the procedures currently used when planning and implementing projects. This is to avoid unnecessary delay, poor performance and possible cost overrun.

3.5 Theories of Risk management

Raz and Michael, (2001), commented that risk management has been a main topic of interest for researchers and practitioners who are involved in project management. According to Flanagan and Norman **(**1993) risk management is defined as a system where all those risks to which a project or business is subject are identified and quantified so that a clear decision can be taken on the management of those risks. Risk management acknowledges the possibility that future events may produce negative or adverse effects and employs the design and implementation of systems or procedures which will control these risks. This definition also states the purpose of risk management, which is to manage systems in order to control risks.

Although risk management need not be very complicated, or involve data collection on a large scale, it should be cost effective, practical and, of course, realistic. Often, in addition to analysis, judgment and experience, it is based on common sense, intuition and gut feeling but, most of all, there needs to be a willingness to adopt a disciplined approach. Depending on the circumstances involved in each project, there will be different degrees of analysis. It is therefore important to formulate a structured risk-analysis system.

Experience shows that to identify and classify risks is more difficult than actually controlling them. Decision-makers therefore need to identify the risks and plan a risk-management system, otherwise they will lose control of the system and fail to find solutions to the risk or solve any problems within the system.

Toakley (1989) suggested that risk management is a procedure in which the level of risk is controlled and its effects mitigated and Ghosh *et al*. (2004) pointed out that risk management is an effective project management tool for the lifetime of the project. Another definition, given by Chapman and Ward (1997) states that project risk implies that there is considerable uncertainty concerning the achievable level of project performance, while Turner (1993) suggested that risk management reduces the likelihood of risk occurring and lessens its impact on the project. Another consideration by Kezsbom and Edward (2001), was that risk management was an integral and important element of project management. Burke (1999) gave a more detailed description and suggested that project risk management involves the need to identify analyses and respond to uncertainty during the whole lifetime of the project with the aim of maximizing the positive outcomes of events and minimizing the effects of adverse events. Burchett (1999) thought all construction companies should include risk management within their decision-making processes because risk and uncertainty can have potential devastating effects, with extremely damaging consequences for some construction projects. Although risk cannot be entirely eliminated, but it can be contained, transferred or minimized and this is important due to the adverse effects it can have on quality, performance and productivity, and consequently on the cost of the project. Chapman (1998) notes that risks may arise during the lifetime of a project and so it is important that project managers understand and deal with them appropriately to avoid major disasters. This process is known as Project Risk Analysis and Management (PRAM).

Once risks have arisen within a project, risk management involves understanding the effect that the particular risk has had on the project and introducing measures which will reduce its' effect and restore the project to its pre-risk state as quickly as possible and cost-effectively.

Due to the uncertain nature of risks, decision makers need to consider which specific risks need to be analyzed and devise strategies to deal with them. Although risk management cannot prevent all risks to the project, it should identify them early so that their relative importance can be assessed and recommendations made on how to control them in order to provide the best outcome for the project.

3.5.1 Key Issues of Risk Management

A report on an Intelligent Risk Identification System was given by Ashley and Perng (1987). This is an expert system designed to identify construction problems and also their likely impact on the project. Possible courses of action, based on previous experience are then considered. This system helps users to analyze risk and potential problems very early in the life of the project using influence diagrams. The influence diagrams illustrate problems, causes and effects and can show the potential impact of the risk on the cost, schedule and actual construction.

Kangari and Boyer (1987) described Expert-Risk, which is a knowledge-based construction risk-management system. The system is designed to work as an intelligent risk questionnaire for the guidance of owners, designers and contractors. It considers financial implications and cost databases and aids the identification of risk management and risk evaluation.

Mustafa and Al-Bahars (1991) outlined a risk management system which focused on the analysis and assessment of risks considered during the bidding stage of a project, using an analytical hierarchy process.

Much work has been carried out in risk management and one example is a risk model known as a Construction Risk Management System, developed by (Al-Bahar and Crandall

1990) which permits contractors to identify and classify all the project risks that might include so-called ‘acts of God’ as well as design, construction, financial, economic, political and environmental risks which are to be found in any typical construction programme. The five strategies which they suggested to deal with risks are: risk avoidance, risk prevention, loss reduction, risk retention, risk transfer, and insurance.

The main five actions, involved in risk management, were given by Flanagan and Norman (1993) as:

- Risk identification, which identifies the source and type of risks.
- Risk classification, which considers the type of risk and its effect on the person or organization.
- Risk analysis, which considers the consequences associated with the particular type of risk, or combination of risks, by using analytical techniques and then assessing the impact of risk using different risk-measurement techniques.
- Risk attitude, which affects the decision taken regarding the risk.
- Risk treatment, (or response), which considers how to manage the risk either by retaining it or transferring it to another party.

Five stages of risk management were suggested by Turner (1993):

1) to identify the source of risk;
2) to determine the impact of each individual risk;
3) to assess the overall impact of all the risks;
4) to determine whether the risk can be reduced;
5) to control the risk which has been identified.

Raftery, (1994), summed this up by noting that risk management concerns the main steps of: risk-management planning, risk identification, risk assessment, risk analysis, risk response, risk monitoring and risk communication. However, Jafaari and Anderson (1995) reduced risk management to three stages, consisting of: risk identification, risk analysis and risk response.

Thomas *et al. (*2006) mentioned three similar main steps concerned with risk management and these are: identification of risks, the measurement/assessment of risks, and prioritization and response to the risks.

According to Bajaj (1997) unidentified risks cannot be controlled or managed in any way, so risk identification is an essential first step and the management of risk should be considered continuously during the lifetime of the project, rather than being a one-off activity.

Three risk-management processes were mentioned by Dey (1999):

(i) Identifying risk factors; (ii) analyzing their effect; and (iii) responding to the risk.

The following outlines some of the usual management actions and procedures which are adopted, such as the identification of the risk, its classification and then its analysis and treatment.

3.5.2 Risk Management Framework

Figure 3.1 shows the Framework Risk management model as suggested by (Flanagan and Norman 1993) and indicates the sequence for dealing with risk. The particular risk management system adopted has to be applied to each variation of the project under consideration. The stages are usually: Risk Identification, when the source and type of risks are considered; Risk Classification, where the type of risk and the effect it might have on the person or organization is evaluated; Risk Analysis which uses analytical techniques to predict the consequences connected with each type of risk, or combination thereof; Risk Assessment in which the impact of the risk is calculated by means of risk measurement techniques; Risk Attitude, which needs to be considered because the attitude of the person, or persons, within the organization who are taking the decisions will affect the outcome; and finally Risk Outcome in which the decision is taken to retain the risk or transfer it.

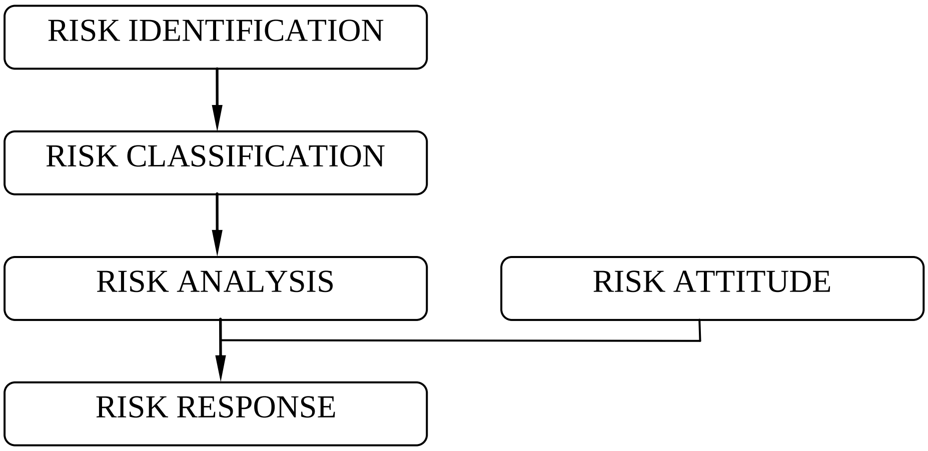


Figure 3-2 The risk management framework proposed by Flanagan (1993)

3.5.3 Risk Identification and Classification for BOT Projects

The classification and categorization of risks is always important, so that they can be managed efficiently and effectively, but this is especially in the case for BOT projects which take place in an environment full of risks and uncertainties. A new approach to risk identification was adopted by Tiong (1990) who suggested visualizing an infrastructure project as two separate distinct projects. These projects consist of: a relatively high-risk construction project and a relatively low-risk utility project. The different risks were then listed separately under the two phases: construction and operation. The type of risk involved in the construction phase would include: political risks, *force majeure*, completion delays and cost overruns, while the operation phase would include risks such as: supply of raw materials, market forces, performance, technical problems involving operation and maintenance and foreign exchange rates, etc.

Some BOT risks may be within the control of one, or several, parties within the project as suggested by Augenblick and Custer (1990) while others might be insurable at an appropriate cost, (or might be uninsurable). They list eight typical risks and these are given as: performance and operations risks, cash flow risks, completion risks, inflation and foreign exchange risks, insurable risks, uninsurable risks, (*force majeure*), political risks, and commercial risk insurance.

A completely different classification scheme was suggested by Walker and Smith (1995) who considered the risks under three headings: technical, financial and political, and suggested that these would appear at different phases of the project. The technical risks might include construction problems, delays in completion and operational risks. The financial risks could include fluctuations in the foreign exchange and interest rates, market risks and those involving income and cost overrun. The political risks would involve instability and sovereign risks. They also suggested a further grouping consisting of, internal risks, (technical risks) and external risks, (financial and political risks). The most difficult, but essential, consideration for risk management is the identification of each risk associated with the project, according to Williams (1995). Here, it is important to consider, as suggested by Godfrey (1996) the particular features of the project, (that is the risk sources), which could cause the failure.

Eight different categories of risk connected with BOT programmes in Kuwait were identified by Schaerer (1996) and these are listed as follows: i) construction risks involving the availability of supplies, of workers and materials and the duration of the construction phase; ii) operation risks, which include the supply of available experts, security problems, strikes and civil disturbances; iii) political risks involving politics and credibility, official support for the project outside the Five-Year-Plan, removal of concessions and the relationship with the local authorities; iv) financial risks involving issues of security, various problems within the local financial sectors, different perceptions of the time horizon amongst the sponsor, government and investor; v) commercial risks, where economic assumptions made may not be relevant over the lifetime of the project or there may be a decrease in the market for products; vi) currency risks involving effects due to the involvement of foreign currency, foreign exchange rules for local currency earnings, off-shore escrow accounts; vi) legal risks; vii) the changing nature of the risks themselves which means that, due to political interference, some good commercial risks today might become bad in the future. These risks are based on two sources: internal risks, caused by the performance of the project, and construction and operation risks while the other six categories are caused by the external influence to the project.

To find a universal method for the identification, classification and allocation of BOT project risks, UNIDO (1996) have produced a risk checklist. This comprises two main categories each containing three subcategories. Category 1 consists of general/country risks and includes political, legal and commercial risks. Category 2 covers specific project risks and these include developmental risks, operating risks and construction/completion risks. The operation and maintenance and service life risks can actually be as high as the construction risks because, if the initial estimates are too low, this error will remain throughout the concession period, which might be 20–25 years. Therefore, as pointed out by Bajaj (1997) it is very important to identify the source of each risk and divide into individual components, or influencing factors, which will allow them to be considered separately from each other, thus simplifying the analysis and management of the risk. Edwards and Bowen (1998) classified risk into two main groups consisting of Natural, which includes the weather and geological systems and Human, which includes managerial, technical, cultural, social, political, legal, financial and health. However, this classification does not take into consideration other important risks such as changes in legislation involving the environment, market demand, foreign exchange and convertibility, obsolete technology and the behavior of local partners, corruption, expropriation as a result of political, social or economic pressure, and a risk to the public image due to differing values, living standards, and social systems .

Lam and Chow (1999) have considered the significance of the financial risks in BOT projects, while Dahel (1997) investigated the various sources of finance available, concentrating on the BOT arrangement, and the risks to which project financers may be exposed. Wang *et al.* (2000) identified risks that are specific to developing countries, while Akintoloye *et al*. (1998) considered PFI risk analysis and management and found that that design changes and the level of information available regarding functional, performance and output requirements for PFI schemes were of greatest concern in this procurement route.

Dey *et al*. (2002) in their work have suggested that, as well as questionnaire surveys and interviews, the Delphi technique could also be used to identify risk. However, since risk analysis follows a top-down sequence only identified risks will be evaluated. Therefore, much time is required to identify all risks. However, they also point out that common or general risks associated with BOT projects could be produced in the form of risk checklists. These could then be separated off according to the type of BOT project. Even so, these authors regard the most appropriate techniques for the evaluation of cash flow risk are the Monte Carlo and Sensitivity Analysis. Xenidis and Angelides (2005) have outlined the legal and financial risks in BOT projects. Li *et al*. (2004) identified risk allocation preferences in PFI/PFI in the UK, while Thomas *et al*. (2003) used India as a location for their study of risk perception for BOT projects. The barriers to Public Private Partnerships, (PPP), were classified by Zhang (2005) into six main areas: 1) political, legal and social; 2) unfavorable economic and commercial conditions; 3) inefficient public procurement framework; 4) lack of mature financial engineering techniques; 5) problems related to the public sector; and 6) problems related to the private sector. There is general agreement amongst experts regarding the particular risks in this type of construction project, there are also many other risks which depend on the country and type of project.

The initial stage in risk management is the identification of relevant risks specific to the project and Godfrey (1996) suggests that the first consideration in risk identification is to discover the particular features, (risk sources), of the project, which might result in failure of the project. However, this should be undertaken by all those involved in the project, in order to manage or mitigate the effect, so that the cost to the community of developing the project is not too great. Several project-planning methods are available when identifying risk and Chapman (1998) has listed the advantages of three of the most common of these.

3.5.3.1 Brainstorming

This is a common technique used in many areas, but particularly for building projects when identifying risk in construction contracts. The idea is to provide a forum in which many ideas are put forward spontaneously and simply listed without comment in the initial stages. It involves redefining the problem, generating ideas for possible solutions, choosing the most feasible of these and carrying out an evaluation.

3.5.3.2 Nominal Group Technique

This method is similar to brainstorming, but instead the ideas are written down. It is considered to be more efficient than brainstorming. The written ideas are submitted to various groups for discussion and the feedback from each group on each idea is recorded on a flip chart, the different ideas may then be voted on and placed in order of suitability to the particular project.

3.5.3.3 Delphi Technique

A description of the Delphi technique has been given by Chapman.RJ (1998) as ' A method for the systematic collection and collation of judgments from isolated anonymous respondents on a particular topic, through a set of carefully designed sequential questionnaires interspersed with summarized information and feedback of opinions, derived from earlier responses.'

The respondents mentioned in the quotation above were either given a questionnaire or a list of the relevant issues. They were then asked to give feedback. All the results were collated and returned to the participants who then had the opportunity of modifying their own responses. This process proceeds until a clear outcome is reached. This technique is quite slow and is relatively expensive and so it is rarely used to identify risks. Risk identification requires the need to 'think outside the box' for those involved in each stage of the project, but the process becomes easier with set guidelines Chapman.RJ (1998).

3.6 Risk Analysis

The most important task of risk management is to analyses the risk so that appropriate decisions can be taken. To carry out a risk assessment all of the potential risks need to be reviewed and understood and their significance for the success of the project assessed. This process includes considering the relative importance of each risk which might have an impact on the project and then calculating the probability of its occurrence and likely size. Risk assessment allows the developers to have some understanding of which parts of the project are the most susceptible to risk and allows them to concentrate their resources; including time and money in the areas where the greatest contribution to minimize the risk.

The aim of risk analysis is to collect all possible suitable options and then to analyze their various outcomes. Each option is weighted so that the decision-maker can quantify the risk and respond to it. In order to select a suitable risk analysis technique the following points ought to be considered:

- The size and type of the project.
- The information on hand.
- The time required to have the risk assessed including cost of the analysis.
- The analyst's experience.

Risk analysis techniques allocate a series of specific values to uncertain data so, if costs and duration for particular a project are uncertain, the decision-maker can select a range of values within which it is believed they are likely to lie. For reasons of speed and accuracy, quantitative risk analysis techniques require the use of a computer and many programs have been designed for this purpose.

Risk analysis tools and techniques, (RATTs), can be chosen in a systematic way, as noted by Dey and Ogunlana (2004) since risk assessment in BOT projects is the formulation of a systematic model for selection and application at various stages of the project. Several risk analysis techniques are available to evaluate the different types of risk within each risk category. A table of the techniques and tools, which can be applied to risk analysis in BOT projects, is given below.

SN.	Method	SN.	Method
1.	Influence Diagrams	8.	Neural network approach
2.	Monte Carlo Simulation	9.	Decision tree
3.	Program Evaluation & Review Techniques	10.	Fault Tree Analysis
4.	Sensitivity Analysis	11.	Risk checklist
5.	Multi-criteria Decision Making	12.	Risk Mapping
6.	Analytical Hierarchy Process	13.	Cause/Effect Diagrams
7.	Fuzzy set approach	14.	Event tree analysis

Table 3-1 - Risk analysis techniques Dey and Ogunlana (2004)

Zayed and Luh-Maan (2002) have cited Dias and Ioannou, 1995 and 1996), as providing a proposal for both a qualitative and quantitative approach to risk analysis. A risk index is derived using the main risk categories of a concession-type agreement. These are then rated using a scaled value. A risk index equation is derived based on completed BOT projects and is amended further by researchers when more BOT projects have been completed so more data is available to improve the accuracy of the risk index equation.

3.7 Risk Index

The model put forward by Dias and Ioannou (1995) has been modified by Tarek and Luh-Maan (2002) who have formulated a prototype risk index which can be used as an evaluation tool for BOT Infrastructure projects. Their proposed risk index constitutes a single level hierarchical structure addressing eight of the main BOT risks. The prototype risk index is calculated using holistic results and has resulted in more reliable results than the (Dias and Ioannou, 1996), approach. However, Tarek and Luh-Maan (2002), also suggest that, to improve the accuracy of the model, a wider range of data collection is required for BOT Ifrastrucuture projects.

3.8 Quantitative Risk Analysis

Dey *et al*. (2002) proposed a quantitative risk analysis approach which is more structured since it uses the risk assessment concept in which the risk categories are separately defined and appropriate risk analysis techniques are used to assess the corresponding risk. This is an intricate component of risk management but there are certain features within risk management systems, which are not considered in the reviewed literature. These include, risk evaluation, organization and accountabilities, risk mitigation, measurement of progress in risk reduction, and finally, assessment and corrective action. Quantitative methods of risk assessment consider the probability or likelihood of occurrence of the risk and its' impact involving the size, time and cost involved. Two true quantitative methods for risk assessment are currently in use and these are the "Direct Calculation" technique and the "Monte Carlo technique". Many and various tools and techniques can be used in BOT Infrastructure project risk analysis, but the particular application will depend on the content and of the particular project and the context in which it is carried out.

3.8.1 Risk Response

The allocation of risk and the response to it can be found to be in four categories:

- Risk retention.
- Risk reduction.
- Risk transfer.
- Risk avoidance.

3.8.2 Risk Retention

In order to allocate the risk adequately, two considerations must be: 1) the ability to contain the risk, and 2) the premium required to carry the risk. One example is when a contractor pays an insured sum to cover the risk. However, for lump-sum contracts, the greater risk will be carried by contractors. As previously noted, there should be adequate rewards connected with each risk, to encourage risk-bearing by the different parties involved.

3.8.3 Risk Reduction

One method of reducing risk is to share it with other parties. One example of this is, in order to avoid paying liquidated damages for late completion of a project; the contractor will include liquidated damages clauses in any subcontract agreement. Also, in contractual arrangements, the management-fee type of contract will be more acceptable to contractors and should reduce the likelihood of direct-loss and expense claims.

3.8.4 Risk Transfer

This option moves the risk to a third party without reducing its criticality in any way. It can, in fact, actually make the risk greater, if the party, who take on the risk, is unaware of the size of the risk. Buying insurance is the usual method to accommodate risk as it converts the risk to a cost and transfers the risk tot\to the insurance broker. The usual method of risk transference is by means of insurance, which converts risk exposure to an insurable cost. Construction projects are often prone to faults and defects may be discovered a considerable time after the project is completed. These could include any latent defects where it is not possible to detect upon completion of the project. The advantage of risk transfer using insurance is that it decreases the need for legal action between different parties.

3.8.5 Risk Avoidance

This is basically a refusal to accept risks. It occurs usually during pre-contract negotiations but often extends to decisions made during the lifetime of the project. The use of exemption clauses is one method of avoiding a specific risk or the consequences resulting from it.

3.8.6 Risk Attitude

As previously mentioned, risk always goes hand in hand with reward. The decision as to whether to accept a particular risk varies between individuals and is based on the attitude of risk choice and individuals' risk preference. Generally, there are three types of people:

- Risk loving.
- Risk averse.
- Risk neutral.

Most risk theories are based on the concept of risk aversion. It is less appealing to lose a given sum than to gain the same sum, since the former might result in a change of living standard.

3.9 Why Is Risk Management Necessary?

Several factors in this review highlighted the need for a systematic and rigorous approach to managing BOT project risks: the largely intuitive approaches to evaluation and management of risks; behavioral and cognitive limitations to systematic risk management; and non-identification of many sources of risk. Another factor is the singular, rather than multidimensional approach to risk management whereby individual risks are treated in isolation from other risks, Miller (1992). The political, policy, economic and social uncertainties within a business environment are clearly interdependent. The reduction of uncertainty in one dimension may result in increased exposure to another, Miller (1992).

Previous Literature shows that no risk management studies are available for BOT Infrastructure Projects risk management in Kuwaiti.

It is important, therefore, to develop new risk-ranking methods for BOT infrastructure projects so that the major factors can be identified and the associated risks involved in these projects assessed for both the private and public sectors. Due to the limited resources available to both private and public sectors, resource planning is essential. The importance of the risk to the participants is carefully evaluated and then risk-ranking is carried out. Risks which are considered to be high are used in the risk response stage which should increase the effectiveness of risk management for BOT infrastructure projects, Ebrahimnajad *et al*. (2010). In this research, a framework which ranked risks in order of priority was developed for BOT infrastructure projects. Also presented are the criteria for the ranking of risks.

A risk management framework developed later in this research will facilitate the recognition of the interdependencies, between various risks, and should improve the risk management and decision-making process.

According to Park and Chapin (1992) risk management, including risk analysis is becoming increasingly important. If a project is "unsuccessful" as per agreement in the project contract, the consequences can be detrimental to the private investors concerned, i.e. projected profit is wiped out. It is apparent, after analysis that hardly any attention has been given to the particular risks which may occur in BOT Infrastructure projects. Forethought may have prevented erroneous decisions and substantial savings may have been made, -saving time and improving quality. The study of BOT Infrastructure projects worldwide indicates that these risks have been ineffectively dealt with.

3.10 Chapter Summary

This chapter introduces the definition of "risk", as each person has a different perception of risk and a different attitude to taking risks. There is a distinction between a "risk" and a "threat" and the different "pre-cautions" needed to identify and accommodate either. The definition of "strategy" was defined concerning the manner in which to cope with, and manage the risk(s). "Risk management" was discussed as a means of aiding and improving the performance of the management team in identifying, prioritizing, dealing with and minimizing risk(s). A flow chart for identifying, classifying, analyzing, grading and responding to risk is discussed.

The concept of using a "Framework" in which all known risks are documented and graded, ("indexed"), into "seriousness", (i.e. What would happen to the project if the risk became a reality?), is introduced and the various methods of constructing such a "Framework" are tabled. A description of different risk analysis, tools and techniques was discussed leading to a final discussion regarding the importance of risk management. The next chapter provides a discussion of the research methodology employed, complete with information on data collection and the techniques used in data analysis.

Chapter 4 Research Methodology

4.1 Introduction

The last two chapters have incorporated an extensive review of the literature concerned with BOT infrastructure projects, including their characteristics, behaviour, the risks and risk management involved. This review has filled some gaps in our knowledge and has also enabled the formulation of research questions as well as defining the research objectives.

The aim of this chapter is to introduce the particular research methodology used in this work. It is designed to form a bridge between the theories of research, such as in the areas of research strategy, techniques and data collection methods, and the level of practicality of this research. The objective is to clearly present a series of activities carried out during the research. There is justification given for the approach used in this thesis. According to Jancowicz (2000) research is undertaken so that people may increase their knowledge by finding information out systematically while Introna and Whitley (1997) state that methodology is a set of techniques and tools which can be used to solve a particular problem, which, in this case, involves the development of a risk management framework to be adopted by almost all parties who are involved in the BOT infrastructure projects in Kuwait. This will enable both the Public and Private sectors to identify the risk variables involved with BOT infrastructure projects in Kuwait. The risks can then be assessed and mitigated. There are many choices to make when planning a research methodology and there is no "perfect" approach so many factors need to be considered. Also, a framework is given for the methodology of the research, including a statement of the problem and a step-by-step approach to the development of the proposed objectives.

4.2 Theories of knowledge in research

In any form of research, the nature of the inquiry, known as "ontology", (see Lincoln, Guba 1985, Tashakkori, Teddlie 1998) is crucial when considering the particular path of inquiry which one is to follow, in order to achieve specific research goals. There are two different types of ontology providing different research perspectives. These are: an objective perspective which uses numbers to describe a reality or a fact, (Easterby-Smith *et al*. 2002) and a subjective perspective which uses reflections, oral explanations and sensations to describe the reality or a fact (Easterby-Smith *et al*. 2002). Quantitative methodological tools involving numbers for the answer to particular research problems would be more suited to the objective perspective, while qualitative methodological tools that use words to formulate a research problem, would be more appropriate for the subjective perspective, (Tashakkori, Teddlie 1998). Both methods will be discussed further in the chapter.

It has been noted, (Lincoln, Guba 1985, Tashakkori, Teddlie 1998) that ontology of research requires the identification of the type of relationship that exists between the inquirer and the object of inquiry; this is called the epistemology of research. The relationship is based on the level of interaction. As described by Lincoln and Guba (1985) the inquirer and the object of inquiry can either be separate, (independent), from each other, known as "discrete dualism", or else, the inquirer and the object of inquiry may be inseparable, (highly interactive). However, in practice, it is more likely to be a combination of types, sometimes tending towards the subjective and sometimes towards the objective side and sometimes being separate while at others highly interactive, (Tashakkori, Teddlie 1998). Epistemology has to formulate the process of searching for the truth using "assumptions about the best ways of inquiring into the nature of the world", (Easterby-Smith *et al*. 2002). This has resulted in continuous 'waves' of epistemology where the emphasis moves from the independence of the inquirer to complete interaction, thus forming a continuum of methods which will be discussed in detail later in the chapter.

4.3 Research procedures

This chapter considers the way in which the research methodology will be conducted and processed. When studying the risks involved with BOT infrastructure project, there are many quantitative and qualitative variables, (risk factors), which need to be considered and assessed when carrying out the risk management of BOT infrastructure projects. Interpreting the complex interrelationships between the risk factors and assessing their impact on the risk management of the BOT infrastructure project is one of the main challenges facing the decision maker.

When commencing to formulate a research methodology, the first objective, that needs to be completed, is to consider the risk factors, both numerical and linguistic, that might affect the risk management of the BOT infrastructure projects. It is therefore necessary to collect all of the related risk factors from previous projects, which might include the environment, the particular characteristics and location of the project, as well as current conditions in the host country. The selection of the BOT infrastructure project risk factors will be based on a wide range of risk factors gathered from the relevant literature, (Tiong 1992, Levy 1996, UNIDO 1996, Gupta and Narasimham 1998, Ranasinghi 1999, Ozdoganm and Birgonul 2000). Therefore, in this study, we will examine the information required and the research questions used in order to identify the risk factors facing the implementation of BOT infrastructure projects in Kuwait. A number of critical research questions need to be asked when considering the extent to which BOT infrastructure project risk management is affected by various issues. The research questions are:

1. Which risks should be considered for BOT infrastructure projects in Kuwait?
2. How can such risks be integrated into a framework that will aid decision making, taking these risks into account and to endeavour to decrease or prevent them?

The first requirement in any research project is to define the research questions, (Bryman 1989). Each subsequent action carried out by the researcher in a research inquiry depends very much on the original definition of the problem, (Graziano and Raulin 2007). For example, the identification of a particular type of risks of BOT Infrastructure project that will be involved in the study will help to keep the researcher focused. However, it is apparent that the research questions considered during the early stages of a research project will be rather tentative and therefore may need changing or revising at a later stage after the discovery of new information, (Huberman, Miles 2002).

Three case study projects are chosen and these are the Sulaibiya Wastewater Treatment Plant in Kuwait, the Channel Tunnel in UK, and Marsa Allam airport in Egypt, (see Appendix B). Mathematical methods are then used to process the data.

The main reason for selecting the Sulaibiya Wastewater Treatment Plant in Kuwait is that the expert participants are familiar with this project and some even worked on this project.
The Channel Tunnel was selected because it is one of the outstanding BOT infrastructure projects of the last century. The expert participants are all familiar with the “Chunnel” and felt that they can use their experience to perform a meaningful project evaluation.

Marsa Allam airport in Egypt completed in 2001 was built by Kuwaiti companies with some of the expert participants having worked on it.

The three case studies are well known to the expert participants and their experience will not only be invaluable but also very constructive, (-or more information, see section 4.6).

A methodology is adopted to determine the most common and important risk factors, affecting BOT infrastructure projects in Kuwait and to consider the extent to which they can be controlled.

A set of risk factors is categorized according to their relevance to BOT Infrastructure Projects. The study of the risk management of BOT systems was conducted on two levels.

The first level considered risks concerning the host country involving eight main categories: Country Risks, Financial, Revenue Risks, Promoting, Procurement Risks, Development Risks, Construction and Operating Risks. The second level are sub-factors of these risk categories and are covered in Chapter 2.

The main objective of this research is to construct a risk management framework that can be used/adapted for any BOT infrastructure project and then to adapt the framework so that it is specific to Kuwait.

4.4 The philosophical position of the research

Amaratunga *et al.* (2002) considers research to be carried out in a spirit of inquiry, with a great reliance on principles, laws, facts, real data, hypotheses and conjectures, experience and concepts and constructs. However, it is important that all research has a well-defined methodology which is soundly scientifically based. The methodology consists of a system of explicit rules and procedures on which the research is based and on which knowledge is evaluated, (Fromkfort-Nachmias and Nachmias, 1996). Eldabi et al. (2002), considers that no research has a "perfect" methodology because none is universally agreed. Since the choice of methodology involves the consideration of many factors including the type of problem under investigation, the resources available, the researcher's background and experience, and the purpose of the study.

Easterby-Smith *et al*. (1991), noted that research within the social sciences is often defined and differentiated in terms of the epistemology or the "theory of knowledge" it adopts.

Epistemology is the belief about the way in which knowledge is constructed. Epistemological assumptions in these cases involve the consideration of whether the knowledge can be acquired, or whether it is personally experienced, (Burrell and Morgan, 1979; Eldabi *et al.* 2002). A long-standing epistemological debate concerning the best way of carrying out research has been in existence between philosophers of science and methodologists and involves the relative value of two fundamentally opposed and competing schools of thought or inquiry paradigms: logical positivism and phenomenology (Amaratunga *et al.* 2002). The choice between them involves many philosophical assumptions and value judgments. A key consideration is the way in which the research will proceed; either inductively or deductively. Inductive research involves the researcher in the examination of specific instances resulting in a generalization, while deductive research is the opposite; reasoning from the general to the particular, (Case 2002). The method of logical positivism uses both experimental and quantitative methods to test hypothetical-deductive generalizations. (Cavaye, 1996; Easterby-Smith;1991 and Remenyi *et al*. 1998), found that one of the main implications of this approach is that the observer should be independent of the subject under observation, and for hypotheses to be formulated for subsequent verification. An objective measurement of the properties is required, rather than a subjective inference, using reflection, intuition or sensation, (Easterby-Smith, 1991). The method of positivism requires fundamental laws and causal explanations, and simplifies analysis by reducing everything to its simplest possible elements, (Easterby-Smith, 1991; Remenyi *et al.* 1998).

The phenomenological, (interpretive science), method of inquiry uses naturalistic and qualitative approaches in both an inductive and holistic way in order to understand human experience in the context of a specific setting. It attempts to understand and explain a particular phenomenon, instead of searching for external causes or fundamental laws (Easterby-Smith, 1991; Remenyi *et al.* 1998). As Eldabi *et al*. (2002) commented, it attempts to understand a phenomenon from the viewpoint of the participant who is directly concerned with the phenomenon being studied. The phenomenological approach also rejects positivists' beliefs, which are based on atomism, i.e., that the objects of experience are atomic, independent events. This concept is central to the idea of didacticism, which claims that by considering a finite set of events from the past, generalizations can be made which will enable the prediction of future events, Amaratunga *et al.* (2002). A summary of the main differences between the phenomenological, (realistic), and positivistic viewpoints was given by Easterby-Smith, (1991) and these are illustrated in Table 4.1.

Theme	Positivist Paradigm	Realism Paradigm
Basic Beliefs	- The world is external and objective. - Observer is independent. - Science is value-free.	- The world is socially constructed and subjective. - Observer is part of what is observed. - Science is driven by human interests.
Researcher should:	- Focus on facts. - Look for causality and fundamental laws. - Reduce phenomena to simplest elements. - Formulate hypotheses and test them.	- Focus on meanings. - Try to understand what is happening. - Look at the totality of each situation. - Develop ideas through induction from data.
Preferred method in research	- Operationalizing concepts so that they can be measured. - Taking large sample.	- Using multiple methods to establish different views of the phenomena. - Small samples investigated in depth or over time.

Table 4-1 Key features of positivist and realism paradigms

Different situations will call for different methods. Table 4.2 summarizes some of the strengths and weaknesses of the two research methods, (Easterby-Smith 1991). Yin (1994) explains the conditions, which provide the basis for strategic choice. These are: the type of question posed which the control over actual behavioral elements, and the degree of focus on historical or contemporary contexts. Table 4.3 presents a comparison of five research strategies in accordance with the three factors identified above. The research approach must be relevant to the purpose of the study. Galliers, 1992, cited in Remenyi *et al.* 1998, gives a list of approaches or tactics. Table 4.4 provides a summary of this list according to the general philosophical base underpinning the different research methods. Most of the research methods listed in the table can be used in some way as either positivistic, (quantitative), or phenomenological, (qualitative) devices.

Theme	Strengths	Weaknesses
Positivist (quantitative method)	-The methods can provide wide coverage of a range of situations. -They can be fast and economical. -Where statistics are aggregated from a large sample, they may be of considerable relevance to policy decisions.	-The methods used tend to be rather inflexible and artificial. -They are not very effective in understanding processes or the significance that people attach to actions. -They are not very helpful in generating theories. -Because they focus on what is, or what has been recently, they make it hard for policy makers to infer what changes and actions should take place in the future.
Phenomenological (qualitative method)	-Data-gathering methods are seen as natural rather than artificial. -Ability to look at change processes over time. -Ability to understand people's meaning. -Ability to adjust to new issues and ideas as they emerge. -Contribute to theory generation.	-Data collection can be tedious and requires more resources. -Analysis and interpretation of data may be more difficult. -Harder to control the pace, progress and end-points of the research process. -Policy makers may give low credibility to results from a qualitative approach.

Table 4-2 Comparison of strengths and weaknesses

Strategy	Form of research question	Requires control over behavioural events?	Focuses on contemporary events?
Experiment	How, why	Yes	Yes
Survey	Who, what, where, how many, how much	No	Yes
Archival analysis	How, why	No	Yes / No
History	How, why	No	No
Case study	How, why	No	Yes

Table 4-3 Research strategies versus characteristics

Research approaches	Positivistic (quantitative)	Phenomenological (qualitative)
Action research		Strictly interpretive
Case studies	Have scope to be either	Have scope to be either
Ethnographic		Strictly interpretive
Field experiments	Have scope to be either	Have scope to be either
Focus groups		Mostly interpretive
Forecasting research	Strictly positivistic with some room for interpretation	
Futures research	Have scope to be either	Have scope to be either
Game or role playing		Strictly interpretive
In-depth surveys		Mostly interpretive
Laboratory experiments	Strictly positivistic with some room for interpretation	
Large-scale surveys	Strictly positivistic with some room for interpretation	
Participant observer		Strictly interpretive
Scenario research		Mostly interpretive
Simulation and stochastic modelling	Strictly positivistic with some room for interpretation	

Table 4-4 Research tactics and philosophical bases

The research methodology is required to answer specific research questions. As pointed out by Poole and McPhee (1994) the method is the researcher's point of contact with the world and therefore offers a choice of ways in which to pose questions and find answers. Therefore both research methods can be accepted.

The various strengths and weaknesses of each method are illustrated in Table 3.2 and the fact there are advantages and disadvantages to both qualitative and quantitative questionnaire methods can be seen in Table 4.4, (Amaratunga *et al*., 2002; Eldabi *et al*., 2002). McGrath (1982) suggests that there are no ideal solutions, only a set of compromises.

In this research, a quantitative approach was adopted at an early stage so that the most important risk categories and sub-factors affecting BOT infrastructure projects could be determined. By researching related documentation, newspaper articles, company and government annual reports, and with discussion with the people involved in BOT Infrastructure projects, a questionnaire was composed. By further research, including a pilot study, the initial questionnaire was refined and improved.

The questionnaires were distributed, by hand, to the expert participants in Kuwait. Upon completion, the questionnaires were collected and the results analyzed.

The results of the questionnaires are fundamental to the research methodology as the results are from local experts with local knowledge of BOT Infrastructure Projects and processes in Kuwait. The Study Methodology Flowchart, Figure 4-1, provides a means to a clear and reasonable process of risk evaluation.

Quantitative analysis techniques were used to rank the risk factors within their categories leading to the formulation of general principles and later qualitative techniques were utilized.

This is a reasonable approach to the design of the study. The various strengths and weaknesses of each method are illustrated in Table 4.2 and the fact that both quantitative and qualitative questionnaire methods have advantages and disadvantages can be seen in Table 4.5, (Amaratunga *et al.* 2002; Eldabi *et al.* 2002). According to McGrath, (1982) there are no ideal solutions, only a series of compromises.

After the quantitative approach discovered the most important risk factors affecting BOT infrastructure projects, in order to implement the proposed research model, it was necessary to examine other research methods, such as case studies, and also to carry out a review of the literature including documents and theories, so that the risk categories could be further evaluated and used in the risk-management model. Therefore, this research has used a mixed approach, using triangulation to combine various methodologies and thus gain and verify the information. (Triangulation is discussed later in the chapter.) This research strategy is illustrated in Figure 4.1 Study Methodology Flow Chart shown below.

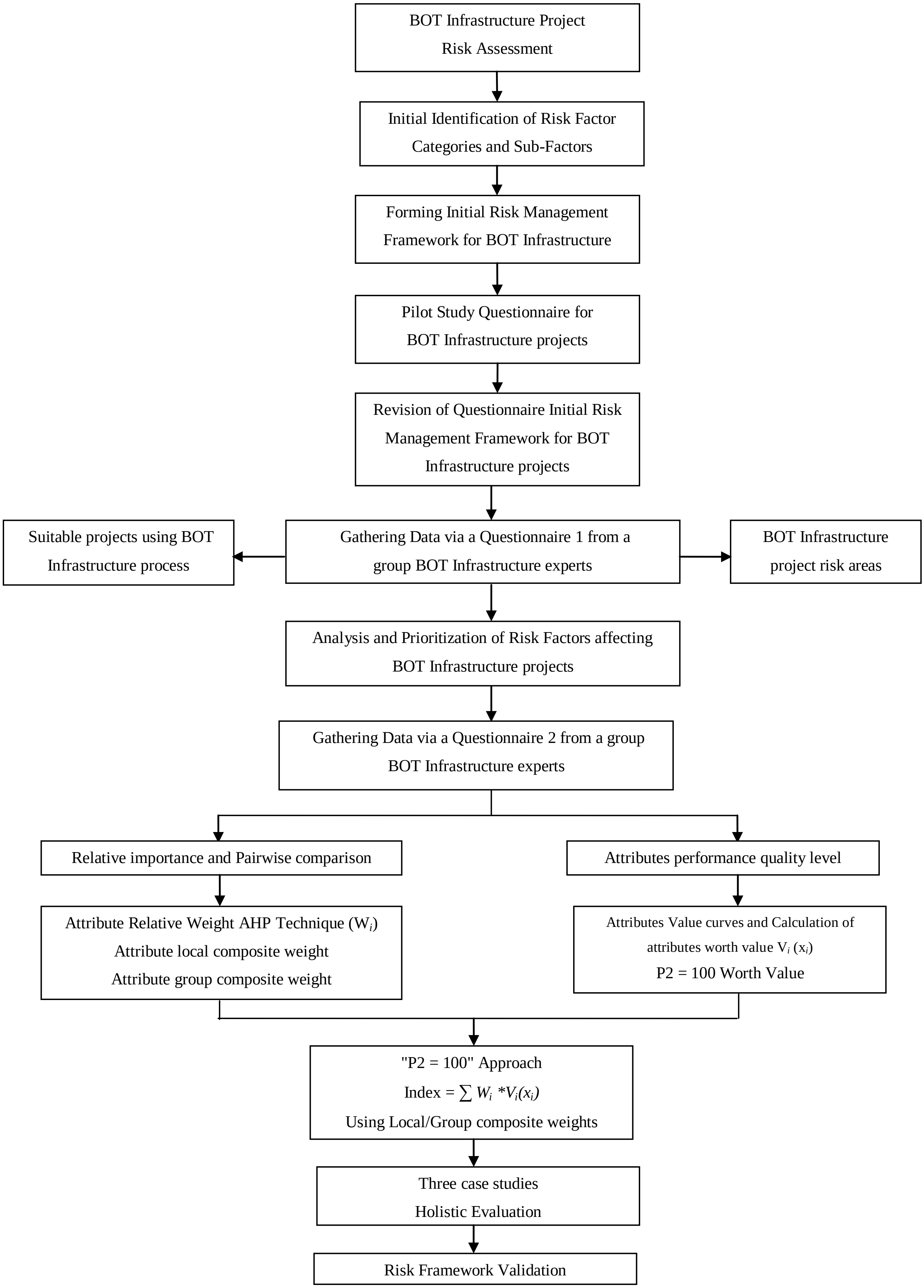


Figure 4-1 Study Methodology Flow Chart

4.5 Stage One: The Framing Stage

According to Sekaran (2003) questionnaires are defined as "a pre-formulated written set of questions to which respondents record their answers, usually within rather closely defined alternatives". They are mainly used to collect participants' opinions and preferences, (Easterby-Smith, Thorpe & Lowe 2002) and can easily be administered personally or conducted through mail or on-line, which is a much less expensive method than using interviews (Sekaran2003). Questionnaires are useful in that they can generate quick data for various research issues, but also have their weaknesses in that respondents might forget to respond or fail to do so due to pressure of work. This involves sending reminders. If there is a low response rate, it may not be possible to generalize the results, (external validity), and the quality of the conclusions, (internal validity), may not be good, (Tashakkori,Teddlie 1998).

In this study the questionnaires are intended for the collection of important data and to provide further direction for this research work. They also provide information, which will identify the applicability for further work and guidance on this research. This research is intended to provide information concerning the risk factors surrounding and inside BOT infrastructure projects. The valuable data collected from the literature review and the participation of experts in developing the questionnaires is intended to strengthen the proposed BOT Risk Management framework.

The questionnaire is designed to provide an understanding of the risks involved with a BOT infrastructure project. The data obtained will provide a 'big picture' of the risk factors influencing BOT infrastructure projects which will enable the presentation of a risk-management framework for BOT infrastructure projects in Kuwait. It is necessary to consider several research questions regarding critical issues to ascertain to what extent these affect the BOT infrastructure project risk management.

In order to identify and gather knowledge, to construct research questions the most appropriate form is the quantitative questionnaire, as mentioned earlier in this chapter. Other types of questionnaire include: by telephone, face-to-face, by self-administration, as a handout, or by e-mail. In this research, the target sample will be selected from experienced professionals in the industry, who are involved in the development of BOT infrastructure projects in Kuwait. Their views and opinions of the research issues will be obtained and analyzed. A self-administration survey was considered to be appropriate and useful for several reasons: Self-administered questionnaires are one of the cheapest types of survey involving only one researcher and since the respondents identity is kept secret, the effects of researcher bias are eliminated, (Bryman, Bell 2007). As pointed out by Neumann (2007) the fact that respondents can complete the questionnaire at their own convenience aids in providing more accurate data. However, the low response rate for self-administered questionnaires requires the researcher to send reminder letters adding to the time and cost of the survey, (Sekaran 2003). As Neuman (2007) comments, researchers cannot observe the conditions under which the questionnaire was completed and this may limit the ability of the researcher to verify the accuracy of the responses. Usually traditional method,s (by mail, self-administered questionnaires and face-to-face), are the most common surveys carried out in academic research. Although a mail survey may be a very reliable method for use in the United Kingdom, it is not an appropriate method for Kuwait because of the poor performance of the postal system there.

4.5.1 Sampling

The difference between qualitative and quantitative methods can be understood best from the sampling approach. Sekaran (2003) explains that sampling is a process involving the selection of a number of elements from the available population. Sample size is important when conducting a study as the results can be used to generalize the findings for the whole population. A sample is a subset within a larger group which is known as a population. Sampling is a procedure mostly used by researchers to select representative units, representing the whole population under study in order to draw valid conclusions about the population. The sample size for this research was determined by the number of experts who were willing to participate in the survey. Using the data from the participants, and using quantitative research, it is possible to generalize the results to the whole of the research population, as stated by Dawson (2006). However, qualitative researchers attempt to describe or explain what is happening with the sample size available, thus providing insight into the behavior of the wider research population.

4.5.2 Sample selection and size

This research involves obtaining in-depth details about the evaluation processes and practices of BOT infrastructure projects risks in Kuwait and so the sample frame consists mainly of experienced professionals in the industries, who are especially involved in the development of BOT projects in Kuwait. The research is concerned with the activities and practices of BOT infrastructure projects risks in Kuwait. To discover the inter-relationships amongst the BOT infrastructure project risk attributes, which include combined qualitative and quantitative factors, it is necessary to assign weights and a performance, (quality), level for each attribute of the project risk and then to compare their relative importance which is a very important part of the process. In this research, the selection of the professional group (respondents) was based on the following criteria:

1. The expert should be involved in developing one of the BOT projects.
2. The expert should be a member of the top project management team.
3. The variety of their project-type experience must be considered.
4. The variety of the project party, which they represent, (i.e., public or private agencies or financiers), should be considered, and the differences in opinions of the participants concerning the feasibility of the potential projects and the degree of importance of the different project attributes should be reflected in the questions.

4.5.3 Pilot Study

Bryman (2004) notes that the purpose of piloting a survey is not simply to ensure that the survey questions are appropriate; but also to ensure that the research instrument as a whole, functions well. The pilot study is the final, and most important, stage before data collection, as it shows whether there are problems regarding the design of the questions.

The methodology for this research began with the design of the questionnaire. It is of a quantitative type because it attempts to investigate and explore the importance of risk factors relating to BOT infrastructure projects. The first questionnaire has the aim of identifying the risk factors affecting BOT infrastructure projects generally. Also, this method obtains much information on how to reach respondents more effectively and improves the quality of the questionnaire. Questionnaire one was a pilot study and was given to two different groups. The first group was the academic staff working at the Kuwait University including four researchers, (project management – engineering). The second group were four experts in BOT infrastructure projects Kuwait. The concept behind the questionnaire methodology is based on gathering as much information as possible from people with different background knowledge: academic knowledge and experience. The technique is particularly useful if the research boundary is very wide and opportunities for further work are not very clear.

The reasons for adopting this technique are to assess the questionnaire, provide valuable insight into, and improve the questions in the questionnaire.

4.5.4 The results of the pilot study.

As mentioned above, the importance of the first questionnaire the pilot study is to improve the design of the questionnaire before it is used in the main study of the research. Many drawbacks and errors were found in the first questionnaire. The improvements made to can be summarized as follows:

1. The length of the questionnaire was reduced significantly.
2. A progress message about how many questions were left was shown to respondents after each question page.
3. The time needed to complete the questionnaire was reduced by changing the design of the questions after using the results from the pilot questionnaire. This was achieved by a reduction in the number of variables for each question and eliminating some of the questions.

The pilot questionnaire had achieved a response rate of 100 percent. Next, the improved questionnaire, which contained modifications from the pilot Questionnaire, was distributed to the expert participants.

This questionnaire was divided to two main parts; the first part was designed to assess the common risk factors affecting the BOT infrastructure project system, and to rank the common BOT infrastructure project risks according to their relevance in each of the project categories. The second part of the first questionnaire was to determine the significance level of the common BOT infrastructure project risks for each category of the project. The projects were grouped under four main categories: 'Public Works", "Public Utilities", "Public/Government Buildings", and "Other Facilities".

4.6 Stage Two: The Risk management Framework stage.

Stage two of the research consisted of three different parts: In the first part the experts were asked to check in depth how relevant the grouped decision factors, (attributes), were to their categories. In the second part, the participants were required to make a pairwise comparison for the relative importance between the attributes within each category and within the categories themselves under the project risk. The pairwise comparisons were performed with the aid of a qualitative scale which attempts to incorporate the decision maker's subjectivity and experience and to reflect the degree to which the decision might discriminate amongst the various relationships between attributes. According to Saaty, (1980), a qualitative scale with intensities which range from 1 to 9 is the most appropriate one. The reasons for this choice are stated as:

1. The qualitative distinctions are meaningful in practice and are more precise when the items being compared are of the same order of magnitude or close together, with regard to the property used to make the comparison.

2. The human ability to make qualitative distinctions is well represented by five attributes: equal, weak, strong, very strong, and absolute. As we can make compromises between adjacent attributes when greater precision is needed, the scale has nine values.

3. The assumptions suggested that 'the brain can simultaneously process 7±2 items' Miller (1956).

Intensity of Importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
3	Slight importance of one over another	Experience and judgment slightly favour one activity over another
5	Moderate importance	Experience and judgment moderately favour one activity over another
7	Substantial importance	An activity is favoured very strongly over another
9	Absolute importance	The evidence favouring one activity over another is of the highest possible order of affirmation
2,4,6,8	Intermediate values between adjacent scale values	When compromise is needed
Reciprocal of above non-zero	If activity *i* has one of the above non-zero numbers assigned to it when compared with activity *j*, then *j* has the reciprocal value when compared with *i*	A reasonable assumption

Table 4-5 Pairwise Comparison Scale (adapted from Saaty, 1980).

A slightly modified version of the above scale was adopted so that a more uniform distance among the verbal expressions than the one provided by the original scale was obtained. This modified scale was used to perform pairwise comparisons in the questionnaires used in this study and an example was provided to explain the process, (see figure 4-2 below).

The third part was designed to determine the score for each attribute by estimating the performance, (quality), and level of each attribute towards the project viability. In this part, the participants were asked to assign a performance level of P1, P2 for each decision factor on the performance scale, (qualitative), as adopted by(Diaz and Ioannou, 1995), (see figure 4-3, below). Two points P1, P2 describe the value curve. P1 is the minimum plausible performance level for an attribute, and indicates the highest point on the performance scale where an attribute is worth its minimum (i.e., 0). P2 indicates the maximum plausible performance level for an attribute, and reflects the lowest point on the performance scale where an attribute is worth its maximum, (i.e., 100). These two points characterize the generic form of value curves by dividing the performance scale into three regions: (1) a low flat region, (2) an intermediate region, (3) a high flat region. (See figure4-4.)

An attribute is worth 0 points if it presents a performance, (quality), level in region A ("low flat"), between 0 and 100 points if it represents a performance level in region B, ("intermediate"), and 100 points if it represents a performance level in region C ("high flat"). Diaz and Ioannou (1995) wrote that: region A, (low flat), is an extreme case of minimal return per unit of performance. It suggests that the characteristics and features of the attribute being evaluated do not need to be a “complete disaster” in order to have the attribute worth zero points. Region C, (high flat), is the attribute performance interval that provides maximum worth. It suggests that the characteristics and features of the attribute being evaluated do not need to be “perfect” in order to have the attribute worth a hundred points. In contrast to the Diaz and Ioannou approach, the performance value of P1 is kept at zero in this study. This is because all of the project decision factors are considered important and have an impact on the outcome of the total project risks. Even when its' impact is minimal, the performance should be considered in the evaluation.

The “P2 =100 Approach” was used for calculating the score of each attribute; The “P2 =100 Approach” will neglect the P1 value. The P2 value will be the maximum value on the performance scale. See figures 4.5.

Figures 4.4 and 4.6 shows the Diaz and Ioannou approach, where both P1 and P2 are considered; and the "P2 Only Approach" which uses the P2 value given by the expert participants.

6

Factor A	more important		more important		more important		important		Equal important		important		more important		more important		important	Factor B
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	

If **A** is more important than **B** use this side

If **B** is more important than **A** use this side

Figure 4-2 The Modified Decision Factors Comparison Table.

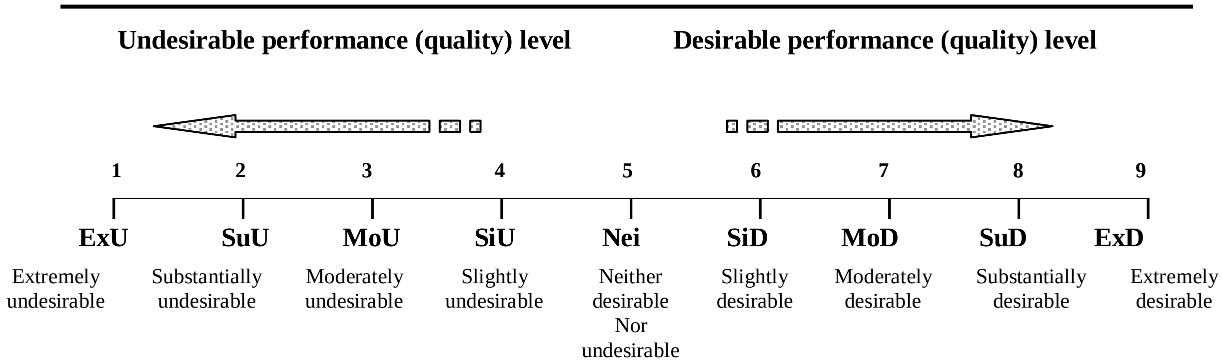


Figure 4-3 Equivalence between Qualitative and Quantitative Performance Scales Performance Scale (Diaz and Ioannou 1995).

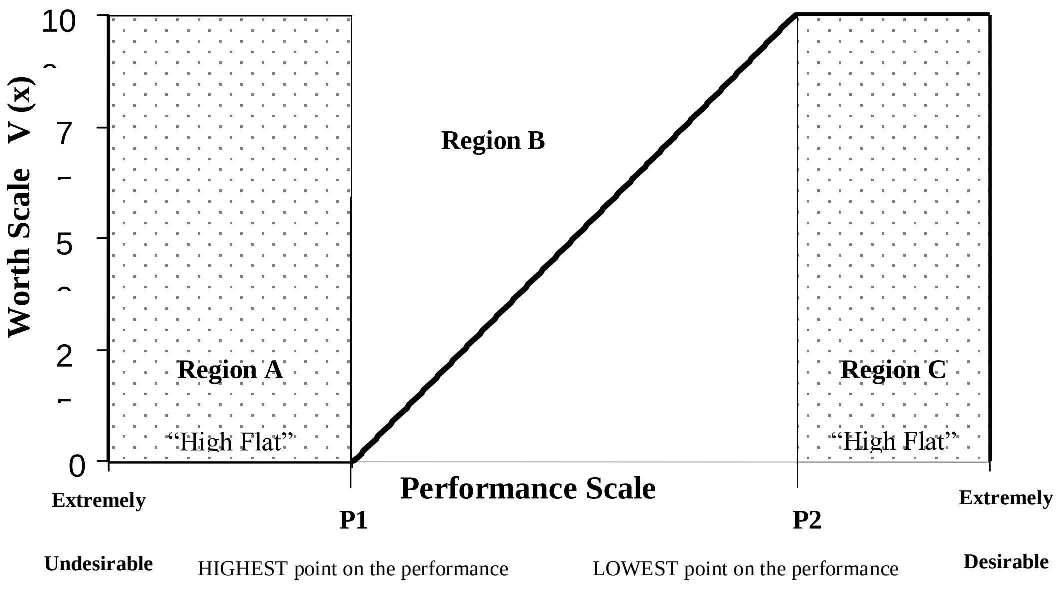


Figure 4-4 The Modified Generic Form of the Value Curves in the "Diaz Approach".

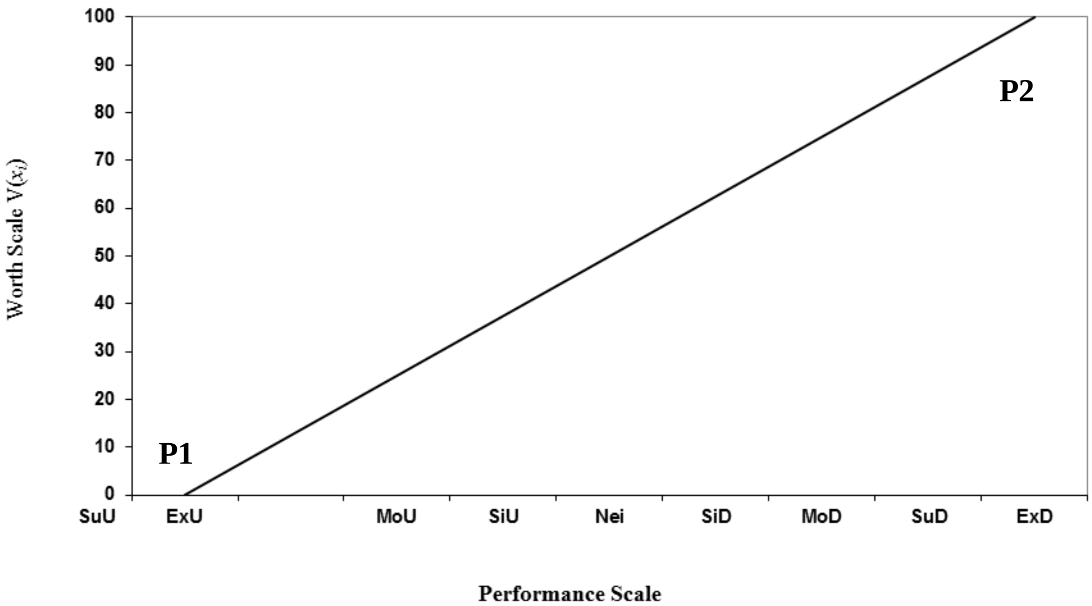


Figure 4-5 The Modified Generic Form of the Value Curves in the "P2=100 Approach".

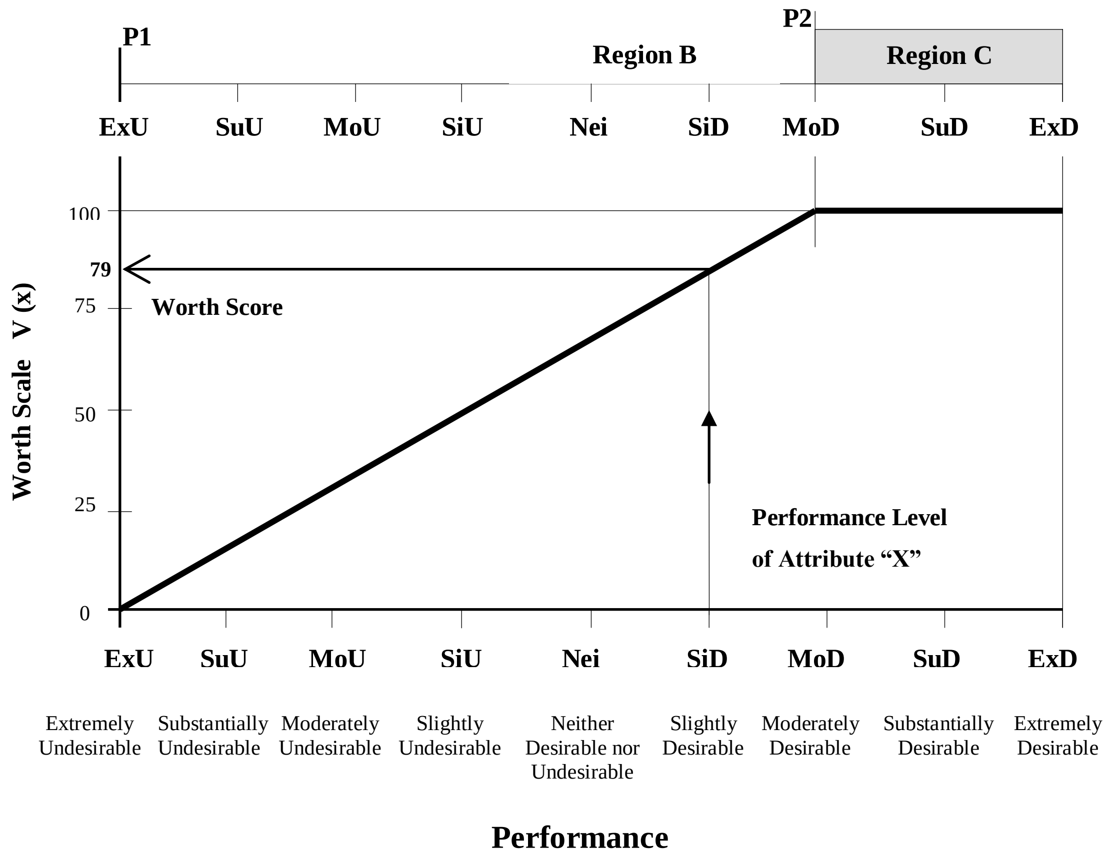


Figure 4-6 The Modified Generic Form of the Value Curves in the "P2 Only Approach"

The third part of the second questionnaire was designed to validate the risk management framework. Three case study projects were considered: The Sulaibiya waste water plant in Kuwait, the Channel Tunnel in the UK, and the Marsa Allam airport in Egypt.

The Sulaibiya waste water plant in Kuwait provides the benchmark and catalyst for the successful implementation of similar BOT projects in the Middle East region, which are particularly relevant due to the scarcity of water in the area. The Sulaibiya Wastewater Treatment and Reclamation Plant in Kuwait won 'Wastewater Project of the Year' in the 2005 Global Water Awards. Described by the judges as a "powerful statement of the future of water resources across the whole Middle East and North Africa region", the plant is currently by far the largest facility of its' kind in the world. This BOT Infrastructure project was chosen because it is a successful BOT Infrastructure project and all expert participants are familiar with this project. This was a large BOT infrastructure project that was completed by the Al-Kharafi group; a company well known in Kuwait and to the expert participants.

The Channel Tunnel was selected because it is one of the best known examples of BOT infrastructure projects in the world. The expert participants are all familiar with this project and felt that they can use their experience to perform a meaningful project evaluation.

Marsa Allam airport in Egypt completed in 2001, is the first airport to use BOT Infrastructure approach in Egypt and was built by the Al-Kharafi Group, a Kuwaiti privately owned company which is the same company involved in the Sulaibiya waste water plant in Kuwait. This was of particular interest to our expert participants, as it was the first time a Kuwaiti private company was using the BOT infrastructure project method outside of Kuwait.

The case studies mentioned above were presented to 14 of the 16 expert participants who replied to the first questionnaire, (as the other 2 did not want any further involvement in the research), and they were asked to perform an intuitive evaluation for the model attributes and to rate them using a 1–10 scale.

4.7 Analytic Hierarchy Process (AHP) and The Weighting Procedure

The Analytic Hierarchy Process, (AHP), is a structured method for organizing and analyzing decisions that are complex in nature. Based on mathematics and psychology, it was developed by Thomas L. Saaty of the University of Pittsburgh and has been constantly developed and improved over time. AHP is popular with decision-makers who find the questions within it easy to answer and the AHP "Expert Choice" software is user friendly, (Goodwin and Wright, 2004) and also allows decision-makers to model a complex problem in the form of a hierarchical structure which indicates the relationship between the goal, objectives, (criteria), sub-objectives and alternatives. It enables decision-makers to break down a decision into smaller parts, proceeding from the objectives to the goal, then to sub-objectives and finally down to alternative courses of action, (Expert Choice, 2000). In this research, the Eigenvalue Method, (EM), (which is a "scaling process"), was used to assign "weights" to the different decision factors. "Weighing" comprises: for each pair of Risk Factors, the decision maker is required to answer the question: “How important is Factor A relative to Risk Factor B? Rating the relative "Priority" of the Risk Factor is done by assigning a "weight" between 1, (equal importance), and 9, (absolute importance), to the more important Risk Factor, whereas the reciprocal of this value is assigned to the other Risk Factor in the pair. [This is also carried out for the Risk Categories.]

EM has been used by Saaty (1980) in the development of a multi-attribute decision method; the Analytical Hierarchy Process (AHP) which is a versatile decision tool having the ability to handle complex or multiple objective, (criteria) decisions. AHP has also has been used in many different scenarios, for example, in the selection of suppliers, (Bhutta and Huq 2002) to formulate a manufacturing strategy, (Quezada *et al.* 2003), to determine business performance measures, (Cheng and Li, 2001a) to determine priorities in a safety management system, (Chan *et al.* 2004) and for many other important tasks (Saaty and Forman 1992).

The basic purpose of the eigenvalue method is to derive results, weighted in order of importance, from Pairwise comparisons amongst the different attributes of a multi-attribute model, to normalize these weights, (eigenvectors), and to detect a similarity in the responses. The Pairwise comparison is performed with the aid of a qualitative scale which incorporates the decision-makers subjectivity and experience and which reflects the degree to which the decision might discriminate amongst the intensity of relationships between attributes. When Pairwise comparisons have been completed for the decision factors, a comparison matrix can be formed and the relative importance weights can be found by using the eigenvector method of raising the Pairwise comparison matrix to a certain power, *"p"*, where the differences amongst its' normalized columns are smaller than a certain value of $1\times10E^{-4}$, then all the columns of the matrix become similar, leading to the resultant eigenvector, (priority weights).

A model with '*n*" attributes needs $n(n-1)/2$ comparisons in order to provide enough information to form the comparison matrix. This is due to the fact that the comparison matrix is reciprocal, i.e. the elements of the main diagonal, $a_{i,j}$ (for all $i = 1,2,\ldots, n$), are equal to unity and the elements below the main diagonal are reciprocal to the elements above the main diagonal, ($a_{j,i} = 1/a_{i,j}$). An example will explain the procedure:

The relative importance weights of a three-attribute model according to specific criteria can be determined. For attributes: A, B, and C. First, it is required o conduct a pairwise comparison of the attributes, i.e. compare A with B, A with C, and B with C. Suppose that the comparisons yield the following results:

- A is slightly more important than B; [A > B, Scale = 3]
- A and C are equally important; [A = C] and
- C is moderately more important than B; [C > B, Scale = 5]

Which can be shown in a table:- 4-6

	A	B	C
A	1	3	1
B	$1/3$	1	$1/5$
C	1	5	1

Table 4-6

$$\mathbf{M} = \begin{vmatrix} a_{1,1} & a_{1,2} & a_{1,3} \\ a_{2,1} & a_{2,2} & a_{2,3} \\ a_{3,1} & a_{3,2} & a_{3,3} \end{vmatrix} = \begin{vmatrix} 1 & a_{1,2} & a_{1,3} \\ 1/a_{2,1} & 1 & a_{2,3} \\ 1/a_{3,1} & 1/a_{3,2} & 1 \end{vmatrix} = \begin{vmatrix} 1 & 3 & 1 \\ 1/3 & 1 & 1/5 \\ 1 & 5 & 1 \end{vmatrix}$$

In the case of exact transitivity the relations between the relative importance weights W_i and the elements $a_{i,j}$ are given by

$$\frac{w_i}{w_j} = a_{i,j} \quad \textbf{for} \quad i, j = 1,2,3 \ldots, n \ \textbf{and} \qquad \textbf{(4.1)}$$

$$\mathbf{M} = \begin{vmatrix} W_1/W_1 & W1/W2 & \ldots\ldots & W_1/Wn \\ W_2/W_1 & W_2/W_2 & \ldots\ldots & W_2/Wn \\ M & M & 0 & M \\ Wn/W_1 & Wn/W_2 & \ldots. & Wn/Wn \end{vmatrix}$$

Rewriting

$$\frac{w_i}{w_j}\ \boldsymbol{a_{i,j}} = \mathbf{1} \qquad \textbf{for} \quad \boldsymbol{i} = \mathbf{1,2,3}\ \ldots,\boldsymbol{n} \qquad \textbf{(4.2)}$$

Thus,

$$\sum_{j=1}^{n} a_{i,j}\, w_j \frac{1}{w_i} = n \qquad \textbf{for} \quad \boldsymbol{i} = \mathbf{1,2,3}\ \ldots,\boldsymbol{n} \qquad \textbf{(4.3)}$$

or

$$\sum_{j=1}^{n} a_{i,j}\, w_j = n\, \boldsymbol{w_i} \qquad \textbf{for} \quad \boldsymbol{i} = \mathbf{1,2,3}\ \ldots,\boldsymbol{n} \qquad \textbf{(4.4)}$$

The above formula can be expressed in the following matrix equation format:

$$\mathbf{M}\, \boldsymbol{w} = \boldsymbol{n}\, \boldsymbol{w} \qquad \textbf{(4.5)}$$

In exact transitivity where the relationship $a_{i,j} = w_i \ / w_j$ is not valid, it was noted by Saaty, (1980), that if matrix M is reciprocal, then small changes in $a_{i,j}$ keep the maximum eigenvalue λ_{max} close to n and there is still a unique solution for the relative weights of the different parameters, (i.e., w_i *and* w_j can change to allow for the change in $a_{i,j}$ from the ideal case). Thus (4.4) can be written as

$$\sum_{j=1}^{n} a_{i,j}\, w_j = \boldsymbol{\lambda}_{\mathbf{max}}\, \boldsymbol{w_i} \qquad \textbf{for} \quad \boldsymbol{i} = \mathbf{1,2,3}\ \ldots,\boldsymbol{n} \qquad \textbf{(4.6)}$$

The problem reduces to finding the eigenvector, w\` which satisfies

$$\mathbf{M}\, \boldsymbol{w}` = \boldsymbol{\lambda}_{\mathbf{max}}\, \boldsymbol{w}` \qquad \textbf{(4.7)}$$

The procedure used to compute the eigenvector, w\`, consists of raising the comparison matrix to the power $P$ where the differences within its normalized columns are smaller than a particular value, ε, (i.e., 0.001). The eigenvector, $w$\`, is any of the normalized columns of the matrix $(M`)^P$.

Saaty (1980) suggested that the variation of λ_{max} due to small changes in $a_{i,j}$ could be used as a measure of consistency, and developed the consistency index CI which measures the closeness of a comparison matrix to a true consistent matrix. The closer CI is to zero the more consistent is M

$$\textbf{CI} = \frac{\lambda_{max} - n}{n-1} \qquad \textbf{(4.8)}$$

The consistency ratio, (CR) = CI/RI, compares the consistency index of a matrix M with a random index (RI) given by a randomly generated reciprocal matrix of the same order as M and gives an indication of whether the comparison matrix is more logically consistent, or more random. Saaty derived the random index from a sample of size 100 of a randomly generated reciprocal matrix of size n using a scale where the elements $a_{i,j}$ (for all i =1,2,3,…,n–1 and j = 1,2,3, …n >i) could assume the following values: 1/9, 1/8, 1/7, 1/5, 1/4, 1/3, 1/2, 1, 2, 3, 4, 5, 6, 7, 8, and 9. This procedure resulted in the creation of a reciprocal matrix by making the elements of the main diagonal, $a_{i,j}$ (for all 1,2,3,…, n), equal to unity and the elements below the main diagonal reciprocal to the elements above the main diagonal ($a_{j,i} = 1/a_{i,j}$). The averages of RI according to matrices of different dimensions are given in Table 4-2. A consistency ratio of 0.1 or less was considered as acceptable by Saaty (1980). If this limit is exceeded, then in order to improve consistency, the decision-maker should revise his pairwise judgement. In this study a computer software program "Expert Choice" is used to compute the eigenvector. For the above example, w` = (0.405, 0.114, 0.481), λ_{max} = 3.029, CI = 0.015, and CR =0.025 < 0.10.

Matrix order (*n*)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Random index (RI)	**0**	**0**	**0.58**	**0.9**	**1.12**	**1.24**	**1.32**	**1.41**	**1.45**	**1.49**	**1.51**	**1.48**	**1.56**	**1.57**	**1.59**

Table 4-7 Random Consistency Index (Saaty 1980).

4.8 Attributes Value Function

In previous studies, the term "value function" represents various different concepts. Diaz and Ioannou (1995) considered the value function to indicate a function used to transform an outcome, (i.e., the performance level of an attribute), into the decision- makers relative worth for this outcome. Transforming an attribute performance level to its worth score, by means of a value function, is more complicated than estimating the performance, (quality), level of an attribute directly through the use of a quantitative scale. It was very difficult to choose appropriate quantitative constructs to represent the model attributes, so a qualitative scale, common to all attributes, was considered to be the best solution for the development of the framework. The worth score of an attribute, $V_i\ (x_i)$, is a non-dimensional number representing the performance level for a specific project. In order to calculate the "worth" score of an attribute, its performance level must be qualitatively assessed, and then the value function used to transform the subjectivity assessment into a numerical scale. In this study, the modified performance scale and the value curve are used to develop the 'worth" score of the viability model attributes. See figures 4-3 to4-6.

4.9 The Delta Dimension (δ)

The delta, (δ), dimension is a term used in situations where the performance of a single dominant attribute is low enough to reject the project or at least to make the project unattractive for promotion by the private sector. The total δ is calculated by summing all the "local deltas", (i.e., the delta of each attribute), that is

$$\boldsymbol{\delta} = \sum_{i=1}^{n} \boldsymbol{\delta_i} \qquad \textbf{(4.9)}$$

An equation was developed by Diaz and Ioannou (1995). Here δ_i represents the delta of attribute *i*. If the intensity of an attribute is less than a certain threshold P1, (the cut-off point), set by the decision maker, its δ_i is set equal to 'zero',- otherwise it is set to 'one'. So, δ_i = 0, whenever a dominant attribute, *i*, has a performance level. $x_i \leq$ P1, i.e. Whenever $V_i\ (x_i) = 0$. The total contribution of the risk management framework attributes can be calculated by multiplying the local delta, δ, in the product of each attribute local weight by the "worth" score and summing the results as

$$V(x) = \sum_{i=1}^{n} \delta_i\ w_i\ v_i(x_i) \qquad \textbf{(4.10)}$$

In this study, the local, δ_i , is always set equal to 1, because all the risk management framework attributes are considered very important, (dominant), and have different effects on the project risks which means that any attribute performance value should be considered in the evaluation. The total contribution of the individual attributes to the total project risks can be found from the following equation

$$V(x) = \sum_{i=1}^{n} w_i \, v_i(x_i) \tag{4.11}$$

4.10 Documentation

Another data collection method for gathering relevant data is from documentation in the public domain, (i.e. government reports, company annual reports, newspapers, articles, etc.). If sufficient accessible data exists, then according to Barnes, (2001), documentation can be considered to be an efficient and effective source of information. However, as Merriam, (1988), points out, there are disadvantages in that documents may contain information that the researcher cannot understand, and very often they have been produced by anonymous people, thus making it difficult to determine their authenticity and accuracy. As a data-collection method there are advantages and disadvantages of documentation. The advantages of this method are as follows.

1. There is no requirement for a written procedure which must be followed.
2. It provides useful data for use in triangulation.
3. According to Barnes (2001) it can be used to trace the company's activities over time.
4. No special skill on the part of the researcher is required.

The disadvantages of the documentation method are as follows:

1. It may be difficult to gain access to the document records required.
2. Care must be taken to overcome the possibility of inadequacies and bias within the documents, (Barnes 2001).
3. The documentary records may be unsuitable, limited or even unavailable for the purpose of the study.

Organizational documents are another valuable source of information used in case studies (Bryman, Bell 2007). These may constitute both private and public records, Creswell (2004). For several reasons, it is likely according to Yi (2009) that documentary information is useful for every case study objective. One main reason is that information can be obtained in areas which cannot be found through other methods, such as the financial performance of an organization. Another reason is that, according to Bryman (1989) they can validate information collected through other means. They are particularly useful in this respect for case studies that enable the researcher to verify the correct names of places, people and processes that were mentioned in interviews.

The documents, which were collected, provided a good source of data from which inferences were made about the risk management style and/or they provided other specific details concerning risk factors in the projects. Documents used in this research provided information regarding risk and risk management in BOT infrastructure projects, which could not be directly observed Patton (2002). However, as Patton (2002) pointed that studying and comprehending documents is a skill required for qualitative research and is considered necessary for a researcher in such a research inquiry.

4.11 Observations

According to Merriam (1988) observations are a primary source of data in case study research and can be used as an initial data source to identify and shape the final elements which are involved in the study, so that a researcher can modify the data-collection procedures during the observations (Graziano, Raulin 2007). Observation methods can be used in conjunction with statements and words collected during interviews in order to describe the facts and people in natural settings (Amaratunga *et al.* 2002). Creswell, (2004), defined observations as "*the process of gathering open-ended, first hand information by observing people and places at a research site*". Patton (2002) describes them as the "fieldwork". Merriam (1988) suggested several reasons why and when a researcher might want to use observation methods:

- ❖ The degree to which a researcher captures behaviour in interviews is limited; observations notice things that may lead to understanding a phenomenon.

- ❖ Observations are powerful in recording behaviours as they are happening.
- ❖ Observations are the best technique to use when a fresh perspective about a phenomenon is required.
- ❖ Observations are the most appropriate alternative when participants do not feel free to discuss the topic under investigation.

This research did not use observation as a data-collection method, as it was not feasible since the phenomenon on which data was to be collected was not observable for the purposes of this research for a number of reasons. One of these is that the pre-construction phase of BOT projects takes years, and time and cost preclude observation of the process and participants. BOT infrastructure projects, as other construction projects, are temporary coalitions formed from many organizations, such as clients/sponsors, contractors, design teams, subcontractors, lenders, lawyers, etc. and access to these meetings is impossible.

4.12 Methodological Triangulation

In social research, triangulation applies to situations in which two, or more, dissimilar measuring instruments or approaches are used (Singleton *et al.* 1993). Triangulation uses a combination of methodologies, which do not have the same weaknesses, for the study of a particular phenomenon. The effectiveness of triangulation lies in the fact that the weaknesses in one particular method will be compensated by the counter-balancing strength of another (Amaratunga *et al.* 2002). When both quantitative and qualitative techniques are used to study a topic, a great deal of insight is gained and the method is very powerful for making inferences and drawing conclusions, as illustrated in Figure 4.3 (Fellows and Liu, 1997).

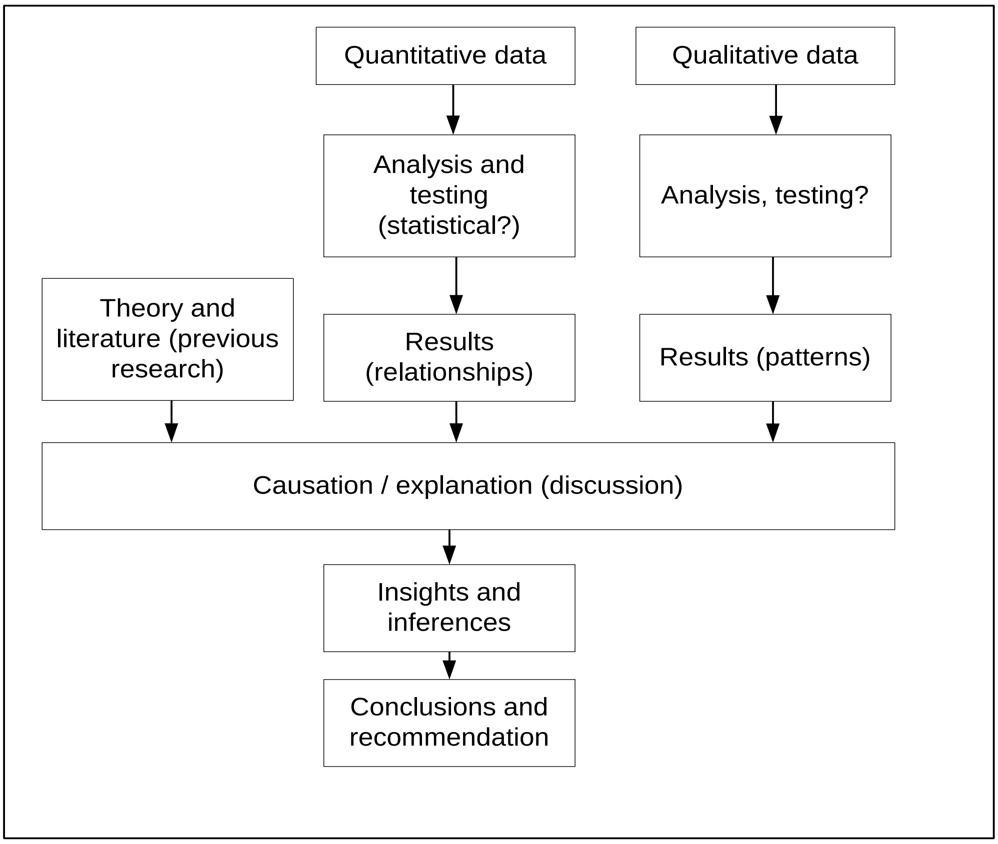


Figure 4-7Triangulation (Source: Amaratunga et al., 2002)

Triangulation, as a research support method, has the following advantages for collecting both quantitative and qualitative data.

1. It provides new lines of thinking by noting surprises or paradoxes; and “turns ideas around”, providing fresh insights (Rossman and Wilson 1991).
2. It enables the confirmation of both sets of data since achieving the same result by different methods produces greater confidence in the results.
3. It helps to elaborate and develop analysis and provides richer details (Rossman and Wilson 1991).
4. It overcomes the limitation of a particular method by using the strengths of the other methods.
5. It provides flexibility in data investigation so that an overall picture of the research topic can be developed.

4.13 Summary

This chapter has presented an extensive account of the particular research methodology used in this research. It has focused on introducing a rigorous presentation of the flow of activities followed in the research inquiry. It also presents the research methodology, adapted by the author, to build up and identify the research framework. The author began by representing the philosophical position of the research, first by selecting a research strategy with a positivist focus in order to establish risk factors for BOT infrastructure projects in Kuwait. The research then takes on a phenomenological focus to investigate the research topic more deeply.

The manner in which the research methodology was be conducted and processed was considered. The methodology consists of a system of explicit rules and procedures on which the research is based and on which knowledge is evaluated.

The research methodology in this chapter is divided into two stages: In the first stage, several risk factors, (quantitative and qualitative), are specified that would affect the BOT infrastructure project risk management. A questionnaire was felt to be the most appropriate type of gathering data and useful for the identification of risk factors which would have an effect on BOT infrastructure projects in Kuwait. These risk factors are necessary to support the author's views to emphasize the importance of the research work and to show how appropriate procedures should be planned. A study methodology flowchart was produced and followed by an explanation of the criteria used in the selection of the expert participants for the risk assessment questionnaire and the results from the first stage questionnaire would be used to develop a risk management framework in the next chapter.

The research then moves to the second stage, involving a second questionnaire, which includes three different parts; the first involves the identification and classification of the risk factors and the removal of the redundant risk factors.

In the second part, the risk factors were evaluated pairwise, by expert participants, under their main categories according to their relevance in order to save extensive effort and time in determining their inter-relationships and evaluation.

The third part was designed to validate the risk management framework by the use of three case studies: the Channel Tunnel Project in the UK, the Sulaibiya Waste Water Plant in Kuwait and the Marsa Allam Airport in Egypt.

The three above case study projects were used for number of reasons: first, to achieve an in-depth investigation; second, to use multiple methods of data collection; third, to triangulate data in order to enhance the validity of the research findings; and fourth, to change the research findings into a generalized form.

These in-depth investigations provide the researcher with important benefits including: discovering what is, and is not, important; finding the appropriate procedures and processes and the reasons for them; discovering the major risk factors that have an effect on BOT infrastructure projects in Kuwait. Mathematical methods were used to process the data.

Finally, the prioritization of risk categories and their sub-factors was examined using methodological triangulation.

In the next chapter, the first stage, Framing Stage, of the research methodology, is discussed in detail.

Chapter 5 Questionnaire Results, Data Analysis and Framework Construction

5.1 Introduction

The research methodology consists of two main stages: the framing stage and the risk management framework stage. This chapter is particularly concerned with the framing stage of the research methodology, as presented in Section 4.5, and provides an understanding of the risks that affect on BOT infrastructure projects in Kuwait. Also, this stage will provide support and direction for further research work.

The major aim of this research is to extract types of Risk that affects BOT projects in Kuwait and the second aim is to develop a framework that will enable to deal with these risks and try to decrease or prevent them.

The methodology for this research began with the design of the questionnaire. It is of a quantitative type because it attempts to investigate and explore the importance of BOT project risk factors. The first questionnaire has the aim of identifying the most important risk factors affecting BOT infrastructure projects in Kuwait.

This chapter is intended to provide information concerning the most important risk factors surrounding and inside BOT projects. Therefore, the data collected via a questionnaire is presented, analyzed and discussed in order to understand respondents' perceptions regarding their experiences in BOT infrastructure project Risks. The questionnaire was distributed within Kuwait to carefully chosen professionals with experience of BOT infrastructure projects and because of the poor state of the postal system in Kuwait, the questionnaire was distributed and collected by hand, which resulted in a100% response rate.

This chapter reports and discusses the information provided by these BOT infrastructure experts. The questionnaire was designed to assess the common risk factors affecting the risk of BOT infrastructure system, and to rank the common BOT infrastructure risks according to their relevancy to each of the project categories (appendix A). It was sent to sixteen BOT professionals representing different sectors, (financial, legal, consultancy, developers, university professors, and official agencies), which is comparable to and more than used in previous studies, (Dias and Ionnou, 1996 and Salman *et al*. 2007). Their answers characterize their understanding of BOT infrastructure risk factors relating to their experience with a BOT infrastructure projects. The sixteen respondents all comply with the criteria set out in Section 4.5.2.

The experts completed the survey and expressed their readiness to provide more support to this research project. The collected data from the questionnaires are tabulated and discussed in the following sections.

The analysis was based on results gained from above questionnaires that targeted different aspects of risks affecting the BOT infrastructure projects, firstly the Risk Factors Affecting the BOT Infrastructure Project System in Kuwait and secondly the Assignment of BOT Risks to Each Project Category.

In the first part of the questionnaire participants were asked to rate and provide answers on a nine point scale in which one refers to an extremely low significance level and nine refers to an extremely high level significance.

In the second part of the questionnaire participants were asked to rate their answers on a five points scale where one refers to no relation at all and five refers to extremely related.

The results in this chapter are explained in the same order as the questions were asked in the questionnaire; the data mainly focuses on the numerical aspects of analysis where the average mean, percentage and the rank numbers are used to determine the study's overall outcome. It is essential to understand that no inferential tests were used in this section as the above statistics were the main concern through which the research aims and objectives are to be answered. The importance of risk factors was ranked based on participants' scores and evaluation. Generally, the risk factor that generated the highest mean number is ranked first and is considered the most influential, and the risk factor that generates the lowest average mean is ranked last. In this manner, the researcher is able to reach a conclusion as to which one(s) of these factors are considered highly relevant to BOT infrastructure projects in Kuwait.

The current study makes use of the same risk analysis factors as previous studies of BOT infrastructure projects in other countries, (Tiong 1992; Levy 1996; UNIDO 1996; Gupta and Narasimham 1998; Ranasinghi 1999; Ozdoganm and Birgonul 2000; Salman *et al*.; 2007, Ebrahimnejad *et al*. 2010).

5.2 Population and sample description

In this research, the population is made up of experienced professionals in the industry of BOT infrastructure projects in Kuwait, who are especially involved in the development of BOT infrastructure projects. The reason as to why there is such a low number of BOT infrastructure projects experts used in this research is because it was difficult to identify and contact such people, however, the sample selected represents many different sectors, i.e. financial, legal, consultancy and development, university professors, and official agencies. One of the most important concerns about the population and the sample of the target participants is to define a convenient and satisfactory sample that would represent the overall population involved in BOT infrastructure projects.

Finding the right people with the required expertise in BOT infrastructure projects in Kuwait was difficult because the private sector companies in Kuwait together with the respective Kuwaiti governmental departments tend to be uncommunicative and unhelpful as a means to protecting their interests.

. In order to overcome this concern, three main strategies were taken into account:

- Information was gathered from acquaintances about Senior Managers of private companies and Kuwaiti government departments working on BOT infrastructure projects in Kuwait.
- Regularly, in Kuwait there is a conference regarding BOT infrastructure projects and Senior Managers, Consultants and government officials were identified as the people who have the right background and experience to assist in this research.
- During the distribution of the questionnaire, further candidates came to light, whom were requested to participate in this research and participated.

5.2.1 Respondents’ personal backgrounds

This section identifies the backgrounds of the respondents in terms of their positions within their organizations. A summary of the results is presented in Table 5.1.

Position of the respondent	Number	Percentages	BOT Project
Project Company Manager	4	25%	Bubiyan Island Development, (2) Bubiyan Harbour development project, (2)
Project Head Of Site offices	3	18.75%	Sulaibiya Waste Water Plant, (1) Bubiyan Island Development, (1) Bubiyan Harbour development project, (1)
Engineering Consultant	4	25%	Silk City- known as Madinat Al Hareer, (2) Kuwait International Airport Expansion Plan - New Passenger Terminal Two, (2)
Management Construction Consultant	2	12.5%	Sulaibiya Waste Water Plant, (2)
Financial Consultant	2	12.5%	Sulaibiya Waste Water Plant, (1) Souk Sharq Shopping Mall (1)
Government Consultant	1	6.25%	Failaka Island Development Project, (1)
Total	16	100%	

Table 5-1 Respondents' personal backgrounds

5.3 Risk factors affecting the BOT infrastructure project system

In the first Part of the Questionnaire a number of risks categories were collected and grouped according to previous studies of BOT infrastructure projects in other countries, (Tiong 1992; Levy 1996; UNIDO 1996; Gupta and Narasimham 1998; Ranasinghi 1999; Ozdoganm and Birgonul 2000; Salman *et al*. 2007; Ebrahimnejad *et al*. 2010).

All participants were asked to rate and indicate the significance level of the BOT risk factors within each category of risks, using a nine-point scale (1-9). On this scale “1” means extremely low level of significance, and “9” extremely high level of significance. The risk categories are Country Risk, (Political & Regulatory Risk), Financial Risks, Revenue Risks, (Economic and Demand), Promoting Risks, Procurement Risks, Development Risks, Construction Risk and Operating Risk, (firstly Performance and secondly Cost Overrun and Liability).

5.3.1 Country Risk (Political & Regulatory Risk)

The first risk to be introduced is the Country Risk, referring to political and regularity risks. This category is divided into 13 risk factors each explaining a different risk with regard to Country Risks. After calculating the mean number for all the thirteen risks, they are ranked and the standard deviation, as well as the percentage, was calculated.

Country Risk (Political & Regulatory Risk)	***Mean*** $\bar{x}$	***SD***	***%***	***Rank***
Government instability	7.50	1.37	10.68	**1**
Government failure to provide permits necessary for construction, maintenance, and operation of the project	6.56	2.53	9.34	**2**
Non-existence of the legal and regulatory system that enforces contracts and provides a framework to resolve disputes	6.50	2.90	9.25	**3**
Outbreak of hostilities (wars, riots, and terrorism)	6.13	3.03	8.72	**4**
Changes on general legislation affects the project	6.06	3.07	8.63	**5**
Lack of commitment to concession contracts	5.50	2.88	7.83	**6**
Changes on legislation affecting technical standards and the use of technology for the construction and maintenance and operation of the project facility	4.94	2.77	7.03	**7**
Government interference in the operation of the facility (tariff levels)	4.94	2.11	7.03	**7**
Expropriation	4.69	2.52	6.67	**9**
Changes in physical policy (tax law and royalties)	4.44	2.76	6.32	**10**
Privatization arrangement	4.38	2.22	6.23	**11**
Nationalization	4.38	3.56	6.23	**11**
Changes to the legislation that determines the repatriation of funds policy	4.25	3.04	6.05	**13**

Table 5-2 This table shows the average rating, SD, percentage and the rank number for risks within the category of country risk.

It was found that the “Government instability” factor was ranked first being the most influential and important factor within the country risk category ($\bar{x}$ = 7.50, SD = 1.37). Since 2005, Kuwait has had 6 governments all of which have had ministers resign due to being questioned about graft indicating a lack of continuity in governance with the result of serious delays in approving/financing BOT projects which discourages foreign investment. The current government, headed by the Prime Minister, is likely to pass a controversial economic stimulus package that was proposed by the previous government but opposed by parliament. The present government will likely pass the stimulus package as an emergency law. However, when a new parliament is elected, it has the power to cancel the emergency law.

It is worth noting that the new parliament will not be able to question the new and current prime-minister about the stimulus package. It will, therefore, resort to questioning other government ministers. The make-up of the new parliament is likely to be similar to the dissolved parliament. As a result, if elections are indeed held within 2 months of the resignation of the present government, the new parliament is likely to question the passage of the economic stimulus package as an emergency law and may scrap it. If this happens, it would create more serious problems for the government, as by then, some companies would have benefited from the bill, making its' termination more difficult. However, the Government may not hold elections within the constitutional period. If this happens, there is a serious likelihood of visible civil unrest, manifested in street protests and demonstrations. It was reported late last year, (2011), that Kuwaiti security forces have already prepared themselves for such an eventuality.

The second most highly rate factor is “Government failure to provide permits necessary for construction, maintenance, and operation of the project”. This factor generated a slightly lower mean than the first ranked factor, ($\bar{x}$ = 6.56, SD = 2.53). Due to the many changes in the Kuwaiti government over the last few years, decisions on providing permits for projects are far and few between because one never knows whether the new government will revoke the permit(s) as has happened recently to the Agility Logistic Co. involved in running a container terminal, including port and harbour management, (2008).

Thirdly is "Non-existence of the legal and regulatory system that enforces contracts and provides a framework to resolve disputes". ($\bar{x}$ = 6.50, SD = 2.90). The Kuwaiti judicial system works at a slow pace and often frustrates claimants so that they give up, however it does recognize, and enforces, foreign judgments when reciprocal arrangements are in place. The Direct Foreign Capital Investment Law states that Kuwaiti courts are accountable for resolving any disputes concerning a foreign investor and other parties, (-arbitration is permitted). Few contracts in Kuwait contain clauses specifying arbitration when in dispute. Kuwait has not developed any effective antitrust laws to discourage wrong doing, and its' bureaucracy can be compared to that of a developing country. When government intervention does occur, however, it is to the benefit of Kuwaitis', usually.

Fourthly, the “Outbreak of hostilities (wars, riots, and terrorism)” risk factor ($\bar{x}$ = 6.13, SD = 3.03). Kuwait's neighbours Iran and Iraq, both have links to terrorism. Any foreign contractors in Kuwait must still be vigilant with respect to their personal safety and to the safety of their personnel. For security reasons the Kuwaiti government has an agreement to have several American Army bases in Kuwait which can be possible targets for terrorist attacks. Depending on how the future government moves forward to revive the economy and improve the lives of ordinary people, there may be Bahraini type disorder in the country. Fifthly, Changes in general legislation effects on the project $\bar{x}$ = 6.06 and SD = 3.07. Do not promote confidence to prospective private investors as in Kuwait there have been at least two changes, (in 2006 and 2008), because of concerns about transparency, corruption and fairness of the tendering process. Finally, "Lack of commitment to concession contracts" ($\bar{x}$ = 5.50 and SD = 2.88), due to disputes within governmental bodies concerning transparency and openness of the tendering process which has led to several large contracts being cancelled within the last three years, i.e. Dow Chemicals, ($17 Billion, Kuwait National Petroleum Co (KNPC) cancelled building a refinery, $4 billion,) which has deterred foreign private companies from investing. The least influentially rated factor was “Changes to the legislation that determines the repatriation of funds policy “which was ranked last in the 13th place ($\bar{x}$ = 4.25, SD = 3.04), which makes private investors more confident in proceeding with BOT projects. However two different factors which had similar means and were both ranked in 11th place: “Privatization arrangement, Government interference in the operation of the facility (tariff levels)", and "Nationalization” all with a mean of $\bar{x}$ =4.38 and SD=2.22 and

3.56, respectively. The Government has little or no interest in Nationalization because of lack of expertise and/or personnel.

5.3.2 Financial Risks

The financial risk contained seven possible risks, each one was rated by all participants, and all these factors were then ranked according to their mean average across all participants. Table 5-3. Below shows the average rating, SD, percentage and the rank number for risks within the category of financial risks.

2. Financial Risks	***Mean*** $\bar{x}$	***SD***	***%***	***Rank***
Failure to raise finance	6.44	2.50	17.67	***1***
Undeveloped general business environment	6.31	2.57	17.32	***2***
Difficulty in the resale of the equity	4.94	2.11	13.55	***3***
Default on loan or bond repayments	4.88	2.80	13.38	***4***
Non viable project	4.81	2.26	13.21	***5***
Default on interest payments	4.75	2.67	13.04	***6***
Inappropriate financial structure	4.31	2.94	11.84	***7***

Table 5-3 Average rating, SD, percentage and the rank number for risks within the category of financial risks.

The first factor to receive the highest rating mean was found to be “Failure to raise finance” with a mean of ($\bar{x}$ = 6.44, SD = 2.50). Irregularities in the Kuwait Stock Exchange forced it to close recently, 16th May 2012, because it failed to submit its' quarterly financial results. As the Stock Exchange is the main source of financing large private sector projects this indeed is a major issue**, (**Khaleej Times May 2012). http://theextinctionprotocol.wordpress.com/2012/05/16/kuwaits-financial-crisis-brewing-31-investment-firms-suspended-in-trading/). The global financial crisis has made banks cautious with respect to lending money for capital projects.

In the second place is the “Undeveloped general business environment” risk factor ($\bar{x}$ = 6.31, SD = 2.57). Over the past few years, Kuwait has passed a series of economic reform measures, including new capital markets, as well as labour and privatisation laws, and has created a $115 billion investment to be undertaken by the public and private sectors in the four-year development program. These measures will contribute to the “Kuwait Vision 2035,” a sweeping plan to transform the country into a regional finance and trade hub (www.ForbesCustom.Com). However amongst businessmen there is a perception of inefficient Government beaurocracy which is somewhat justified a Kuwait is ranked as 142nd out of 183 countries for starting a business. The least influential factor according to participants is the “Inappropriate financial structure” ($\bar{x}$ = 4.31, SD = 2.94). Currently, there is a lack of adequate banking regulations that prevent foreign investment. Banking Regulations should be developed so that the legal structure prohibits a clash of interests regarding allied parties dealings. Which can be realized that by further strengthening the supervision capacity by engaging and training inspectors which will cut down the time of the on-site supervision phase.

5.3.3 Revenue risks

The Revenue risks category was divided into 13 factors each explaining a different risk with regard to Revenue risks. After calculating the mean number for all the thirteen risks, they were ranked and the standard deviation as well as the percentage was calculated.

3. Revenue Risks (Economic & Demand)	**Mean, $\bar{x}$**	**SD**	**%**	**Rank**
Failure to receive revenues from principal (end user)	6.50	2.25	9.21	**1**
Changes in demand of the product or the facility over concession period due to economic downturns competing facilities.	6.44	1.67	9.12	**2**
Change in economic policies	6.31	2.27	8.95	**3**
Error in forecasting demands for service	6.13	2.03	8.68	**4**
Tariff fight with competing facilities	6.06	2.02	8.59	**5**
Accuracy of demand with the existing facilities	5.75	1.91	8.15	**6**
Social acceptability of user pay policy	5.56	2.25	7.88	**7**
Low historical pricing of services	5.25	2.29	7.44	**8**
Exchange rate fluctuation	4.88	2.09	6.91	**9**
Convertibility to foreign currency	4.69	2.44	6.64	**10**
Inflation	4.63	2.06	6.55	**11**
Reliability of demand and growth of forecasts	4.44	2.63	6.29	**12**
Variation in interest rate	3.94	2.35	5.58	**13**

Table 5-4 Table shows the average rating, SD, percentage and the rank number for risks within the category of revenue risks (Economic and Demand).

The first ranked factor, that was considered the most important, in this section, was "Failure to receive revenues from principal (end user)" ($\bar{x}$ = 6.50, SD = 2.25). For services such as electricity and water, government officials do not collect/ask for payment of bills. Therefore, ordinary people just do not pay their bills. This has become the "norm" in

Kuwait and as a result, all moneys due are cancelled after 5 years because people cannot be expected to pay the full accumulated amount in one go. This extends to the private sector as well, where private companies do not pay any utility bills either. This has become standard practice and is a part of Kuwaiti culture as the government rarely enforces existing laws and does not prosecute any people/companies. Also, recently, people are advised by some MP's not to pay any utility bills because the MP's are making promises that the bills will be cancelled and paid by the government as a form of vote chasing.

For example, the Kuwaiti Ministry of electricity has major obstacles those difficulties in meter reading and also fee collection. Moreover, the political philosophy of tolerating nonpaying consumers is another and even more serious issue.

The second important factor which is "Changes in demand of the product" with a mean of ($\bar{x}$ = 6.44, SD = 1.67). In, 2009, the Kuwaiti government has taken a number of steps to liberalize the economy and create new opportunities for both domestic companies and international investors. For example, the parliament passed a series of economic reforms for new capital markets, labour and privatization laws. This year, 2009, the government launched a $107 billion plan to modernize the country's infrastructure, giving Kuwait's hard-bitten investment companies a golden opportunity to make up losses incurred during the crunch. The plan covers a wide range of projects, including construction of a national railway, a metro system, a causeway, and various airport schemes and tourism projects. Mr. Al Marzooq said that the attention of local and foreign investors has already turned to infrastructure companies such as construction and cement. This has gone some way to counteract the worsening of the global economy over the last three years.

In the third place is the "Changes in economic policies" factor with a mean of ($\bar{x}$ = 6.31, SD = 2.27). Kuwait's economic policies change whenever a new government is voted into power, presently approximately every year. New governments have been known to cancel existing contracts and permits amidst accusations by same new government that when the contracts/permits were issued by the outgoing government, there was little to no transparency and graft taking place, for example, the ongoing Dow Chemicals court case in the US regarding the cancellation of the contractor agreement by the incoming government.

The reasons for changes in economic policies have been addressed above, but in 2011, the Muthanna Investment Company (MIC), launched a "Business Optimism Index". The Business Optimism Index on Kuwait is issued quarterly and is based on a survey conducted amongst a sample of the country's business community, representing key sectors of the country's economy and will measure the optimism in the Kuwaiti business community, gauge their expectations and measure how this relates to the current economic environment in Kuwait, regionally, and globally. The index is intended to be an aid to companies planning for the future.

The least important or significant factors were “Variation in interest rate“($\bar{x}$ = 3.94, SD = 2.35, and “Reliability of demand and growth of forecasts” $\bar{x}$ = 4.44, SD = 2.63 respectively). According to the World Bank survey, lending Interest rates in Kuwait were 4.9% in 2011. (Lending interest rate is the rate charged by banks on loans to prime customers.) http://data.worldbank.org/indicator/FR.INR.LEND.

In (2009) a Business Optimism Index, was introduced which is a quarterly survey of business sentiment in companies such as hydrocarbons, financial enterprises, transport and communications. The index measures the pulse of the business community and strives to make up for a dearth of economic indicators in the local market. The index is intended to be an aid to companies planning for the future. The trend over the last few years is that Kuwaiti's have started to shop in supermarkets, previously where mainly the ex-pat community has shopped, and as a result, due to increased disposable income the supermarkets have thrived.

5.3.4 Promoting Risks.

Promoting Risks	Mean $\bar{x}$	SD	%	Rank
Lack of experience	6.63	2.47	17.58	**1**
Lack of expertise	6.56	2.45	17.41	**2**
Lack of independent management	6.44	2.48	17.08	**3**
Inability to allocate risks to participants best able to manage them	4.81	3.21	12.77	**4**
Lack of negotiation skills	4.69	3.14	12.44	**5**
Financial weakness	4.63	2.87	12.27	**6**
Inability to define the specific functions of each member of the promoting team	3.94	1.84	10.45	**7**

Table 5-5 Average rating, SD, percentage and the rank number for risks within the category of promoting risks.

Table 6-4 above shows the average rating, SD, percentage and the rank number for risks within the category of promoting risks. There are a number of risks associated with the Promoting risks, these risk factors were rated and ranked according to their mean. "Lack of experience" appeared to have received the highest mean among other risk factors, it showed a mean of ($\bar{x}$ = 6.63) and a standard deviation of (SD = 2.47). Lack of experience is due to several factors concerning administration of an organization of the contract by both governmental departments and private companies. This relates to the supervision of the site by all parties, how to deal with relationships between sub-contractors and how to deal with relationships between the employers and the labor force. Experience is needed by both the governmental departments and private companies, (and their sub-contractors), of suitable and relevant project management skills for Kuwait. Experience is needed in inspection for quality, of build and quality of design. Also, experience is needed to provide appropriate training for proper operation after handover.

The second most influential factor was found to be the "Lack of expertise" with a mean slightly less than the first factor ($\bar{x}$ = 6.56, SD = 2.45). Lack of expertise is due to Lack of experience and the only way to overcome this is to conduct more projects and gain experience/expertise on site. Presently, the Kuwaiti Government, together with the private sectors, uses a lot of foreign labor to do the work. There is a shortage of highly skilled productive workers, i.e. Scientists & Engineers and of those working in the company, due to cultural values and belief, there is a perception that there is a lack of work ethic. Any projects now require for the private sector to train Kuwaitis and transfer of modern management techniques including practical, technical and marketing expertise. Furthermore the Kuwaiti Government is encouraging the private sector in Kuwait to expand and take up more contracts, with the aim of creating jobs for more Kuwaitis. This in turn will lead to more training of Kuwaitis. The government is also encouraging the export of national products, (-not just oil!).

In third place, the "Lack of independent management" factor, ($\bar{x}$ = 6.44, SD = 2.48). Promoting the BOT project is the responsibility of the government, and there is a shortage of capable manpower that can convince private investors that the government is committed to the project and to distribute information regarding the project to any interested/affected parties including the general public. This is the reason as to why the Audit Bureau was introduced. The least influential factor to have the lowest mean on the risk scale is the "Inability to define the specific functions of each member of the promoting team" which scored a mean of ($\bar{x}$ = 3.94) and a standard deviation of (SD = 2.84). Management needs to effectively develop and implement overall contracts management strategies and define specific job functions for each individual /department.

5.3.5 Procurement Risks

Procurement Risks	**Mean $\bar{x}$**	**SD**	**%**	**Rank**
Changes in project specifications	6.56	2.19	18.17	**1**
Expensive and long tendering process	6.50	2.19	17.99	**2**
Lack of integrity on the (tendering process)	6.38	2.13	17.65	**3**
Delay in granting concession	4.50	2.94	12.46	**4**
Unrealistic expectations of the principal due to lack of experience and experts	4.25	2.72	11.76	**5**
Intellectual rights not protected	4.19	2.26	11.59	**6**
Innovative ideas not being rewarded by the principal	3.75	2.77	10.38	**7**

Table 5-6 this table shows the average rating, SD, percentage and the rank number for risks within the category of procurement risks. Further information can be seen in the table below.

Procurement risks category was constructed from seven related risk factors, after being rated on the risk scale from 1-9, it was found that the highest ranked risk is the “Changes in project specifications” risk factor, ($\bar{x}$ = 6.56, SD = 2.19), which can be addressed by careful identification of requirements before finalizing the contract as there normally is a financial penalty to pay for implementing any changes made afterwards. There is a need for the Audit Bureau to oversee contracts and verify the final specification. The same independent monitoring body should be consulted with respect to any additional changes and modifications to the contract and approval for changes should be authorized before implementation.

In second place is the “Expensive and long tendering process” factor with a slightly lower mean number ($\bar{x}$ = 6.50, SD = 2.19), therefore they can be considered the most influential risk factors within the Procurement risk category as by their nature, BOT projects are large and complex projects which require very careful and very detailed analysis and perceptive understanding. Extensive time is taken up by the preparation and agreement of the specification.

Thirdly, "Lack of integrity in the tendering process", ($\bar{x}$ = 6.38, and SD = 2.13), discourages private companies in tendering for BOT contracts. The Audit Bureau is to oversee contracts should also carry out an audit of current practice, legislature and institutional infrastructure to eliminate the possibility of any wrong doing.

Al-Hamad in (2007) noted that 6 of the 12 contracts approved by the Ministry of Finance in Kuwait in the 1990's were later cancelled for violations, (i.e. for alleged graft, corruption and bribery), and, in fact, only 10 projects have been carried out over the last forty years. Unfortunately, according to Taleb, (2008), billions of Kuwaiti Dinars have left the country, since there were much better opportunities elsewhere and Kuwaiti legislation has prevented the procurement of BOT projects.

According to Curran (2008) the Audit Bureau were concerned about the fairness and transparency of the award processes and possible irregularities in their implementation and for this reason, in 2006, they suspended several lucrative BOT projects which had been granted to the private sector by four government bodies, including the Public Authority for Industry, the Public Customs Department, the Touristic Enterprises Company, and the Finance Ministry. The government had then appointed a ministerial committee to carry out a review of these projects (Curran 2008). While the investigations were taking place, all work on any new Kuwaiti BOT projects stopped until 2008 when, in January, Law No. 7 “seeking to establish and clarify a structure for the BOT model in Kuwait” was passed by parliament (Curran 2008). Under this new law, government bodies needed to obtain the approval of a new ‘supreme committee’, without which it would be impossible to enter into a BOT agreement which involved state-owned land. The committee would consist of senior administrators, such as the head of the environmental authority, and would be chaired by the Minister of Finance and include the Minister of Public Works and the Minister of Municipality. The purpose of the committee is to set BOT policy, to review and issue approvals and to administer a sub-committee with the remit of coordinating all technical aspects of the reviews (Curran 2008).

Furthermore, for Sulaibiya Wastewater project tendering for the contract started in October 1998 and bids were received in April 2001. The Sulaibiya Wastewater project was approved by The Ministry of Public Works and awarded BOT contract to Utilities Development

Company (UDC). The formal signing of the contract was delayed until May 2001 by unsuccessful legal action over aspects of the tender process and the plant opened in 2004.

On the other side the "Innovative ideas not being rewarded by the principal " showed the lowest mean on the risk scale ($\bar{x}$ =4.19, SD=2.26), leading to employees being unenthusiastic about making any suggestions, which in the longer term would be more beneficial to the project and reduce costs had the suggestions been implemented, -in whole or even in part.

5.3.6 Development Risks

The Development risks category was made from eight related risk factors. As it was done with previous categories, all participants were asked to rank the importance of these points on the risk scale of 1-9 points.

Development Risks	**Mean $\bar{x}$**	**SD**	**%**	**Rank**
Excessive development cost	7.13	1.54	16.06	**1**
Delays in design approval	6.69	2.44	15.07	**2**
Use of technology that may be proving economically or structurally non-viable	6.63	1.86	14.93	**3**
Changes in design during construction	6.50	1.83	14.65	**4**
Incomplete design scope	4.69	2.91	10.56	**5**
Inadequate specifications and standards	4.63	2.92	10.42	**6**
Short design life	4.31	2.91	9.72	**7**
Incompatibility with existing facilities and services	3.81	2.69	8.59	**8**

Table 5-7 Average rating, SD, percentage and the rank number for risks within the category of developmental risks.

The Development risks category shows that the "Excessive development cost" factor is the most influential of the eight categories receiving a mean of $\bar{x}$ =7.13 and a standard deviation of SD=1.54 means that some private investors may be un-enthusiastic about bidding for a BOT project due to high development costs which they may never recover.

In the second rank came the “Delays in design approval” risk factor ($\bar{x}$ =6.69, SD=2.44), may be due to the fact that the private contractor has to deal with officials from the government who have many other duties to perform and the officials who are empowered to make a final decision may be difficult to reach.

In third place is "Use of technology that may be proving economically or structurally non-viable" risk, ($\bar{x}$ = 6.63 and SD = 1.86). Excessively sophisticated technology may not be practicable in some BOT projects, not only increasing to the initial cost of the project but increasing operation, maintenance and repair costs. Suitable technology needs to be updated during the operating time of the plant and be fit for purpose during, and after, the handover at the end of the concession period.

Fourthly, "Changes in design during construction" ($\bar{x}$ = 6.50, and SD = 1.83), can add a significant cost. The causes of project change may be due to technological changes, changes in the customer expectations/requirements, changes in government and policies and/or changes in the economy. In BOT contracts there are usually conditions and financial penalties to pay whenever a change is made to the specification taking into consideration that the completion date for the project may not be met. In this case both the Government and the private sector have to share the risk and come to a new agreement.

The least influential risk factor within the development risk category was found to be the “Incompatibility with existing facilities and services” receiving a mean of $\bar{x}$ =3.81 and a standard deviation of SD=2.69 should not be an issue due to feasibility studies undertaken during the procurement stage.

5.3.7 Construction Risks

Construction Risk	**Mean, $\bar{x}$**	**SD**	**%**	**Rank**
Cost-overrun risks	6.75	1.81	39.71	**1**
Performance related risk	5.88	2.55	34.56	**2**
Safety related risks	4.38	2.68	25.74	**3**

Table 5-8 Average rating, SD, percentage and the rank number for risks within the category of construction risk

The construction risk was constructed of three risks. It was found that the "Cost-overrun risks" generated the highest mean number, ($\bar{x}$ = 6.75, SD= 1.81) and may be due to not having the Audit Bureau oversee the project. Cost over runs might be also related to providing an initial unrealistic estimate of the project cost, inadequate project management. Unproductive use of materials and resources together with increased prices of materials can considerably contribute to cost over runs and finally, (but not least), "unforeseen events" such as disruption/delays due to weather or the economical/political situation. Completion guarantees could be rewarded by performance incentives.

In second place is the "Performance related risk" ($\bar{x}$ =5.88, SD=2.55), whereby (sub-contractors do not complete their part of the project on time or to the required standard or specification. Performance incentives could be introduced to encourage the contractor to complete their part on time and to specification.

5.3.8 Operating Risk

Operating Risk	Mean $\bar{x}$	SD	%	Rank
Unavailability of power supply	6.69	2.36	9.16	**1**
Error in operation and maintenance cost estimate	6.56	2.28	8.99	**2**
Unavailability and quality of personnel to operate the facility	6.50	2.13	8.90	**3**
Inappropriate operating methods	6.13	2.47	8.39	**4**
Lack of license to operate facility	4.94	2.52	6.76	**5**
Error in training cost estimates	4.94	2.08	6.76	**5**
Inability to perform as expected	4.88	2.60	6.68	**7**
Latent Construction Defects	4.81	2.37	6.59	**8**
Incompatibility with associated facility	4.75	2.46	6.51	**9**
Operations and maintenance contractors may not meet the quality standards	4.69	2.63	6.42	**10**
Inability To Meet Increase In Demand	4.63	2.83	6.34	**11**
Equipment Failure Or Accidental Damages	4.63	2.36	6.34	**11**
Inappropriate operating conditions	4.56	2.34	6.25	**13**
Changes in local ecosystem due to the environmental impact caused by project during the operation phase	4.56	2.16	6.25	**13**
Accidents and labour injuries	4.31	2.12	5.91	**15**
Insufficient time allowance for maintenance	4.19	2.32	5.74	**16**
Employee dishonesty	3.81	2.10	5.22	**17**
Vandalism	3.25	2.21	4.45	**18**

Table 5-9 This table shows the average rating, SD, percentage and the rank number for risks within the category of operations risk (Performance & Cost Overrun and Liability).

Operating risk was divided included 18 factors; the factors were ranked as previous sections. The first ranked factor in this sections was "Unavailability of power supply" ($\bar{x}$ =6.69, SD=2.36). The demand for electrical power in Kuwait has doubled over the last fourteen years and meeting the demand is becoming more and more difficult. In Kuwait, every summer temperatures can reach 55° Celsius with the consequence of having a high peak load every July and August. The peak load increases every year in proportion to the size of increase in population.

Stable electrical supply is crucial for development of BOT infrastructure projects in Kuwait and the government is in the process building an adequate and stable electrical supply system, i.e. The Ministry of Electricity and Water, (MEW), is planning and constructing several new power stations in conjunction with the private sector.

Followed by the "Error in operation and maintenance cost estimate" with a mean of ($\bar{x}$ =6.56, SD=2.28), is a concern for private sector even though BOT contracts should stipulate that there is a warranty and maintenance contract in place to repair any equipment. The BOT contract should also include an insurance clause for loss and damage to the project facilities by means of a mandatory insurance package. The BOT contract should state that there is to be regular inspection of the facility to ensure that satisfactory investment programme and maintenance regimes are followed. Also, in the BOT contract there may be a requirement for a technical assistance agreement between the suppliers of the equipment and the project company.

In the third place is the "Unavailability and quality of personnel to operate the facility" factor with a mean of ($\bar{x}$ =6.50, SD=2.13) can be initially addressed by the private sector who are required by the BOT contract to provide the personnel and expertise to run and operate the facility to a good standard including any technical documentation. BOT infrastructure project contracts in future in Kuwait must include provisions that the private sector provides education and training to Kuwaitis in order ensure that the operation of the plant is maintained to a good standard. This becomes crucial when approaching the end of the concession to allow smooth transfer and operation of the plant.

In fourth place is "Inappropriate operating methods", $\bar{x}$ = 6.13 and SD = 2.47. This risk factor is due to a shortage of highly skilled productive workers, i.e. Scientists & Engineers and of those working in the company, due to cultural values and belief, there is a perception that there is a lack of work ethic. It can be overcome by having experienced and reliable management personnel. Good management personnel as well as experienced operating personnel are needed to operate the plant. The senior management of the plant makes the operating decision policy and arranges for the training, maintenance and inspection regime of operation system of the plant.

5.4 The Structure of the Project Risk Management Framework

The research aim is to develop a framework that will enable decision makers in the private and public sectors decide how to deal with the risks that affect BOT infrastructure projects in Kuwait and allow decision makers to investigate ways to decrease or prevent them. The most important task in the development of a multi-attribute decision Framework is the identification of the relevant Framework attributes.

The first questionnaire included all of the eighty Risk Factors grouped together in their respective Category Risk sections for the BOT infrastructure projects and expert participants were requested to rank the Risks Factors in order of importance with respect to their experience of BOT Infrastructure projects.

The most important Risk Factors, (i.e. Government instability, Lack of experience), were identified and classified into five main categories, (i.e. Countries Risk, Development risks, etc.). The reason for combining the original eight risk categories into only five risk categories was to make the comparisons of the factors easier and more meaningful to the respondents, and to make the calculations easier, i.e. to reduce the size of the comparison matrix). Also, this was based on the assumptions that the brain can simultaneously process 7±2 items, Miller (1956). Risk Factors were listed according to their relative importance in descending order by the participants, (i.e. the most important risk factor is at the top, the second most important risk factor is second, etc.).

Information collected from the first questionnaire was analyzed by using the mean average, $\bar{x}$, standard deviation, SD, percentage and ranking which resulted in Figure 5.1, which is a Risk Management Framework for BOT Infrastructure Projects specific to Kuwait showing the ascendency of the twenty-eight different Risk Factors within their respective Risk Category. Each Risk Category is taken to be of equal significance, (weighting), with respect to the others whilst the Risk Factors were "graded" in descending order of importance within their Risk Category.

The information gathered from the expert participants from the first questionnaire are shown in Tables 5-2 to 5-9. Within each Risk Category, i.e. Country Risk, the Risk Factors are listed, in the Framework shown below, in descending order of importance, (-with the most important at the top). This process is repeated for all Risk Categories from information in the above Tables.

The original eight Risk Categories have been combined into five with the Financial Risk being combined with Revenue Risk; Promoting Risks have been combined with Procurement Risks; and finally, Construction Risks have been combined with Operating Risks to show five categories, for reasons mentioned earlier.

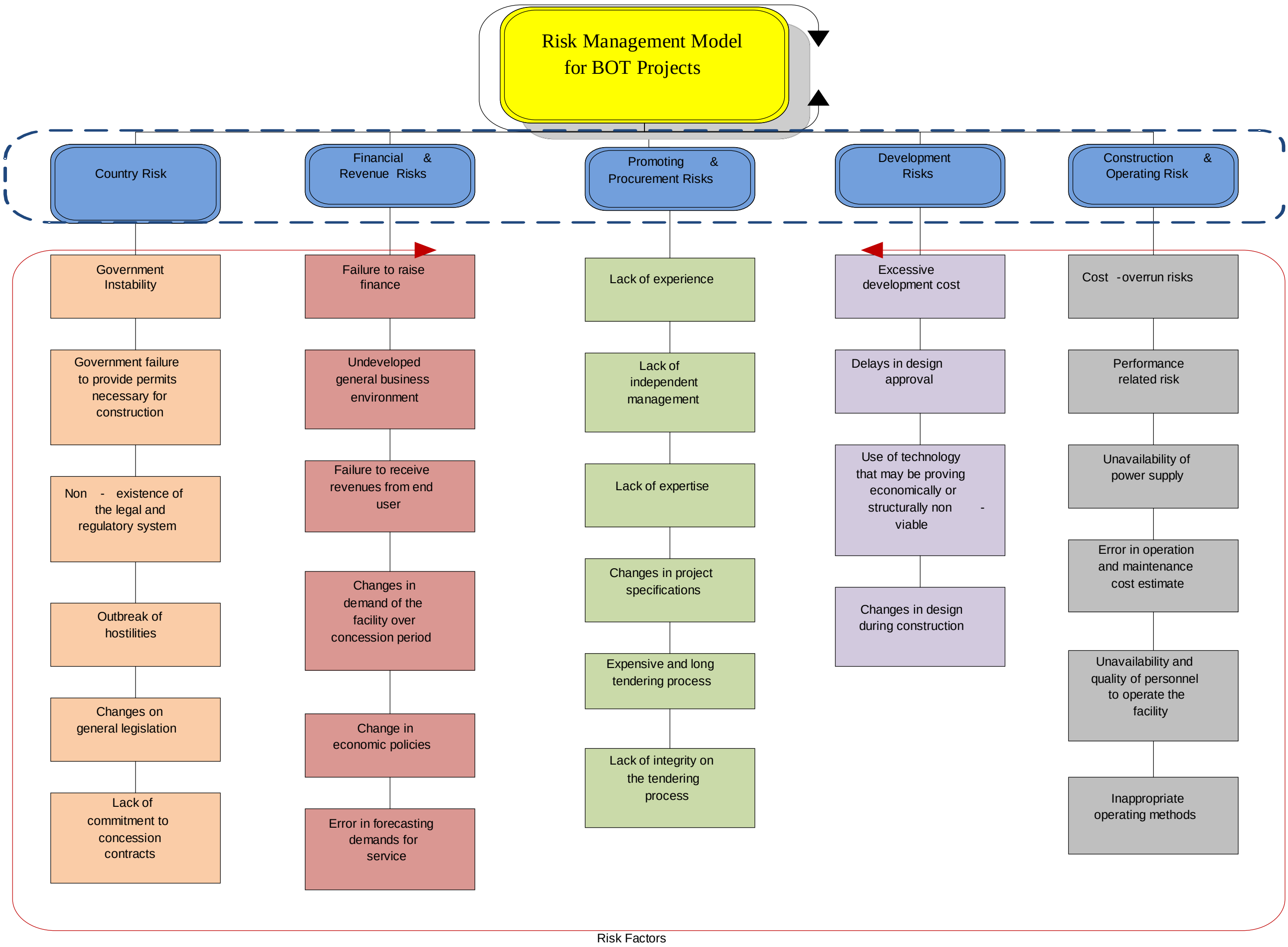


Figure 5-1 Risk Management Framework for BOT Infrastructure Projects specific to Kuwait

5.5 Risk categories assignment to BOT projects groups

The objective of studying the risk factors affecting Kuwaiti BOT infrastructure projects in this study is to indicate the most important risk factors in different BOT infrastructure projects. Naturally, each project has its' own risks and different policies may be used to allocate and mitigate the same risks in different projects due to the different countries conditions. However, determining the most important risk factors that will mostly be inherent in any BOT project which will offer the benefit of decreasing the vast cost in money and in time.

The second part in the first questionnaire deals with risks in BOT projects which includes identification, assignment, and evaluation of risk significance levels in each group of projects on qualitative scale from '1-5'. Previous studies of BOT risks (Tiong 1992, Levy 1996, UNIDO 1996, Gupta and Narasimham 1998, Ranasinghi 1999, Ozdoganm and Birgonul 2000, Salman *et al*, 2007, Ebrahimnejad, Mousavi and Seyrafianpour, 2010), classified the sources of risks in ten different risk categories. Each category consists of a group of risk sub-factors, the classification and identification of these risks and their sub-factors are mentioned in detail in chapter two. Assignment of risk categories to each project group with their average significant levels, the standard deviations of responses, (Appendix A), and rank of risk factors are shown in tables 5-9 to 5-12.

This section of the results explains a number of risk categories that could have an effect on the BOT infrastructure project system. A number of possible risks were selected and evaluated by 16 participants, all of whom were asked to rate their answers between 1 and 5 points, (in this case 1 refers to no relation at all, and 5 refers to absolute relation of the risk factor). The infrastructure projects were divided into four groups the first is called "Public Works", secondly "Public Utilities", thirdly "Public/Government Buildings" and fourthly "Other Facilities".

The average mean, Standard deviation (SD), percentage and the rank of each risk factor were calculated through Excel. Based on these descriptive statistics the researcher can find which risk category has the highest, or least, effect on the BOT infrastructure project systems in Kuwait.

The risk categories were assessed for all project groups, and each one of these groups was assessed with 10 possible risk categories regarding each one of these project groups, i.e. political, force majeure, physical, financial, revenue, promotion, procurement, development, construction and operation risk category.

The table 5.10 below illustrates the significance of each type of risk category to each different group involved in the project. The Financial Risk is the most important to all of the groups. It is interesting to note that there is a significant difference in following risk categories depending on the type of BOT Infrastructure project.

For Public Utilities,(i.e. Power Generation), and Other Utilities, (i.e. Industrial plants), the Revenue risk is of major concern mainly for the private companies operating the plant during the concession period as the private sector is eager to return a profit to the investors. Whereas, for Public Works, (i.e. Bridges, airports, roads), and Public/Government Buildings, (i.e. Hospital, Schools, Jails), are a services provided by the government for the people and funded by the government during the operating period, and may have private companies running the project during the life span of the facility.

The most interesting difference between the four types of BOT Infrastructure projects in the table is the significance of the Political risk factor. In the Public Works, (i.e. Bridges, airports, roads), sector the Political risk factor is placed second, whereas in the other three project types the Political risk factor is far less important. The Kuwaiti government and investors understand that the Public Utilities,(i.e. Power Generation), Other Utilities, (i.e. Industrial plants), / Government Buildings, (i.e. Hospital, Schools, Jails), are always going to be needed even when there is a change in government. However, for Public Works, (i.e. Bridges, airports, roads), the private sector seems to be much more cautious about embarking on a BOT Infrastructure project which infers that Public Works Infrastructure are most susceptible and prone to graft. The recent frequent change of the Kuwaiti government over the recent years has meant that many Public Works Infrastructure projects have been re-negotiated or at worse revoked.

Finally, it can be seen that the Promotion risk category is more important in the Other Facilities, (Industrial plants) projects rather than in the other three project groups. The Other Facilities, (Industrial plants) BOT Infrastructure projects include the main industry in

Kuwait, i.e. the drilling for and refining of oil. The oil drilling companies and oil refineries, (and the ancillary companies which support the oil industry), promote their interest very vigorously due to the sums of potential revenue/profits involved.

Project	Risk factors	Mean	SD	%'age	Rank	Project	Risk factors	Mean	SD	%'age	Rank
Public Works: Bridges; Tunnels; Airports; Roads; Mass rapid transportation system	Financial	3.81	0.91	11.73	**1**	**Public Utilities; Power generation; Power transmission and distribution; Telecommunications,**	Financial	3.88	0.96	19.37	**1**
	Political	3.38	1.45	10.38	**2**		Revenue	3.75	1.13	18.75	**2**
	Procurement	3.31	0.87	10.19	**3**		Procurement	3.50	1.15	17.50	**3**
	Development	3.31	1.08	10.19	**3**		Operation	3.50	0.89	17.50	**3**
	Construction	3.31	1.25	10.19	**3**		Development	3.38	1.15	16.87	**5**
	Operation	3.25	1.06	10	**6**		Physical	3.31	1.08	16.56	**6**
	Revenue	3.13	1.20	9.61	**7**		Construction	3.13	1.36	15.62	**7**
	Promotion	3.13	1.54	9.61	**7**		Force Majeure	2.75	1.06	13.75	**8**
	Force Majeure	3.00	1.37	9.23	**9**		Political	2.63	1.75	13.12	**9**
	Physical	2.88	1.36	8.84	**10**		Promotion	2.56	1.63	12.81	**10**

Project	Risk factors	Mean	SD	%'age	Rank	Project	Risk factors	Mean	SD	%'age	Rank
Public/Government Buildings; Health facilities (e.g., hospitals); Correctional facilities (e.g., prisons); Educational facilities (e.g., schools)	Financial	3.75	1.18	11.29	**1**	**Other Facilities, (Industrial plants).**	Revenue	4.13	0.89	11.32	**1**
	Construction	3.69	1.35	11.11	**2**		Financial	4.06	0.85	11.14	**2**
	Operation	3.69	1.08	11.11	**2**		Promotion	3.94	0.93	10.80	**3**
	Procurement	3.69	0.87	11.11	**2**		Operation	3.94	1.24	10.80	**3**
	Development	3.44	1.21	10.35	**5**		Construction	3.75	1.34	10.29	**5**
	Revenue	3.38	1.31	10.16	**6**		Development	3.56	1.31	9.77	**6**
	Promotion	2.94	1.44	8.85	**7**		Procurement	3.50	1.10	9.60	**7**
	Political	2.94	1.53	8.85	**7**		Political	3.25	1.53	8.91	**8**
	Force Majeure	2.88	1.15	8.66	**9**		Physical	3.19	1.17	8.74	**9**
	Physical	2.81	1.28	8.47	**10**		Force Majeure	3.13	1.02	8.57	**10**

Table 5-10 Assignment of Risk Categories to Infrastructure of Project Types in Kuwait

Table 5-11 shows the overall priority of the Risk Categories for all four types of project groups shown in Table 5-10 above and the most important categories are discussed below.

Risk factors	Mean	**%'age**	**Rank**
Financial	3.8750	15.1708	**1**
Procurement	2.6250	10.2770	**2**
Operation	2.6100	10.2183	**3**
Revenue	2.5650	10.0421	**4**
Development	2.5325	9.9148	**5**
Construction	2.5325	9.9148	**5**
Physical	2.2500	8.8088	**7**
Political	2.2375	8.7599	**8**
Promotion	2.1575	8.4467	**9**
Force Majeure	2.1575	8.4467	**9**

Table 5-11 Significance Level of Risk Categories Impact on BOT Infrastructure Projects in Kuwait

5.5.1 Financial Risk Category

The Financial Risk category was considered as the most important in three of the four project types in Kuwait indicating that this is of greatest concern to the private sector and governmental departments because in Kuwait because banks are reluctant to lend money due to the global recession. According to "Trading Economics", 14th June 2012, inflation in Kuwait is presently stabilized at around 3.6%, down from a high of 10.5% in 2008 at the start of the global economic crisis, thus becoming a lesser risk factor over time. Variations in Kuwaiti inflation were not only due to the global crisis in 2008, but due to wage increases, currency fluctuations and the rise in demand for food and housing.

According to Bloomberg's, in May 2007, the Kuwait government removed the link between the Kuwaiti Dinar and the US Dollar, meaning that the Dinar is now linked to a basket of currencies including the Euro, the Pound Sterling and the Japanese Yen, as well as the US Dollar, with the intention to keep the Dinar stable in, (the present), difficult economic conditions.

Private contractors, together with Kuwaiti Government agencies should also seek financial backing from international financial institutions such as the World Bank, European Bank for Reconstruction and Development. Flexible loan payments should be used whenever possible to facilitate the finance for the project and the use of international professional consultants who introduce an appropriate financial structure should ensure a smooth flow of investment funds. If required, the Kuwaiti government should also make sure that further loans, via an escrow arrangement, are available if the project company's cash flow is insufficient.

5.5.2 Procurement Risk Category

As the Procurement Risk category shows a significant concern to all parties, the procurement process has been amended by the Kuwaiti government with the intention of making the procurement process more transparent and fair in order to clarify the roles to be played by the government and the private sector, however, the private sector has complained that this has made the procurement process more difficult and longer as there has been an increase in regulations and red tape. The increase in paper work and subsequent delays has led to a smaller number of tenders being submitted over the last few years. (Amendments to Kuwait's state BOT contracts, Law No. 7 of 2008).

The Kuwaiti government's overhaul of the procurement process was intended to make clearer the principal requirements of the project and to expedite the tender process as in the past, several potential project promoters spent a lot of time and money to prepare a package to procure a BOT infrastructure project only to be disappointed with the outcome and left with large costs incurred in the tendering/preparation for the BOT project. Further amendments should be introduced which would restrict the tendering process to smaller number of companies and also share the cost of the procurement process especially the areas of research and analysis of proposed site, expected demand for the final product(s). Also, the Kuwaiti Government should refund some of the costs for tendering to the private companies and should guarantee adequate compensation to the innovating private companies for their intellectual property rights.

5.5.3 Operating Risk Category

Minimising the Operating Risk is vital to make sure that there is profit to be made during the life span of the plant. There are concerns regarding a stable electrical power supply in Kuwait, as demand for which has doubled over the last few years the Kuwaiti government has responded by signing a US$2.7 billion deal in September 2009, with General Electric of the US and South Korea’s Hyundai Heavy Industries to build a 2,000 MW power plant, which is expected to be fully operational by mid-2012. A gas-fired plant at Subbiya, north of Kuwait City, is set to start production next year, according to www.constructingweekonline.com, (14th June 2010). According to Mohammed Al Khaldi of Al Watan Daily, (11th Feb 2010), the city Ali Sabah Al-Salem (Um Al-Haiman, is presently under consideration because of environmental factors and pollution. The Kuwaiti government is debating whether to relocate the population, or some of the factories close to the city, so as to protect the local population from health hazards such as cancer in which there has been a significant increase over the last few years.

Another concern from the point of view of the private sector are warranty and maintenance agreements which may be overcome by a technical assistance agreement between the suppliers of the equipment and the project company.

In all projects types, good management and operators are needed to run and operate the facility after completion which presently is a difficulty in Kuwait and can only be resolved with education and training of the indigenous workforce.

Experienced personnel should be appointed to provide accurate estimates for the safe operation and safe maintenance to avoid cost over runs when operating and maintaining the plant. Operating costs overruns can be substantial amounts, but with the use of the correct equipment, proven technology can be minimised. Introducing performance incentives which are meant to increase the use safe practice, including quality assurance systems, will lessen the risk of cost over run.

Commercial insurance is available in the case of interruption and stoppage of the plant to pay for overheads and loss in earnings.

5.5.4 Revenue Risk Category

Revenue risks include could be due to changes in demand of the product due to economic downturns or competition. In the case of failure to receive sufficient revenues from the end user, the Kuwaiti government should allow the private company to revise their pricing structure, and even provide loans and/or grants whenever the revenues drop below certain amounts agreed in the contract. In the case of competition, the Kuwaiti government is in a unique position at the outset of the procurement process to protect the project from competition. i.e. there is a guarantee that a competing plant will be built during the lifetime of the existing project. Changing economic policies by the Kuwaiti government is another method of guaranteeing agreed revenue earnings, i.e. the Kuwaiti government take a lower percentage of the profit thereby guaranteeing the private company's profit margin. Error in forecasting long term demands for service(s) may prompt the Kuwaiti government to change the length of the concession period of the BOT project with compensation being paid to the private company and the time of the handover brought forward.

5.5.5 Development Risk Category

Decisions made at the initial stages of a BOT infrastructure project may have serious and costly consequences which may be detrimental to the overall profitability of the BOT project. These decisions may affect the type of technology used in the construction of the project, (which may well increase the development costs substantially), as well as in the operation of the facility and subsequently whether the project is fit for the purpose initially intended. These developmental risks may be decreased or even prevented by careful selection of known and proven technologies and complete with consultants' expertise which this should ensure that the development of the BOT Infrastructure project makes a good start.

The Kuwaiti government and the private company should aim to avoid costly delays in design approval by employing experienced and established consultants to finalise the design specification. The design should incorporate apposite technology as well as being economical and, finally, the agreed design specification may not be changed during construction as this is a considerable source of cost over runs. Should the design be altered during the construction phase then this may have substantial knock-on effects on the whole of the project. High Development costs are a source of concern to the private sector that may become un-enthusiastic about bidding for a BOT infrastructure project due to high development costs which may never be recovered.

5.5.6 Construction Risk Category

Cost over runs tend to be mainly due to incomplete site geological surveys, delays in procuring construction materials, technical difficulties, poor management, or by a combination of above. Since BOT Infrastructure investors only start receiving income from the completed project(s), any delay in completion delays the generation of revenue. Cost over runs result in lower profitability of the project by increasing construction and financing costs. The Kuwaiti government and the private company should have contingency plans in place to mitigate for cost over runs by having an efficient quality assurance system in place and completion/performance incentives and bonuses together with penalties for delays in the construction. The Kuwaiti government should order the private company to have casualty insurance covering personnel as well as plant and equipment.

5.5.7 Physical Risk Category

Physical risks are those where there is damage to property or assets that the private company own or have in their possession during the construction and the concession periods. Physical risks include damage to equipment and/or material and/or facilities and also injury, or worse, to members of the workforce. This risk is minimal in Kuwait and if this risk does become more significant, the Kuwaiti government should issue guarantees and/or provide insurance cover.

5.5.8 Political Risk Category

Political risks are divided into two categories, instability risks and sovereign risks. , According to Tam (1999) instability risks can mean that not only there are revisions and/or cancellations of contracts but also damage and/harm to property and people from riots and/or terrorism. According to Lang (1998) sovereign risk is due to government interference, including expropriation of assets, restriction of operating freedom, increases in tax or other financial penalties, restraint on the ability to keep profits and any further government action which could jeopardize the project. In developing countries, the political Risk factor becomes more and more important as there may be a sudden and violent change in government, which could cause the company to pull out and end the project altogether or the company goes bankrupt. Kuwait is a developing country and to move forward to have a stable government in place where longer term decisions can be made and followed through, then: Parliament of Kuwait and the ruling government should make a pact to cooperate with each other which will result is a smoother running of the country as the conflict between the rulers is lessened. Any BOT infrastructure project under consideration should not be automatically suspended when there is a change in government so that there is confidence in the procurement process regardless of the political party in power. Private companies can still protect themselves from the political fallout in Kuwait by purchasing Political risk insurance from export credit agencies, (i.e. US Overseas Private Investment Corporation or UK Export Credits Guarantee Department), or from Multilateral Investment Guarantee Agency.

5.5.9 Promotion Risk Category

The private sector company is responsible for managing a project through all the project stages. In interactions between the Kuwaiti government, Private Sector Company, lender, contractors and other interested parties, there should be the necessary experience and expertise to minimize this risk. Reasons for delays include the following factors: The private sector company should ensure that there is sufficient expertise within the negotiation team responsible for the promotion. The Kuwaiti government and private sector company should agree to have an independent management system in place to oversee the project which can advise in allocating risks to suitable project team members so as to ensure that each party knows who is responsible for certain functions of the project. For any BOT Infrastructure project to be successful, appropriate financing should be in place as weak financing will lead to uncertainty and lack of confidence in pursuing the project

5.5.10 Force Majeure Risk Category

Some risks are outside the control of the Kuwaiti Government and project investors. Events like natural disasters and wars are causes of force majeure risk. Besides the force majeure, (or Acts of God), these risks are related to damage to property and to personnel and are beyond the control of project investors. Although this risk can be classified as having a low chance of happening, the consequences can be quite significant and severe. The investing companies should find ways to limit these risks and the Kuwaiti Government, together with the private companies, should make provision by including fair clauses to provide relief against this type of risk in the Concession Agreement. The risks can be accommodated by taking out Commercial insurance coverage. The Kuwaiti government should provide assurances and give backing to any outstanding debts, and other financial obligations, in case of force majeure events which affect of the operability of the project.

5.6 Chapter Summary

This chapter has presented the results for first part of the research methodology with discussion. This part is a very important stage for gathering knowledge about the BOT Infrastructure projects and to provide further direction for this research work by means of providing information concerning the risk factors regarding BOT projects and providing a strong foundation for implementing the proposed framework in this research.

The questionnaire survey was carried out via a self-administration questionnaire. The responses were tabulated in order to examine and represent responses in terms of average, $\bar{x}$, percentage and the rank numbers with the aim to ascertain the extent of which risk factors in risk categories risk affect the BOT infrastructure projects.

Significant results were presented and discussed and related to BOT Infrastructure projects in Kuwait. A Risk Management Framework was developed which shows ranking of the most important, or the most influential, Risk Factors affecting the work of the participants in the survey.

All information collected and analyzed in this chapter constitutes important knowledge that will be used to build an Analytical Hierarchy Process model to be presented in Chapter 6.

5.6.1 Summary

The first questionnaire assessed the common risk factors which affected the management systems for BOT infrastructure projects and to rank the common BOT risk factors according to their relevance to each of the project categories on a qualitative scale of 9 points. After careful selection of the project risk factors framework attributes, 28 attributes were extracted from the first questionnaire. The attributes were identified and classified under 5 main categories. In order to reduce the size of the comparison matrix and to also ensure that the comparison attributes were more meaningful, only attributes of the same nature were compared and these were divided into 5 categories. This was following the assumption made by Miller (1956) that the brain can simultaneously process 7±2 items.

The graphs below refer to the results generated from the first questionnaire in which a number of risk factors were recognize with regard to their importance to the expert participants when related to BOT infrastructure projects.

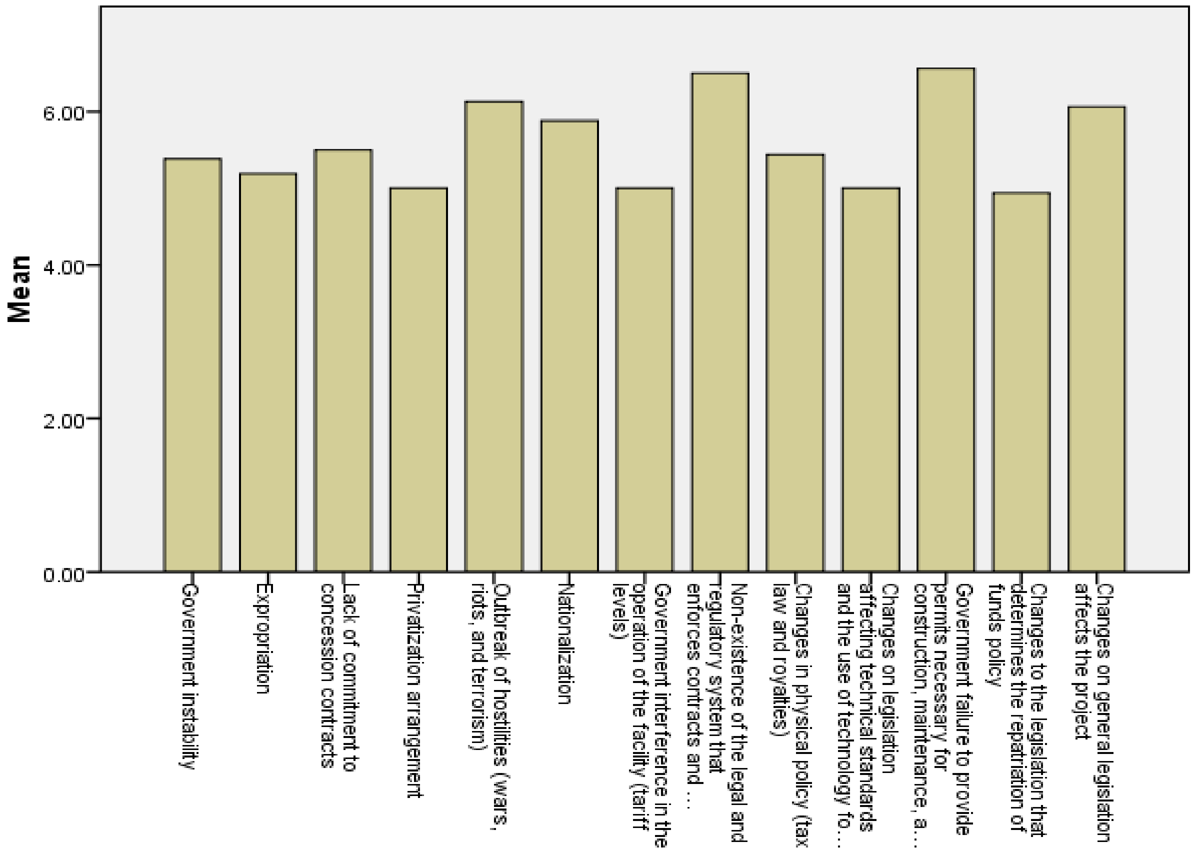


Figure 5-2 Country Risk (Political & Regulatory Risk

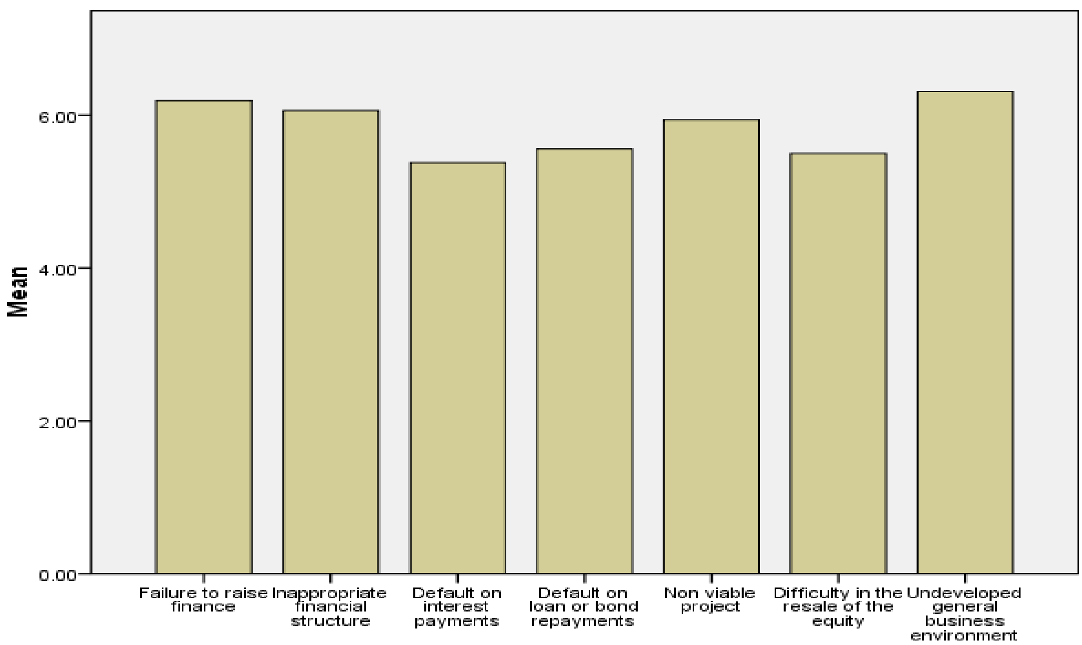


Figure 5-3 Financial Risks

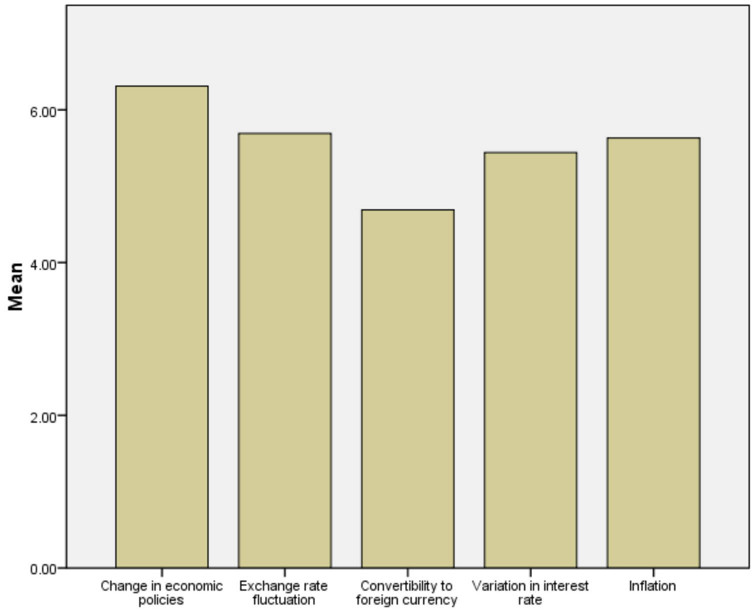


Figure 5-4 Revenue Risks –Economic

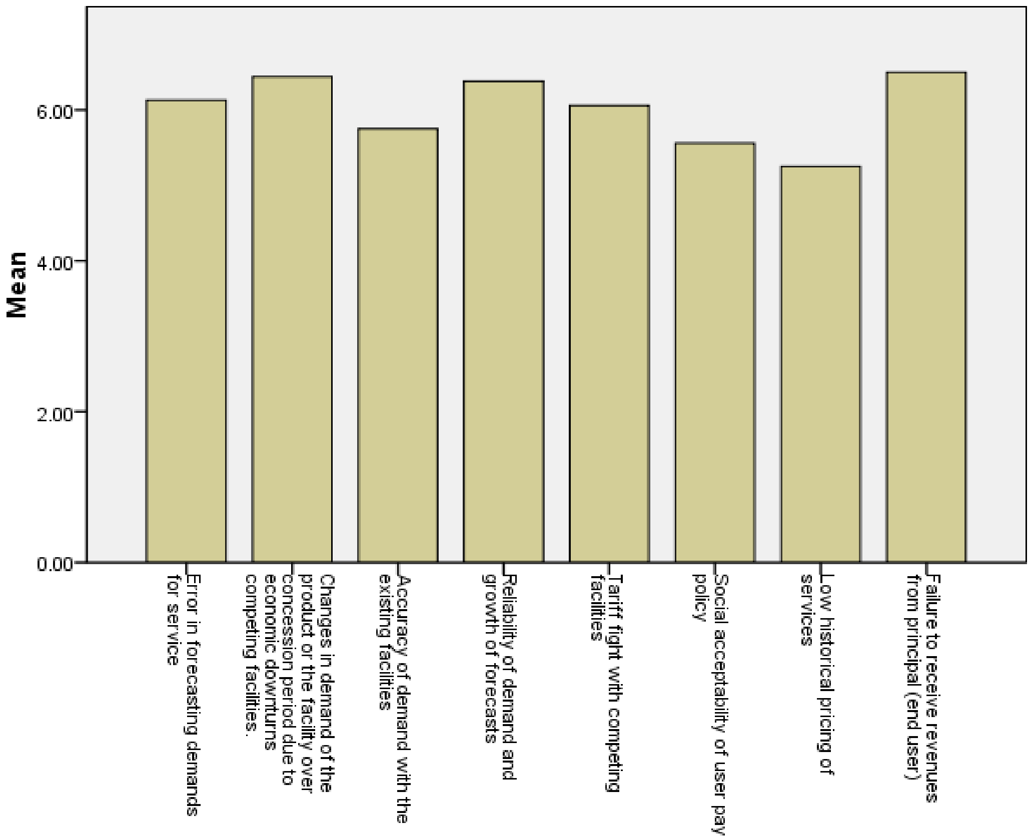


Figure 5-5 Revenue Risks-Demand

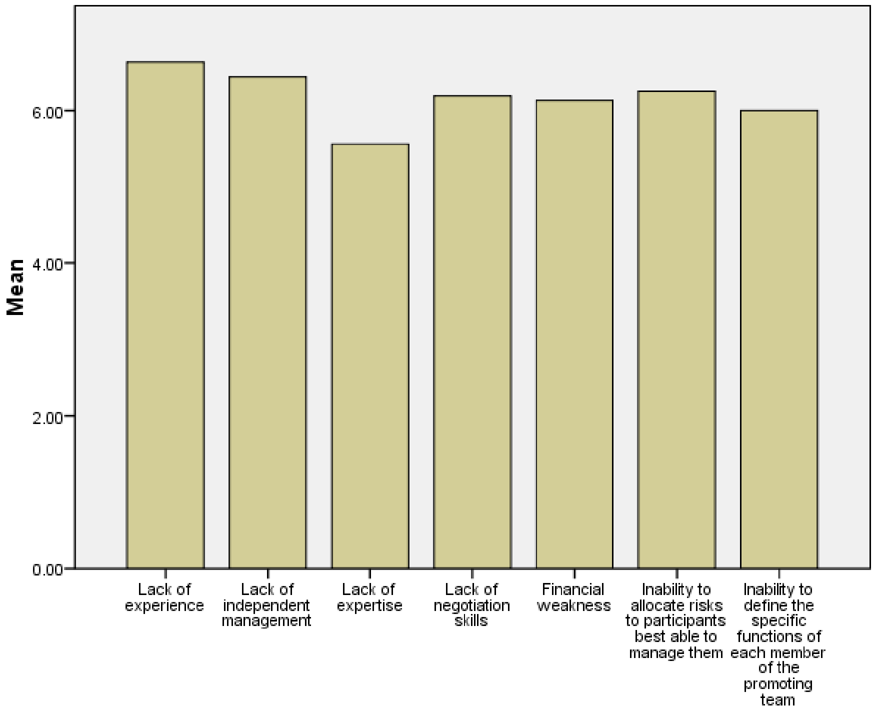


Figure 5-6 Promoting Risks

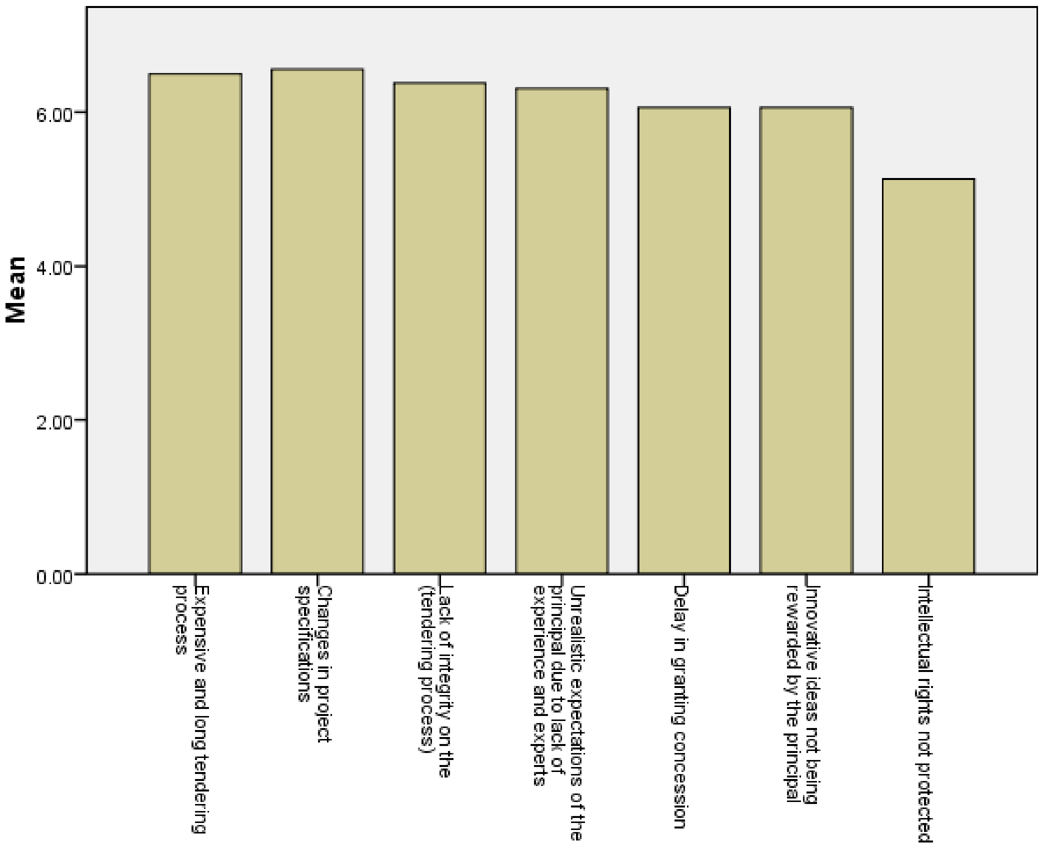


Figure 5-7 Procurement Risks

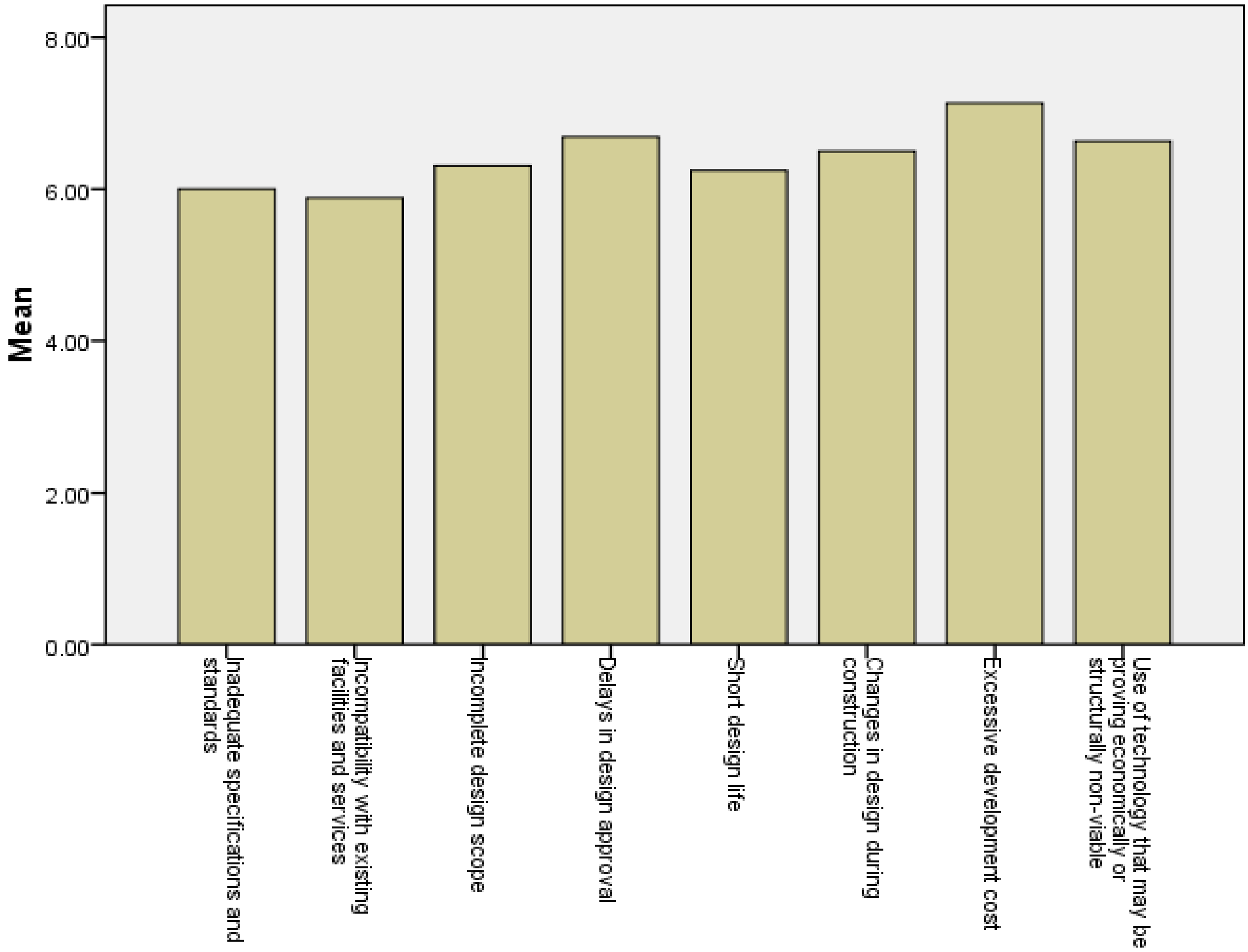
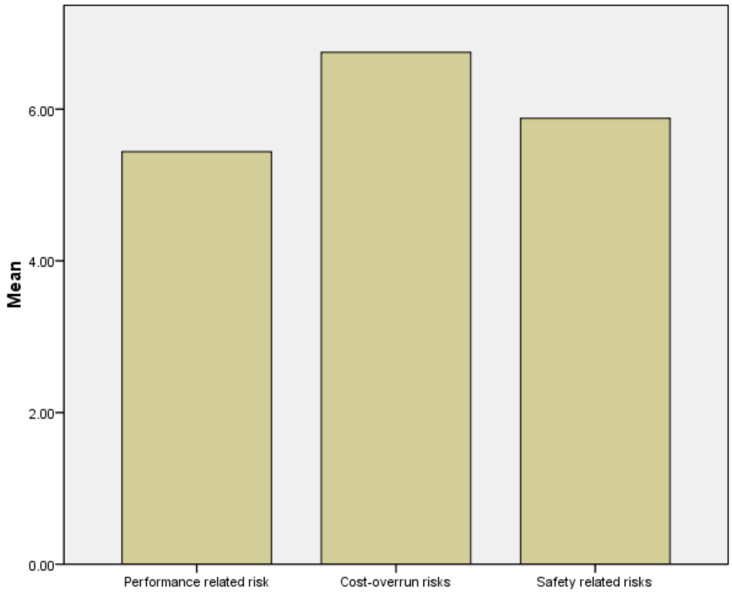


Figure 5-8 Development Risks



sks

Figure 5-9 Construction Risk

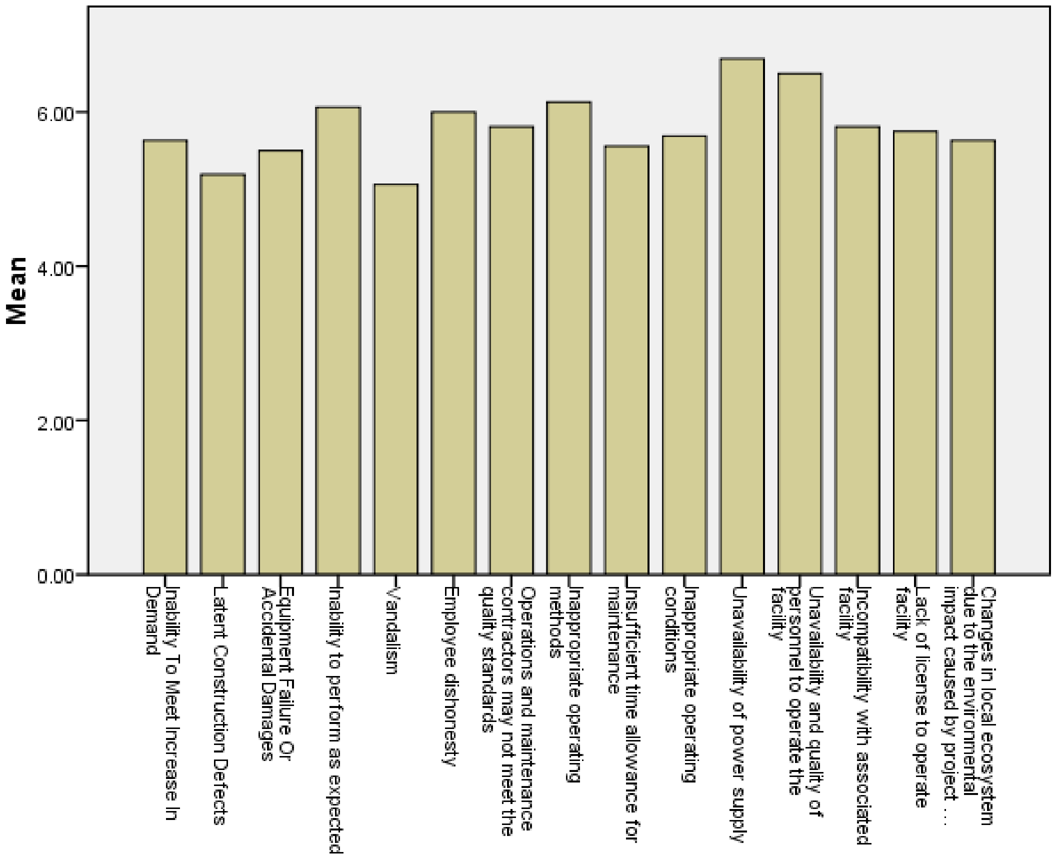


Figure 5-10 Operating Risk-Performance,

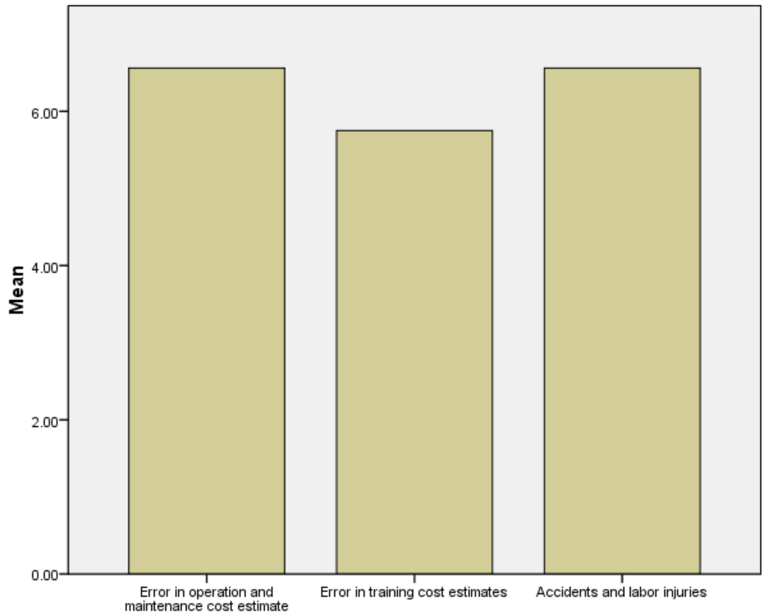


Figure 5-11 Operating Risk- Cost Overrun and Liability

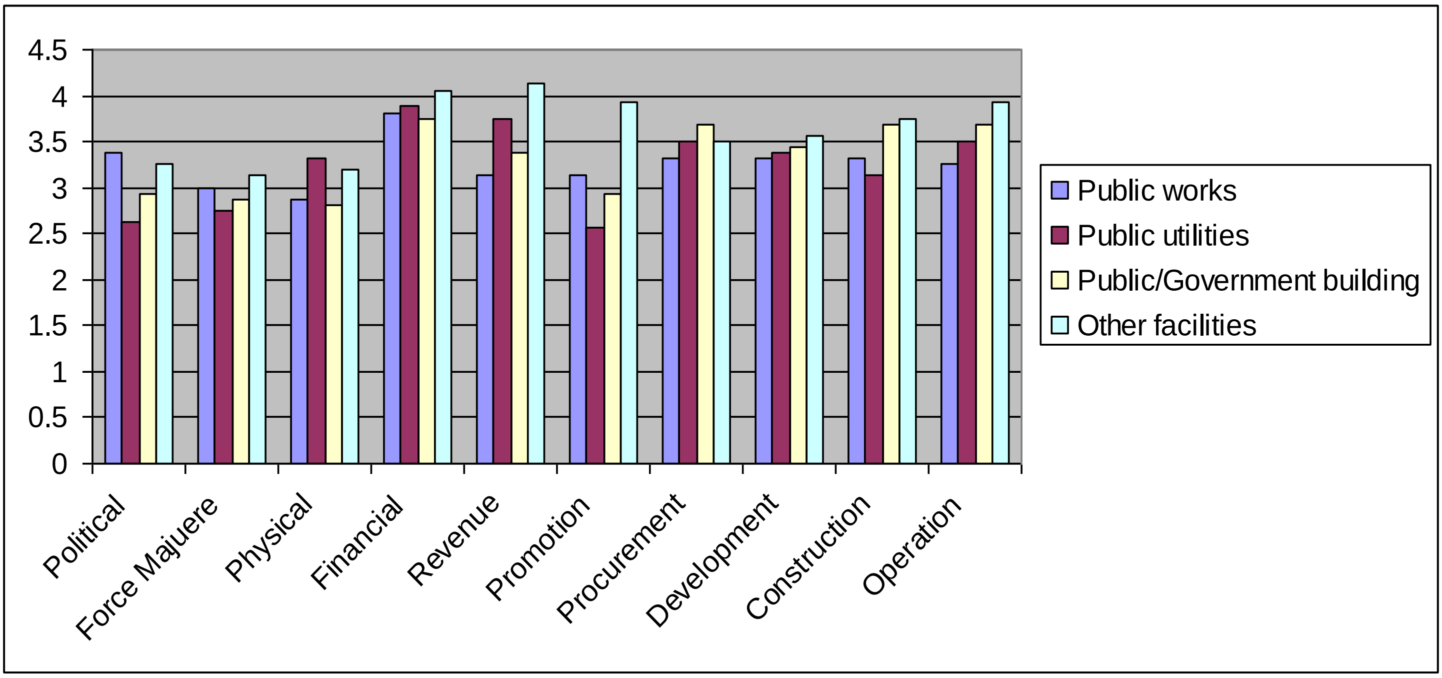


Figure 5-12 This figure shows the results of the second part of the questionnaire based on average for each infrastructure project (public works, public utilities, public/government buildings and other facilities).

Chapter 6 BOT risk Management Framework result and discussion

The scope of this research is very broad as there are many risk factors that have an influence on the actions of decision makers. The author of this research has constructed a BOT infrastructure project risk management framework, using the results from the first questionnaire, for companies to evaluate, and thereby accommodate, the various risk factors in different stages of the BOT project life cycle.

The purpose of this chapter is to provide a better understanding of the risk factors mentioned in Chapter 2 and to further prioritize the same risk factors relative to the BOT project concept.

In order to consider and evaluate the BOT project method in Kuwait, a decision-making tool is required. From the literature review, it is apparent that no standards are available to assist the Kuwaiti Government and/or private companies, in managing the risks for BOT projects. This research has developed a general evaluation process which can be used by the Government to determine the appropriate importance of each risk.

6.1 BOT Risks framework Attributes Selection

In the first questionnaire, the respondents were required to assess the common Risk Factors which affected the management systems for BOT infrastructure projects and to rank the common BOT Risk Factors according to their relevance within their respective Risk Category on a quantitative scale of 1 to 9 points. The five Risk Categories and twenty-eight subsequent Risk Factors can be seen in the Framework, fig. 5.1, whose position in the Risk Management Framework was determined by calculating the average mean, $\bar{x}$, and the Standard Deviation, SD. All of the five Risk Categories and the twenty-eight respective Risk Factors, were utilized in the second questionnaire which was divide into three parts: Part 1: "Relative Importance among project risk factors and categories; Part 2: "Measurement of performance level", (for P2 = 100 approach); and Part 3: "Holistic Evaluation", (in order to validate the Risk Management Framework);

6.2 BOT Project Risk Attributes Relative Weights

From the responses obtained in the second questionnaire, (from the remaining fourteen expert participants out of sixteen, 87.5%, -as the other two did not want to participate any more), pairwise comparisons of Risk Factors were carried out by the respondents which represented the relative importance of one Risk Factor compared to another, utilizing a numerical scale of 1-9.

By means of the "Eigen value Method", (EM), in the Analytical Hierarchy Process, (AHP), as described in Chapter 4, the "weight" of each Risk Category were calculated relatively to each other, as well as the "weight" of each Risk Factor relative to the other Risk Factors were calculated using the computer software package called “Expert Choice”, -which also uses an Analytical Hierarchal Process, (AHP).

The five Risk Categories and twenty-eight Risk Factors were carefully input into the Expert Choice software, according to the Risk Management Framework, fig. 5.1.

Next, the values of pairwise comparisons, from the respondents, (second questionnaire), were also input into the "Expert Choice" Analytical Hierarchal Process, (AHP) software package. The inconsistency index was calculated by the Expert Choice software using equation 5.8. and table: 5.2. There were two inconsistent responses in the questionnaires and the respondents were contacted and revised their responses and the questionnaires were returned, (about three months later).

6.2.1 Category Weights

6.2.1.1 Local Weights

The project Risk Categories were classified within 5 main categories as shown in Figure 5-1. Individual results provided by participants for comparison of the relative importance of the different categories, as well as the calculated risk category weights, are presented in Table 6-1. The results indicate, (Average Weights), that 28% of the respondents, suggest the Financial & Revenue Risk category to be the most important in the project risk decision, while 27% find the Country Risks category to be the most important, ranking it

2nd in the list. 18% thought that Construction & Operating Risk was the most important category, while 17% found Development Risk to be the most important category. Promoting & Procurement Risks, (10%), came out as the least important of all. From this, it can be concluded that the Financial & Revenue Risks category is the most important one, being slightly ahead of the Country Risks category and about twice as important as the Construction & Operating Risk and Development Risk categories. From this, it follows that the decision-maker needs to give the highest priority to Financial & Revenue Risks and Country Risk factors when carrying out an assessment for project risks in Kuwait.

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
***Category* Relative Importance**														
CR vs FR	1	1/9	1/3	6	1	*1/3*	1/2	1/3	4	5	1	1	1/2	2
CR vs PP	2	1/7	1/4	9	3	*1/3*	1/2	1/3	7	5	3	2	7	5
CR vs DR	2	1/6	1/5	9	1	*1/3*	2	1/3	7	5	1	1	1/3	7
CR vs Co	8	1	1/5	9	1	*1/5*	2	1/5	9	5	1	9	1/3	7
FR vs PP	7	3	1/2	9	1	*1/3*	6	¼	9	3	1	9	9	7
FR vs DR	4	5	1/3	9	1/3	*1/7*	5	1	9	3	1/2	2	3	9
FR vs CO	4	5	1/5	7	2	*1/3*	3	1/3	5	3	3	5	2	7
PP vs DR	1/5	1	1/6	1	1	*1*	1	1	1	1/3	1	1/5	1/6	2
PP vs CO	1	1	1/5	1	2	*1/3*	1/2	1/3	1	1/3	1	1/2	1/4	1/3
DR vs CO	4	1	1/2	1	3	*1/2*	1/2	1/5	1/3	1/2	3	5	1/2	1/5

	R1	R2	R3	R4	R5	*R6*	R7	R8	R9	R10	R11	R12	R13	R14
Weights														
CR	0.30	0.05	0.05	0.61	0.25	0.06	0.17	0.06	0.55	0.53	0.24	0.28	0.13	0.44
FR	0.39	0.51	0.09	0.26	0.17	0.09	0.46	0.12	0.29	0.20	0.21	0.36	0.38	0.37
PP	0.07	0.18	0.12	0.04	0.18	0.19	0.13	0.22	0.05	0.06	0.16	0.06	0.04	0.06
DR	0.18	0.15	0.32	0.04	0.29	0.27	0.09	0.14	0.04	0.09	0.27	0.24	0.20	0.03
CO	0.06	0.11	0.43	0.04	0.12	0.38	0.15	0.46	0.07	0.12	0.13	0.06	0.25	0.10

		Ave wt.
Legend	CR: Country Risk (Political & Regulatory)	(0.27)
	FR: Financial & Revenue Risks	(0.28)
	PP: Promoting & Procurement Risks	(0.10)
	DR: Development Risk	(0.17)
	CO: Construction & Operating Risk	(0.18)

Table 6-1 Category Pairwise Comparison Matrix and Relative Weights

6.2.1.2 Group Weights for five Risk Category

In order to calculate the contribution weight of each Risk Category to the project risk, the overall weight of individual responses, (the group weight), for each Risk Category is required. The geometrical, rather than the arithmetic mean of responses, was used to group the individual judgments for each risk category, because, according to Saaty and Aczel (1983) the method used to consolidate individual judgments, needs to preserve the reciprocal nature of the comparison matrix. From Table 6-2, it can be seen that the group weights of risk categories are almost the same as the average of the local weight.

It is apparent that the Financial & Revenue Risks category has the highest weight of 31.1%, followed by Country Risks which have 23.4%, Construction and Development, 17.1%, Development Risks, 17%, and finally, the Promoting & Procurement Risks category, which has the lowest weight of 11.4%.

Category Comparison	Relative Importance (Geo-mean)
Country Risk (Political & Regulatory) vs Financial & Revenue Risks	**0.90**
Country Risk (Political & Regulatory) vs Promoting & Procurement Risks	**1.61**
Country Risk (Political & Regulatory) vs Development Risk	**1.19**
Country Risk (Political & Regulatory) vs Construction & Operating Risk	**1.65**
Financial & Revenue Risks vs Promoting & Procurement Risks	**2.62**
Financial & Revenue Risks vs Development Risk	**1.94**
Financial & Revenue Risks vs Construction & Operating Risk	**2.19**
Promoting & Procurement Risks vs Development Risk	**0.60**
Promoting & Procurement Risks vs Construction & Operating Risk	**0.56**
Development Risk vs Construction & Operating Risk	**0.83**
Category group weights	
Country Risk (Political & Regulatory)	0.234
Financial & Revenue Risks	0.311
Promoting & Procurement Risks	0.114
Development Risk	0.170
Construction & Operating Risk	0.171

Table 6-2 Category Group Pair-wise Comparison and Group Relative Weights

6.2.1.3 Local Weights for Risk Factors

Twenty-eight Risk Factors in the Risk Management Framework were classified according to their relationship to 5 risk Categories, see Fig 5.1. The relative importance to the participants for each risk factor within each risk category and also the local attribute weights are presented in Tables 6-3, 6-4, 6-5, 6-6 and 6-7.

Considering the local weights of Risk Factors within their Risk Categories, it is apparent that changes in general legislation will affect the project and the regulations in the Country Risks Category. The failure to raise the necessary finance will affect the Financial & Revenue Risks Category. Lack of integrity during the tendering process will affect the Promoting & Procurement Risks Category. Changes in design during the construction phase will affect the Development Risk Category. These are the most significant decision factors that will have the maximum impact on the project risk and therefore, they should be given very high priority by the decision-maker.

6.2.1.4 Group Weights for the Risk Factors

The group weights of the Risk Factors were calculated by a similar method to that used for the Risk Category group weights, in order to find the contribution of each Risk Factor to its' Risk Category. From the results in Table 6-8, it can be seen that the Risk Categories with the highest weights are: Changes in General legislation,0.261), affecting the project in the Country Risks category, an Failure to raise Finance, (0.248), in the Financial & Revenue Risks category, a Lack of Integrity, (0.305), in the Tendering Process in the Promoting & Procurement Risks category, Use of Technology, (0.408), in the Development Risk category and Inappropriate Operating Methods, (0.242), in the Construction & Operating Risk category. The weights of the attributes in each category sum to unity.

6.2.1.5 Composite Weights

The process of comparison was simplified by classifying the initial eight project risk categories under 5 main Risk Categories and then calculating the local attributes weights within their Risk Categories. Afterwards, the similarities and differences between individual weights were checked and the contributions of individual Risk Factors to the overall project risk were calculated. In order to do this, it was necessary to determine the individual relative weight of each Risk Factor towards the total project risk, (composite weight "W*i*"). The composite weight of each Risk Factor is equal to the local weight of that Risk Factor "W*i*" multiplied by its' local Risk Category weight "W_c".

$$Wi = W^1 * W_c \qquad (6\text{-}1)$$

The sum of the composite weights of the "Risk Factor Weight" × "Risk Category Weight" must equal to unity, so,

$$\Sigma W_i = 1 \qquad (6\text{-}2)$$

The composite weights of the 28 Risk Factors calculated from equation (6-1) for each contribution are displayed in Table 6-10.

The average composite weight of each Risk Factor and its' boundaries of ± standard deviation can be seen in Figure 6.1 from results seen in Table 6.13.

These results show that for the Country Risk Category, the most significant Risk Factor is the "Government Failure to Provide Permits", (Composite Weight = 0.0636).

In the Financial and Revenue Risk Category, the "Failure to Raise Finance" is the most important Risk Factor, (Composite Weight = 0.0579).

The Promoting and Procurement Risk Category, indicates that the most important Risk Factor "Lack of Integrity in the Tendering Process", (Composite Weight =0.0629).

The Development risk Category shows that "Use of Technology",

(Composite Weight = 0.0707), is the most significant Risk Factor.

Finally in the "Construction and Operating Risk" Category, the main Risk Factor is "Cost Over-runs", (Composite Weight = 0.0636).

The expert participants recommend that the BOT project participants should pay particular attention to the Country Risk, Construction & Operating and Financial Risk categories. However, they also need to be aware of all the other model risks, because their weights are relatively close.

6.2.1.6 Group Composite Weights

The relative importance of a risk to the total project is given by its group composite weight. This can be found by multiplying the Risk Category Weight, (Table 6-8), by the corresponding group Risk Factor Weight, (Table 6-2).

For example, to find the group composite weight of the Risk Category "Government Instability", the group weight of this Risk Factor, (from Table 6-8), must be multiplied by the group weight of the Country Risk category, (from Table 6-2). Therefore, we find that the group composite weight of this Risk Factor is: $0.126 \times 0.234 = 0.02945$

Table 6-9 shows the group composite weights of Risk Factors, (attributes), towards the project risk.

The highest weight of 7.7%, is allocated to "Failure to raise finance", in the Financial and Revenue Risks Category. Followed by 6.9%, "Use of Technology", in the Development Risk Category. Next is 6.1%, for "Changes in general legislation affecting the project", in the Country Risk Category. Followed by 4.1%, for "Inappropriate operating methods" in the "Construction & Operating" risk Category and finally, 3.5%, for "Lack of Integrity in the Tendering Process", in the Promoting & Procurement Risk Category.

In Figure 6-2, the individual range of each Risk Factor Weight shown in the form of a column can be seen. For each a Risk Factor, the lower part of the column represents the minimum importance weights, which were assigned by respondents, while the top of the column indicates the maximum importance weights.

The darker line in the middle indicates the group composite weight of the Risk Factor, whilst the shaded regions, which can be seen above and below the line of group composite weights, indicate the standard deviation of the individual Risk Factor Weights, where half of the standard deviation is above and the other half is below the line. Table, 6.13, shows the data in figure 6.2 in a table format.

A close look at this figure indicates that three Risk Factors have quite a large range between their maximum and minimum importance weights. Changes in the project specifications risk Factor will have the maximum range of weight difference, with reference to the different replies of respondents, (the minimum weight was given by R13, 'government consultant' and the maximum weight was given by R6, 'private consultant').

Three Risk Factors have quite a small range, (i.e. the difference in weights), with the 'lack of experience' Risk Factors having the smallest, due to the fact that respondents have approximately the same view regarding the risk weight for the project team experience.

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
Country Risk Political & Regulatory														
GI vs. GFP	9	1/5	1/2	9	1	1/7	9	1/3	7	1/3	1/4	5	1/2	2
GI vs. NLS	5	1/9	1/5	1	1/3	1/7	6	1/5	2	1/9	1/4	1/4	1/2	2
GI vs. OH	8	1	1/5	9	1/3	1/5	3	1/3	9	1/5	1/5	5	1/4	1/5
GI vs. CGL	2	1/9	1/4	1/2	1	1/7	2	1/7	7	1/9	1	1/2	1/3	1/3
GI vs. LCCC	7	1/9	1/6	9	3	1/7	8	1/3	9	1/3	3	3	1/5	1
GFP vs. NLS	1/5	1/9	1/7	1/9	3	1	1/3	½	1/3	1/9	3	1/9	1/3	3
GFP vs. OH	1/7	1	1/2	2	3	1	1/4	1/3	3	3	2	3	1/3	1/7
GFP vs. CGL	1/9	1/9	1/3	1/7	5	1/2	1/8	1/7	1/7	1/9	5	1/9	1	1/3
GFP vs. LCCC	1/3	1/9	1/5	7	5	2	1/2	1/5	2	1	5	2	1/2	1/5
NLS vs. OH	1/2	8	1/3	9	1	4	1/2	1/5	7	4	1	9	1/3	1/7
NLS vs. CGL	1/2	2	1	2	3	2	2	¼	2	2	3	2	1/2	1/3
NLS vs. LCCC	1/2	1	1/3	9	3	2	2	1/3	7	5	3	9	1/2	1/5
OH vs. CGL	1/4	1/3	1	1/9	5	1/2	1	1/3	1/9	1/3	1	1/3	1/2	7
OH vs. LCCC	3	1/4	1/4	1	5	1/3	2	1/3	1	1/3	4	1/3	2	3
CGL vs. LCCC	6	1	1/2	7	2	1/2	7	2	7	4	2	9	2	1/3

	R1	R2	R3	R4	R5	*R6*	R7	R8	R9	R10	R11	R12	R13	R14
Local Attribute weights														
GI	0.453	0.029	0.037	0.274	0.124	0.026	0.431	0.042	0.484	0.027	0.1	0.152	0.056	0.096
GFP	0.024	0.093	0.059	0.061	0.347	0.196	0.033	0.059	0.056	0.088	0.378	0.056	0.107	0.057
NLS	0.078	0.347	0.171	0.334	0.189	0.086	0.135	0.096	0.216	0.416	0.162	0.431	0.134	0.039
OH	0.116	0.03	0.193	0.028	0.224	0.102	0.153	0.175	0.028	0.089	0.211	0.037	0.261	0.478
CGL	0.262	0.244	0.159	0.281	0.07	0.187	0.194	0.376	0.187	0.314	0.099	0.278	0.258	0.128
LCCC	0.067	0.278	0.382	0.026	0.45	0.202	0.053	0.252	0.03	0.066	0.049	0.048	0.184	0.202

Table 6-3 Country Risk Political & Regulatory Category & Local attribute weights

Legend:

- GI: Government instability
- GFP: Government failure to provide permits
- NLS: Non-existence of the legal and regulatory system
- OH: Outbreak of hostilities (wars, riots, and terrorism)
- CGL: Changes in general legislation affect the project
- LCCC: Lack of commitment to concession contract

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
Financial & Revenue Risks														
COR vs. PRR	2	9	1/3	2	1/3	1/2	9	9	7	9	9	2	9	1/3
COR vs. UOPS	2	2	1/5	4	1/5	1/3	3	1	5	9	7	2	2	1/5
COR vs. EIO	1	1	1/7	1	1/7	1/2	1	1	1/3	3	7	1	1	1/7
COR vs. UPO	9	3	1/3	5	1/3	1/2	1	5	5	5	7	9	3	1/3
COR vs. IOM	3	3	1/3	8	1/3	4	1/3	3	6	3	7	3	3	1/3
PRR vs. UOPS	3	1/4	1/3	3	1/3	1	1	1/6	3	1/3	1/7	3	1/4	1/3
PRR vs. EIO	2	1/7	1/4	1/2	1/3	1	1/3	1/9	1/7	1/7	1/2	2	1/7	1/4
PRR vs. UPO	7	1/7	1/5	3	1/2	2	1/9	1/7	1/2	1/7	1/3	7	1/7	1/5
PRR vs. IOM	2	2	1/3	3	1/3	2	1/9	1/7	1/2	1/2	1/3	2	2	1/3
UOPS vs. EIO	2	7	1/6	2	1/6	1	1	1	1/3	1/2	5	2	7	1/6
UOPS vs. UPO	7	2	1/6	3	1	1/2	1/6	2	2	1/2	5	7	2	1/6
UOPS vs. IOM	3	4	1/5	4	1/3	1/5	1/3	7	1	1	3	3	4	1/5
EIO vs. UPO	8	2	1/	6	2	1	1/3	2	6	2	1/2	8	2	1/
EIO vs. IOM	3	4	1/4	6	3	2	1/3	2	6	8	1/3	3	4	1/4
UPO vs. IOM	1/3	3	3	1	1/3	1/4	3	1	1/2	1	1/3	1/3	3	3

	R1	R2	R3	R4	R5	*R6*	R7	R8	R9	R10	R11	R12	R13	R14
Local Attribute weights														
FRF	0.478	0.056	0.24	0.282	0.294	0.044	0.327	0.041	0.196	0.186	0.28	0.307	0.452	0.564
UGBE	0.092	0.386	0.206	0.256	0.037	0.073	0.186	0.079	0.216	0.033	0.024	0.093	0.03	0.03
FRRFP	0.115	0.3	0.084	0.184	0.302	0.077	0.164	0.128	0.215	0.062	0.279	0.096	0.73	0.202
CIDP	0.154	0.059	0.206	0.175	0.202	0.309	0.234	0.902	0.15	0.1	0.217	0.43	0.248	0.044
CIEP	0.08	0.099	0.152	0.026	0.12	0.32	0.047	0.124	1.217	0.353	0.105	0.044	0.118	0.6
EIFDS	0.086	0.1	0.111	0.078	0.045	0.177	0.041	0.226	1.075	0.265	0.095	0.058	0.078	0.1

Table 6-4 Financial & Revenue Risk Category & Local attribute weights

Legend:

- FRF: Failure to raise finance
- UGBE: Undeveloped general business environment
- FRRFP: Failure to receive revenues from principal (end user)
- CIDP: Changes in demand of the facility over concession period.
- CIEP: Change in economic policies
- EIFDS: Error in forecasting demands for service

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
Promoting & Procurement Risks														
LOE vs. LE	1/3	1/2	1/2	1/6	1/5	2	1/2	1/3	1/2	3	8	3	1/6	1/3
LOE vs. LIM	1/6	1	1/6	1/3	1/6	1/4	1/6	1/3	1/6	1/2	3	1	1/6	5
LOE vs. CIPS	1/7	1/4	1/7	1/6	1/5	1/3	1/7	1/3	1/7	1/9	3	3	1/7	1/3
LOE vs. ELTP	1/3	1/4	1/7	1/6	1/7	1/3	1/7	1/3	1/7	1/5	1/3	1/9	1/7	1/5
LOE vs. LOI	1/9	1/4	1/9	½	1/7	1/3	1/9	1/3	1/7	1/5	1	1/9	1/9	5
LE vs. LIM	1/2	1/2	1/2	2	1	1/5	1	2	1/2	1/4	3	1/3	2	5
LE vs. CIPS	1/2	1	1/7	½	1/5	1/5	1/7	1/2	1/7	1/9	1/7	1/3	2	2
LE vs. ELTP	2	1/2	1/6	2	1/3	1/5	1/7	1/3	1/7	1/5	1/7	1/9	3	1
LE vs. LOI	1/5	2	1/6	2	1/5	1/5	1/9	1/3	1/9	1/5	1/9	1/9	1/2	7
LIM vs. CIPS	1/2	2	1/6	1/3	1	1/4	1/7	1/3	1	1/9	1/7	1	1/2	1/5
LIM vs. ELTP	1	1	1/4	2	1/3	1/3	1/7	1/3	1/7	1/4	1/7	1/8	1	1/5
LIM vs. LOI	1/8	1	1/4	2	1/3	1/3	1/9	1/3	1/9	1/9	1/9	1/5	1/3	2
CIPS vs. ELTP	2	1	1/5	7	1	1/3	1	1/3	1/2	1/5	1/2	1/2	1/2	3
CIPS vs. LOI	1/3	1/2	1/2	6	1	1	1/2	1/2	1/5	1/5	1/9	1/5	1/6	5
ELTP vs. LOI	1/5	1	1	½	3	1	1/3	1/2	1/5	1	1/9	1	1/5	5

	R1	R2	R3	R4	R5	*R6*	R7	R8	R9	R10	R11	R12	R13	R14
Local Attribute weights														
LOE	0.030	0.074	0.026	0.040	0.029	0.066	0.026	0.058	0.028	0.050	0.196	0.084	0.025	0.113
LE	0.099	0.162	0.041	0.202	0.083	0.039	0.040	0.115	0.037	0.028	0.028	0.028	0.215	0.286
LIM	0.113	0.200	0.078	0.112	0.119	0.127	0.057	0.088	0.083	0.079	0.037	0.066	0.106	0.045
CIPS	0.153	0.156	0.206	0.431	0.221	0.225	0.237	0.168	0.135	0.216	0.097	0.078	0.115	0.284
ELTP	0.117	0.210	0.367	0.094	0.313	0.306	0.226	0.266	0.272	0.274	0.256	0.367	0.122	0.239
LOI	0.487	0.197	0.281	0.121	0.235	0.237	0.414	0.035	0.445	0.353	0.387	0.375	0.418	0.034

Table 6-5 Promoting & Procurement Risks & Local attribute weights

Legend:

- LOE: Lack of experience
- LE: Lack of expertise
- LIM: Lack of independent management
- CIPS: Changes in project specifications
- ELTP: Expensive and long tendering process
- LOI: Lack of integrity on the tendering process

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
R1	R2	R3	R4	R5	*R6*	R7	R8	R9	R10	R11	R12	R13	R14	
Development Risks														
EDC vs. DIDA	1/2	1/7	1/2	7	1	1/2	1	1/3	7	1/9	1	1	1	7
EDC vs. UOT	1/8	1/4	1/4	1	1/6	1/4	1/7	1/3	1	1/8	1/6	1/8	3	9
EDC vs. CIDDC	1/8	1/3	1/4	1	1/5	1/3	1/7	1/3	1	1/4	1/8	1/6	1/3	5
DIDA vs. UOT	1/8	3	1/6	1/3	1/8	1/5	1/4	1/3	1/7	3	1/9	1/5	7	2
DIDA vs. CIDDC	1/8	2	1/6	1/7	1/3	1/3	1/7	1/3	1/7	5	1/7	1/9	1/5	1/3
UOT vs. CIDDC	1/2	1/2	1	1	1	3	1	1	2	1	1	2	9	1/6
R1	R2	R3	R4	R5	*R6*	R7	R8	R9	R10	R11	R12	R13	R14	

Local Attribute weights

EDC	0.046	0.06	0.08	0.333	0.076	0.09	0.065	0.096	0.312	0.042	0.062	0.06	0.167	0.658
DIDA	0.065	0.493	0.095	0.06	0.083	0.138	0.076	0.169	0.045	0.581	0.057	0.064	0.193	0.083
UOT	0.368	0.181	0.413	0.274	0.481	0.502	0.401	0.368	0.378	0.218	0.44	0.497	0.047	0.048
CIDDC	0.521	0.261	0.413	0.333	0.36	0.27	0.458	0.368	0.266	0.159	0.442	0.379	0.593	0.212

Table 6-6 Development Risks Category: local attribute weights

Legend:

- EDC: Excessive development cost
- DIDA: Delays in design approval
- UOT: Use of technology
- CIDDC: Changes in design during construction

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R14
Local Attribute weights															
COR	0.232	0.047	0.056	0.233	0.087	0.05	0.278	0.066	0.084	0.042	0.074	0.087	0.112	0.109	
PRR	0.387	0.16	0.122	0.047	0.105	0.056	0.327	0.088	0.089	0.069	0.105	0.192	0.204	0.028	
UOPS	0.033	0.08	0.058	0.152	0.315	0.176	0.032	0.153	0.241	0.07	0.309	0.137	0.066	0.422	
EIO	0.209	0.117	0.243	0.03	0.168	0.116	0.157	0.203	0.271	0.135	0.161	0.171	0.285	0.23	
UPO	0.061	0.11	0.37	0.208	0.144	0.287	0.062	0.297	0.104	0.342	0.199	0.137	0.074	0.143	
IOM	0.078	0.485	0.15	0.33	0.181	0.307	0.144	0.194	0.205	0.342	0.153	0.276	0.26	0.069	

Table 6-7 Construction & Operating Risk Category; local attribute weights

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R14
(	[illegible]	[illegible]	1/4	7	1	1/2	1	1	1	1/5	1	1	1/2	5	
(UOPS	8	1	1	2	1/5	1/5	8	1/3	1/3	1/5	1/5	1/2	2	1/7	
(EIO	1	1/5	1/4	7	1/3	1/3	2	1/3	1/7	1/5	1/3	1/2	1/2	1	
(UPO	3	1/4	1/3	1	1/5	1/3	3	1/3	1/2	1/5	1/5	1/2	2	1/3	
(IOM	3	1/5	1/4	1/5	1	1/4	3	1/3	1	1/5	1	1/4	1/3	2	
I PS	5	1	2	1/5	1/3	1/4	5	1/4	1/2	1/2	1/3	2	3	1/9	
I O	5	1	1/4	2	1/3	1/4	2	1/4	1/2	1/5	1/3	2	1	1/5	
I PO	5	2	1/3	1/7	1	1/7	5	1/2	1	1/5	1	2	2	1/7	
I M	5	1/2	1	1/6	1	1/2	5	1	1/5	1/5	1	1/3	1	1/3	
UOPS vs. EIO	1/7	1	1/4	7	3	2	1/7	1/5	1	1	3	1/2	1/3	2	
UOPS vs. UPO	1/3	1/2	1/4	1	9	1/2	1/3	1/5	2	1/5	2	1	1	3	
UOPS vs. IOM	1/3	1/7	1/3	1/2	1	1/3	1/5	1/3	2	1/5	1	1	1/4	7	
EIO vs. UPO	5	1	1/4	1/7	1	1/3	3	1/3	3	1/5	½	2	1/2	3	
EIO vs. IOM	4	1/7	2	1/7	1/9	1/5	1	1	1	1/5	1	1/2	3	6	
UPO vs. IOM	1/2	1/7	2	1/2	1	1	1/5	2	1/2	1	1	1	1/7	1	

Legend:

COR: Cost-overrun risks

PRR : Performance related risk

UOPS: Unavailability of power supply

EIO : Error in operation and maintenance cost estimate

UPO : Unavailability and quality of personnel to operate the facility

IOM : Inappropriate operating methods

6.3 Attributes one-dimensional value function *Vi (xi)*

In order to determine the individual contributions of the Risk Factors to the project risk index, see equation (4.11),

$$V(x) = \sum_{i=1}^{n} w_i \, v_i(x_i) \qquad (4.11)$$

it is necessary to find the "worth score", V_i (x_i), of each attribute and then to multiply it by its relative composite weight. The "worth score" measures the value of a particular Risk Factor for a specific project and is a non-dimensional number. To determine the "worth scores" of worth score", first evaluate the performance, (quality), level of this Risk Factor and then use a value function to obtain its "worth score", V_i (x_i). This process has been described in detail in Chapter 4.

6.4 Attributes performance (quality) level

The second questionnaire involved asking the expert participants, (14), to estimate two points, P1 and P2, (where the normal is P), which represent the lowest and the highest points of each Risk Factor performance, as well as the normal performance level for each Risk Factor on the performance scale shown in Figure 4-4. P1 represents their complete discontent and P2, their complete satisfaction with the performance of the Risk Factor characteristics and features. In this research, the normal performance level, N, is used in the analysis. The individual "worth score" of each Risk Factor, $V_i(x_i)$, in every project profile was obtained by plotting the performance level points N given in Table 6-12 on the corresponding value curve and obtaining the resulting "worth scores" for each approach. The value curve used here is the curve of P1=0 and P2=100, as verified in Salman (2003). This is because all the modelled Risks Factors and their categories are the most important ones and therefore, the performance effects on the project must be considered.

It is interesting to note that the highest performance, (quality,) levels were obtained by: use of technology, unavailability of power supply, government failure to provide permits, cost-overrun risks and lack of integrity on the tendering process. The average N is between moderately and substantially important. For other Risk Factors, the average N lies in the region between moderately important and slightly important.

Attribute	**Group Weight**
Country Risk (Political & Regulatory)	
Government instability	**0.126**
Government failure to provide permits	**0.101**
Non-existence of the legal and regulatory system	**0.242**
Outbreak of hostilities (wars, riots, and terrorism)	**0.142**
Changes in general legislation affecting the project	**0.261**
Lack of commitment to concession contracts	**0.128**
Financial & Revenue Risks	
Failure to raise finance	**0.248**
Undeveloped general business environment	**0.103**
Failure to receive revenues from principal (end user)	**0.165**
Changes in demand of the facility over concession period	**0.222**
Change in economic policies	**0.130**
Error in forecasting demands for service	**0.132**
Promoting & Procurement Risks	
Lack of experience	**0.056**
Lack of expertise	**0.079**
Lack of independent management	**0.088**
Changes in project specifications	**0.207**
Expensive and long tendering process	**0.264**
Lack of integrity in the (tendering process)	**0.305**
Development Risks	
Excessive development cost	**0.113**
Delays in design approval	**0.115**
Use of technology	**0.408**
Changes in design during construction	**0.364**
Construction & Operating Risk	
Cost-overrun risks	**0.106**
Performance related risk	**0.130**
Unavailability of power supply	**0.150**
Error in operation and maintenance cost estimate	**0.184**
Unavailability and quality of personnel to operate the facility	**0.188**
Inappropriate operating methods	0.242

Table 6-8 Group Weights for Comparison of Attributes within their Categories

Attribute	**Group Composite Weight**	**Group Composite Weight(×10E-2)**
Country Risk (Political & Regulatory)		
Government instability	0.029	2.90
Government failure to provide permits	0.024	2.40
Non-existence of the legal and regulatory system	0.057	5.70
Outbreak of hostilities (wars, riots, and terrorism)	0.033	3.30
Changes in general legislation affecting the project	0.061	**6.10**
Lack of commitment to concession contracts	0.030	3.00
Financial & Revenue Risks		
Failure to raise finance	0.077	**7.70**
Undeveloped general business environment	0.032	3.20
Failure to receive revenues from principal (end user)	0.051	5.10
Changes in demand for the facility over the concession period	0.069	6.90
Change in economic policies	0.04	4.00
Error in forecasting demands for service	0.041	4.10
Promoting & Procurement Risks		
Lack of experience	0.006	0.60
Lack of expertise	0.009	0.90
Lack of independent management	0.01	1.00
Changes in project specifications	0.024	2.40
Expensive and long tendering process	0.03	3.00
Lack of integrity in the (tendering process)	0.035	**3.50**
Development Risks		
Excessive development cost	0.019	1.90
Delays in design approval	0.02	2.0
Use of technology	0.069	**6.90**
Changes in design during construction	0.062	6.20
Construction & Operating Risk		
Cost-overrun risks	0.018	1.80
Performance related risk	0.022	2.20
Unavailability of power supply	0.026	2.60
Error in operation and maintenance cost estimate	0.031	3.10
Unavailability and quality of personnel to operate the facility	0.032	3.20
Inappropriate operating methods	0.041	**4.10**

Table 6-9 Attribute Group Composite Weight

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
Country Risk (Political &Regulatory)														
Government instability	0.137	0.001	0.002	0.166	0.031	0.002	0.075	0.002	0.0264	0.002	0.014	0.024	0.0043	0.007
Government failure to provide permits	0.007	0.003	0.003	0.38	0.086	0.012	0.006	0.003	0.031	0.012	0.047	0.092	0.016	0.014
Non-existence of the legal and regulatory system	0.023	0.017	0.008	0.025	0.047	0.017	0.023	0.006	0.118	0.017	0.221	0.039	0.112	0.018
Outbreak of hostilities (wars, riots, and terrorism)	0.035	0.002	0.009	0.017	0.056	0.006	0.027	0.01	0.015	0.006	0.047	0.051	0.01	0.035
Changes in general legislation affecting the project	0.079	0.012	0.007	0.172	0.017	0.011	0.034	0.002	0.103	0.011	0.167	0.024	0.079	0.034
Lack of commitment to concession contracts	0.02	0.014	0.018	0.016	0.011	0.012	0.009	0.015	0.017	0.012	0.035	0.012	0.013	0.025
Financial & Revenue Risks														
Failure to raise finance	0.187	0.029	0.021	0.074	0.05	0.004	0.149	0.005	0.043	0.038	0.058	0.11	0.172	0.207
Undeveloped general business environment	0.036	0.198	0.018	0.067	0.006	0.007	0.085	0.01	0.063	0.007	0.005	0.033	0.011	0.011
Failure to receive revenues from principal (end user)	0.043	0.154	0.008	0.048	0.0051	0.007	0.075	0.015	0.063	0.013	0.058	0.025	0.028	0.074
Changes in demand of the facility over concession period	0.06	0.03	0.018	0.046	0.34	0.028	0.107	0.048	0.044	0.02	0.045	0.154	0.095	0.016
Change in economic policies	0.031	0.051	0.014	0.007	0.02	0.029	0.021	0.015	0.064	0.072	0.022	0.016	0.045	0.022
Error in forecasting demands for service	0.034	0.051	0.01	0.02	0.008	0.016	0.019	0.027	0.017	0.045	0.02	0.021	0.03	0.037
Promoting & Procurement Risks														
Lack of experience	0.002	0.013	0.003	0.002	0.005	0.013	0.003	0.013	0.001	0.003	0.03	0.005	0.001	0.006
Lack of expertise	0.007	0.028	0.005	0.008	0.015	0.007	0.005	0.025	0.02	0.002	0.04	0.002	0.008	0.016
Lack of independent management	0.008	0.035	0.009	0.005	0.021	0.024	0.007	0.019	0.004	0.004	0.006	0.004	0.004	0.002
Changes in project specifications	0.01	0.027	0.024	0.018	0.039	0.43	0.031	0.037	0.007	0.012	0.015	0.005	0.004	0.016
Expensive and long tendering process	0.008	0.037	0.042	0.004	0.055	0.059	0.03	0.058	0.014	0.015	0.04	0.002	0.0034	0.013

Lack of integrity in the (tendering process)	0.033	0.035	0.032	0.005	0.041	0.046	0.055	0.067	0.022	0.02	0.06	0.022	0.015	0.002
Development Risks														
Excessive development cost	0.008	0.01	0.026	0.014	0.022	0.025	0.006	0.013	0.013	0.004	0.017	0.014	0.033	0.023
Delays in design approval	0.012	0.076	0.03	0.002	0.024	0.038	0.007	0.024	0.002	0.053	0.015	0.015	0.038	0.003
Use of technology	0.067	0.028	0.132	0.011	0.0\139	0.137	0.035	0.051	0.016	0.02	0.1119	0.119	0.009	0.002
Changes in design during construction	0.095	0.04	0.132	0.014	0.104	0.074	0.04	0.051	0.011	0.014	0.119	0.09	0.116	0.007
Construction & Operating Risk														
Cost-overrun risks	0.013	0.005	0.024	0.01	0.01	0.019	0.042	0.03	0.006	0.005	0.009	0.005	0.028	0.011
Performance related risk	0.022	0.017	0.053	0.002	0.012	0.025	0.05	0.041	0.006	0.008	0.013	0.012	0.052	0.003
Unavailability of power supply	0.002	0.009	0.025	0.007	0.037	0.067	0.005	0.071	0.016	0.008	0.039	0.008	0.017	0.043
Error in operation and maintenance cost estimate	0.012	0.013	0.104	0.001	0.02	0.045	0.024	0.094	0.018	0.016	0.02	0.01	0.072	0.023
Unavailability and quality of personnel to operate the facility	0.003	0.012	0.159	0.009	0.017	0.11	0.009	0.137	0.007	0.041	0.025	0.008	0.019	0.015
Inappropriate operating methods	0.004	0.055	0.065	0.014	0.021	0.117	0.022	0.09	0.014	0.041	0.019	0.017	0.066	0.007

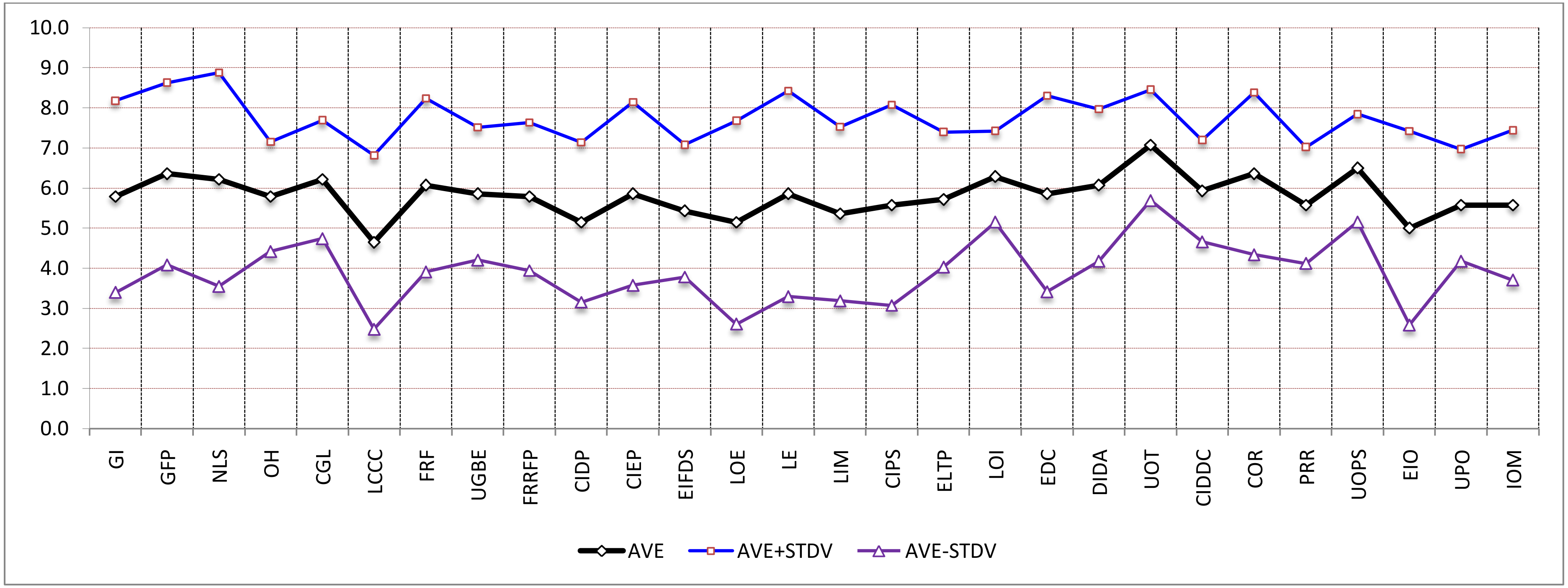
Table 6-10 Local Composite Weights of the Attribute towards the Project Risk

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
Country Risk (Political & Regulatory)														
Government instability	13.7	0.1	0.2	16.6	3.1	0.2	7.5	0.2	2.64	1.4	2.4	0.43	0.7	4.2
Government failure to provide permits	0.7	0.3	0.3	38	8.6	1.2	0.6	0.3	3.1	4.7	9.2	1.6	1.4	2.5
Non-existence of the legal and regulatory system	2.3	1.7	0.8	2.5	4.7	1.7	2.3	0.6	11.8	22.1	3.9	11.2	1.8	1.7
Outbreak of hostilities (wars, riots, and terrorism)	3.5	0.2	0.9	1.7	5.6	0.6	2.7	1	1.5	4.7	5.1	1	3.5	21.1
Changes in general legislation affecting the project	7.9	1.2	0.7	17.2	1.7	1.1	3.4	0.2	10.3	16.7	2.4	7.9	3.4	5.7
Lack of commitment to concession contracts	2	1.4	1.8	1.6	1.1	1.2	0.9	1.5	1.7	3.5	1.2	1.3	2.5	8.9
Financial & Revenue Risks														
Failure to raise finance	18.7	2.9	2.1	7.4	5	0.4	14.9	0.5	4.3	3.8	5.8	11	17.2	20.7
Undeveloped general business environment	3.6	19.8	1.8	6.7	0.6	0.7	8.5	1	6.3	0.7	0.5	3.3	1.1	1.1
Failure to receive revenues from principal (end user)	4.3	15.4	0.8	4.8	0.51	0.7	7.5	1.5	6.3	1.3	5.8	2.5	2.8	7.4
Changes in demand of the facility over concession period	6	3	1.8	4.6	34	2.8	10.7	4.8	4.4	2	4.5	15.4	9.5	1.6
Change in economic policies	3.1	5.1	1.4	0.7	2	2.9	2.1	1.5	6.4	7.2	2.2	1.6	4.5	2.2
Error in forecasting demands for service	3.4	5.1	1	2	0.8	1.6	1.9	2.7	1.7	4.5	2	2.1	3	3.7
Promoting & Procurement Risks														
Lack of experience	0.2	1.3	0.3	0.2	0.5	1.3	0.3	1.3	0.1	0.3	3	0.5	0.1	0.6
Lack of expertise	0.7	2.8	0.5	0.8	1.5	0.7	0.5	2.5	2	0.2	4	0.2	0.8	1.6
Lack of independent management	0.8	3.5	0.9	0.5	2.1	2.4	0.7	1.9	0.4	0.4	0.6	0.4	0.4	0.2
Changes in project specifications	1	2.7	2.4	1.8	3.9	43	3.1	3.7	0.7	1.2	1.5	0.5	0.4	1.6
Expensive and long tendering process	0.8	3.7	4.2	0.4	5.5	5.9	3	5.8	1.4	1.5	4	0.2	0.34	1.3
Lack of integrity in the (tendering process)	3.3	3.5	3.2	0.5	4.1	4.6	5.5	6.7	2.2	2	6	2.2	1.5	0.2

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
Development Risks														
Excessive development cost	0.8	1	2.6	1.4	2.2	2.5	0.6	1.3	1.3	0.4	1.7	1.4	3.3	2.3
Delays in design approval	1.2	7.6	3	0.2	2.4	3.8	0.7	2.4	0.2	5.3	1.5	1.5	3.8	0.3
Use of technology	6.7	2.8	13.2	1.1	0.139	13.7	3.5	5.1	1.6	2	11.19	11.9	0.9	0.2
Changes in design during construction	9.5	4	13.2	1.4	10.4	7.4	4	5.1	1.1	1.4	11.9	9	11.6	0.7
Construction & Operating Risk														
Cost-overrun risks	1.3	0.5	2.4	1	1	1.9	4.2	3	0.6	0.5	0.9	0.5	2.8	1.1
Performance related risk	2.2	1.7	5.3	0.2	1.2	2.5	5	4.1	0.6	0.8	1.3	1.2	5.2	0.3
Unavailability of power supply	0.2	0.9	2.5	0.7	3.7	6.7	0.5	7.1	1.6	0.8	3.9	0.8	1.7	4.3
Error in operation and maintenance cost estimate	1.2	1.3	10.4	0.1	2	4.5	2.4	9.4	1.8	1.6	2	1	7.2	2.3
Unavailability and quality of personnel to operate the facility	0.3	1.2	15.9	0.9	1.7	11	0.9	13.7	0.7	4.1	2.5	0.8	1.9	1.5
Inappropriate operating methods	0.4	5.5	6.5	1.4	2.1	11.7	2.2	9	1.4	4.1	1.9	1.7	6.6	0.7

Table 6-11 Local Composite Weights of the Attribute towards the Project Risk (× 10E-2)

EM Composite Attribute Weights



Risk Attribute

Figure 6-1 Average EM Composite Attribute Weights with its Boundaries of ± Standard Deviation

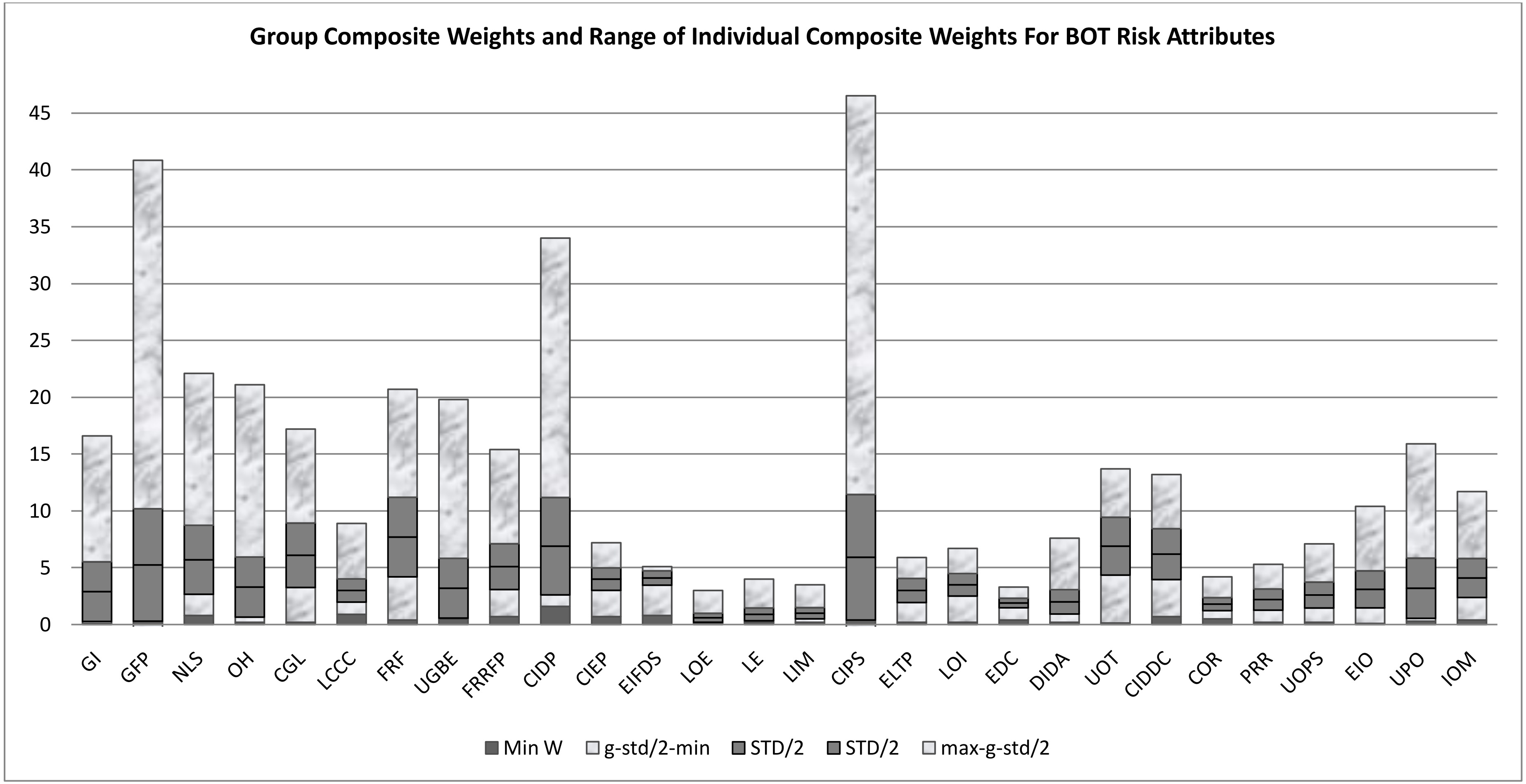


Figure 6-2 Group Composite Attribute Weights with Range of Individual Composite Weights

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	AVG
	N	N	N	N	N	N	N	N	N	N	N	N	N	N	
Government instability	9	1	6	9	4	4	8	3	8	7	4	7	5	6	5.8
Government failure to provide permits	9	1	8	9	5	5	7	5	8	8	5	8	4	7	6.4
Non-existence of the legal and regulatory system	7	1	4	9	4	6	9	6	9	9	4	9	3	7	6.2
Outbreak of hostilities (wars, riots, and terrorism)	6	5	4	7	5	4	8	4	8	6	5	6	7	6	5.8
Changes in general legislation affecting the project	8	5	4	7	5	6	9	6	7	7	5	7	4	7	6.2
Lack of commitment to concession contracts	7	1	4	6	4	5	9	5	7	4	2	4	2	5	4.6
Failure to raise finance	7	6	8	9	2	5	7	6	9	7	3	7	3	6	6.1
Undeveloped general business environment	6	7	7	7	3	7	6	6	8	4	3	4	7	7	5.9
Failure to receive revenues from principal (end user)	5	5	6	8	3	7	8	6	8	4	3	4	8	6	5.8
Changes in demand of the facility over concession period	5	1	4	7	5	7	7	5	9	4	5	4	3	6	5.1
Change in economic policies	5	6	9	7	1	7	7	7	7	7	1	7	5	6	5.9
Error in forecasting demands for service	4	5	5	8	3	7	6	7	7	4	3	4	6	7	5.4
Lack of experience	4	1	5	8	1	6	5	7	8	7	1	7	5	7	5.1
Lack of expertise	7	9	5	7	1	7	5	7	9	7	1	7	3	7	5.9
Lack of independent management	4	6	5	8	1	7	5	7	8	6	1	6	6	5	5.4
Changes in project specifications	4	6	4	7	1	6	4	6	8	8	1	8	9	6	5.6
Expensive and long tendering process	5	5	8	8	4	6	5	6	7	8	3	6	3	6	5.7
Lack of integrity in the (tendering process)	6	6	8	8	5	6	7	6	8	6	5	7	5	5	6.3

	R1	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**	**R10**	**R11**	**R12**	**R13**	**R14**	**AVG**
Excessive development cost	**4**	**1**	**8**	**9**	**4**	**6**	**5**	**6**	**8**	**9**	**4**	**9**	**4**	**5**	**5.9**
proval	**6**	**6**	**5**	**7**	**3**	**6**	**4**	**6**	**8**	**9**	**3**	**9**	**6**	**7**	**6.1**
Use of technology	**6**	**6**	**8**	**8**	**9**	**7**	**6**	**7**	**7**	**8**	**9**	**8**	**4**	**6**	**7.1**
Changes in design during construction	**6**	**5**	**7**	**8**	**5**	**4**	**6**	**4**	**8**	**6**	**5**	**6**	**7**	**6**	**5.9**
Cost-overrun risks	**7**	**1**	**6**	**8**	**9**	**5**	**6**	**5**	**8**	**6**	**9**	**6**	**6**	**7**	**6.4**
Performance related risk	**7**	**6**	**4**	**8**	**5**	**5**	**7**	**5**	**8**	**4**	**5**	**4**	**4**	**6**	**5.6**
Unavailability of power supply	**7**	**5**	**4**	**8**	**8**	**6**	**7**	**6**	**8**	**7**	**8**	**7**	**5**	**5**	**6.5**
Error in operation and maintenance cost estimate	**4**	**1**	**4**	**7**	**1**	**6**	**7**	**6**	**8**	**6**	**1**	**6**	**6**	**7**	**5.0**
Unavailability and quality of personnel to operate the facility	**5**	**5**	**4**	**8**	**5**	**6**	**4**	**6**	**7**	**7**	**5**	**6**	**3**	**7**	**5.6**
Inappropriate operating methods	**5**	**1**	**3**	**8**	**5**	**6**	**5**	**6**	**8**	**6**	**5**	**6**	**7**	**7**	**5.6**

Table 6-12 Risk Attributes Performance Level point N in the Performance Scale

Risk Factors, (Attributes)	Average	STD	AVE+STDV	AVE-STDV
Government instability	5.79	2.39	8.18	3.39
Government failure to provide permits	6.36	2.27	8.63	4.08
Non-existence of the legal and regulatory system	6.21	2.67	8.88	3.55
Outbreak of hostilities (wars, riots, and terrorism)	5.79	1.37	7.15	4.42
Changes on general legislation affects the project	6.21	1.48	7.69	4.74
Lack of commitment to concession contracts	4.64	2.17	6.81	2.47
Failure to raise finance	6.07	2.16	8.24	3.91
Undeveloped general business environment	5.86	1.66	7.51	4.20
Failure to receive revenues from principal (end user)	5.79	1.85	7.63	3.94
Changes in demand of the facility over concession period	5.14	1.99	7.14	3.15
Change in economic policies	5.86	2.28	8.14	3.57
Error in forecasting demands for service	5.43	1.65	7.08	3.78
Lack of experience	5.14	2.54	7.68	2.61
Lack of expertise	5.86	2.57	8.42	3.29
Lack of independent management	5.36	2.17	7.53	3.19
Changes in project specifications	5.57	2.50	8.07	3.07

Expensive and long tendering process	5.71	1.68	7.40	4.03
Lack of integrity on the (tendering process)	6.29	1.14	7.42	5.15
Excessive development cost	5.86	2.44	8.30	3.41
Delays in design approval	6.07	1.90	7.97	4.17
Use of technology	7.07	1.38	8.46	5.69
Changes in design during construction	5.93	1.27	7.20	4.66
Cost-overrun risks	6.36	2.02	8.38	4.33
Performance related risk	5.57	1.45	7.02	4.12
Unavailability of power supply	6.50	1.34	7.84	5.16
Error in operation and maintenance cost estimate	5.00	2.42	7.42	2.58
Unavailability and quality of personnel to operate the facility	5.57	1.40	6.97	4.17
Inappropriate operating methods	5.57	1.87	7.44	3.70

Table 6-13 Average Composite Weight of Each Risk Factor and Standard Deviation

6.5 Chapter Summary

This chapter has described the processes used for the Pairwise comparisons to prioritize the Risk Factors into descending order of importance within each Risk Category that will be used in the BOT Risk Management Framework. The research into the structure of the BOT Risk Management Framework describes the complexities associated with the practices used in BOT infrastructure projects. It also presents a clearly defined technique to prioritize Risk Categories and their Risk Factors which can be used to evaluate alternative risk decisions by means of "Expert Choice" software that uses Analytical Hierarchal Process, AHP method.

The size of any infrastructure project is too complex to make an informed risk analysis without the use of computers and vast experience. According to Al-Bahar and Crandell (1990) people involved in large scale infrastructure projects have a difficulty of understanding the magnitude of risk. Furthermore, the perception and importance of "risk" is different to different people associated with the same project, states Kogan and Wallach (1964) and the role a person plays in a project has a direct effect on their perception/importance of risk. With reference to fig. 6.2, "Government Failure to provide Permits", Changes in Demand of the facility over concession period" & "Change in project specifications" are much more important to the private sector, represented by the upper value in each respective bar, than to the Public Sector, represented by the lower value in each respective bar.

It is intended that, for many risk decisions, the approach used within the Risk Management Framework, will provide a systematic and practical aid for decision-makers in BOT project risks.

In the next chapter, the BOT Risk Management Framework will be tested using three case studies with the intention of demonstrating its' potential use when examining and evaluating risks in BOT infrastructure projects.

Chapter 7 Framework Validation

The benefits of the proposed risk Management Framework need to be demonstrated and evaluated in order to prove that the Framework can be applied by anyone involved in BOT Infrastructure projects. According to Adler and Winograd (1992) the main consideration as to whether a design will be effective, is its usability. It is therefore important to evaluate the proposed Framework in order to achieve the research objectives. Previous Frameworks which have been developed to assist any parties involved with the risk evaluation process, have mostly been designed to be explanatory, or guidance models, and may be difficult to implement in practice. The applicability and usability of the proposed Risk Management Framework will be assessed and feedback provided.

The purpose of the Frameworking procedure is to extract information from reality. It is important that the Framework provides comprehensive, reliable information. A serious shortcoming in many Frameworks is due to the lack of attention given to the validation phase of Framework development. Validation is extremely important, as it attempts to develop a rigorous and practical approach for the testing and future development of the Framework. As Creswell (2003) states it is important that developers describe the steps they will take in their studies, so that the accuracy and credibility of their findings can be checked. Framework validation is a major stage in the sequence of Framework building. This research uses validation and experts' opinions in order to provide an assessment of the validity of the BOT Risk Management Framework.

Mutti (2004) commented on the idea that the purpose of the Framework validation is not to prove whether it is true or false, but rather to concentrate on the degree of confirmation of the particular Framework. If more positive results are achieved in relation to the Framework, then confidence in the Framework should grow. One of the best ways for validation of the Framework could be to use it for case study for evaluation. However, it is not always practicable for implementation of the Framework to test the results. High costs and time constraints may be limiting factors for the completion of validation studies. The next section describes the validation process of the BOT Risk Management Framework.

This process aims to deliver a reliable and acceptable Framework which has been validated for use in the risk management process.

7.1 Attributes worth scores and the framework validation approach

It was Diaz and Ioannou (1996) who stated that, due to multi-attribute decision models being essentially subjective in nature, it is difficult to use external criteria to assess the validity of evaluation models objectively. For this reason, previous researchers have used indirect approaches, such as convergent validation, predictive validation and axiomatic validation. Convergent validation involves comparing the results obtained by a multi-attribute decision model with holistic evaluations made by the decision makers(s). For this approach, several alternative projects are defined and then evaluations based using the Framework and on the decision maker's judgments, are compared regarding how they rate and/or rank the alternatives. If there is good correlation between the decomposed Framework and the holistic evaluation, then it can be verified that the Framework meets the decision maker's requirements. A convergent validation approach was used in this research to validate the Risk Management Framework.

Three existing BOT projects, (the Channel Tunnel Project in the UK, the Sulaibiya Waste Water Plant in Kuwait and the Marsa Allam Airport in Egypt), were described and presented to the expert participants. The expert participants evaluated the twenty eight Risk Factors within each Risk Category twice.

Firstly, on a scale of 1 – 9, (for the P2 = 100 approach), with respect to the "Performance Level", i.e. how desirable a Risk Factor is, (or is not), within its' Risk Category; (1 is "Extremely Undesirable, and 9 is Extremely Desirable).

Therefore:

1. Determine the Relative Importance of each Risk Factor with respect to the other Risk Factors, (Appendix B).

   Within the same Group Category, the participants initially compared Risk Factors to other Risk Factors to determine the relative importance of each Risk Factor compared to the other Risk Factors.

2. Determine the Relative Importance of each Group Category with respect to the other Group Categories, (Appendix B).

   The participants then compared each Group Categories to the other Group Categories to determine the relative importance of each Group Category with respect to the others.

3. Risk Category Performance Level section of the questionnaire indicates the level of "requirement" for each of the Group Risk Categories, (Appendix B, Part II, Table 1):
   a) The value in the top row is the "minimum preferred" level of performance
   b) The values in the second row are "worst" experience of performance and the "best" experience of performance encountered by the participants.

4. Risk Factors Performance Level section of the questionnaire indicates the level of performance towards the Project Risk Categories, (Table 2, p 340 to 343):
   a) The value in the top row is the "minimum preferred" level of performance.
   b) The values in the second row are "worst" experience of performance and the "best" experience of performance encountered by the participants.

5. The results of the questionnaires were carefully input into "Expert Choice 2000" AHP Software package for analysis and shown in Tables 7-2 to Table 7-10.
   a) The into "Expert Choice 2000" AHP Software calculated the "weights" between each Group Category, (Section 6.2.1.2), Group Weights for Five Risk Categories,
   b) The into "Expert Choice 2000" AHP Software calculated the "weights" for each Risk Category, (Section 6.2.1.3), Local Weights for Risk Factors.

Secondly, the respondents completed a questionnaire using "Holistic Evaluation" which was in two parts.

In Part 1, the respondents were required to evaluate the performance level or "quality", (on a scale of 1 – 9), for each Risk Category and Risk Factor using their expertise and knowledge of the three projects. (Number 9 was of the Highest quality and excellent performance and number 1 is poor.)

In Part 2, the respondents were asked to assign a “weight” value, ”, (on a scale of 1 – 10), to each Risk Category and Risk Factor to determine the level of influence and/or importance of each Risk. (Where a value of 1 = 10%, therefore the respondent indicates that this risk Factor has a very low priority in their opinion, (and in their present job function), for the case study project).

As the questionnaire was completed by Kuwaiti respondents, the author believes that the replies represent the Kuwaiti perspective to Risk evaluation. Indicating that if the respondents to the same questionnaire were from a different country, and in a different country, the results, once analyzed, would be characteristically different to the Kuwaiti results.

In Table 7-1, the average risk Factor performance level for each of the three project profiles can be seen in the following tables: Table 7-2, Channel Tunnel, (UK, and France); Table 7-3, Marsa Allam Airport, (Egypt) and Table 7-4, Sulaibiya Waste Water Treatment plant, (Kuwait), which demonstrate the performance levels for the three case studies.

The decomposed evaluation approach, (P2=100), was used to calculate the "worth score" for each project profile as shown in Tables 7-5,7-6 and 7-7, to establish the best approach to attaining a holistic evaluation.

7.1.1 P2 = 100 Approach

For this approach, the P1 value is always equal to zero, based on the logical assumption that all of the framework decision factors, (attributes), are important and will have some impact on the project risk. Their performance level, P, must therefore be considered in the evaluation, (even for very small performance values where $P \leq P1$), whilst the P2 value is always equal to 9, (the extremely desirable point on the performance scale). The value curve will therefore extend from the origin to the extreme point of extremely desirable. See Figure 4-6. Tables showing the average Risk Factor performance level: Table 7-2 Channel Tunnel, (UK, France); Table 7-3, Marsa Allam Airport, (Egypt); and Table 7-4, Sulaibiya

Waste Water Treatment plant, (Kuwait).Tables using P2=100 showing Individual "worth score" are below Table 7-5, Channel Tunnel, (UK, France); Table 7-6 Marsa Allam Airport, (Egypt); and Table 7-7, Sulaibiya Waste Water Treatment plant, (Kuwait).

Attribute	Project		
	Sulaibiya waste water plant	Marsa Allam	Channel Tunnel
Country Risk (Political & Regulatory)	**8.1**	**6.4**	**5.21**
Government instability	5.6	6.1	7.57
Government failure to provide permits	7.4	7.2	7.29
Non-existence of the legal and regulatory system	6.3	5.9	5.14
Outbreak of hostilities (wars, riots, and terrorism)	7.2	7.6	6.29
Changes in general legislation affecting the project	6.9	7.1	6.43
Lack of commitment to concession contracts	7.0	7.3	5.43
Financial & Revenue Risks	**5.6**	**7.9**	**5.71**
Failure to raise finance	6.9	7.1	6.00
Undeveloped general business environment	5.1	8.0	8.07
Failure to receive revenues from principal (end user)	6.4	7.1	6.43
Changes in demand for the facility over concession period	7.7	7.7	6.93
Change in economic policies	6.1	6.1	6.07
Error in forecasting demands for service	6.1	5.9	6.71
Promoting &* Procurement *Risks	**5.8**	**5.6**	**6.71**
Lack of experience	6.0	5.8	5.00
Lack of expertise	5.6	6.9	4.64
Lack of independent management	4.8	7.6	6.93
Changes in project specifications	6.4	5.6	7.50
Expensive and long tendering process	7.0	5.1	8.14
Lack of integrity in the (tendering process)	7.4	5.2	7.93
Development Risks	**5.0**	**5.9**	**8.00**
Excessive development cost	4.4	5.0	7.43
Delays in design approval	7.4	6.6	6.64
Use of technology	5.0	6.2	4.79
Changes in design during construction	5.1	5.6	6.21
Construction & Operating Risk	**6.9**	**7.0**	**6.71**
Cost-overrun risks	7.4	7.0	7.57
Performance related risk	8.1	6.4	5.21
Unavailability of power supply	5.6	6.1	7.57
Error in operation and maintenance cost estimate	7.4	7.2	7.29
Unavailability and quality of personnel to operate the facility	6.3	5.9	5.14
Inappropriate operating methods	7.2	7.6	6.29

Table 7-1 Average Performance Level for Project Profiles

Performance Level Channel Tunnel	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
Government instability	1	1	4	1	4	5	4	7	3	6	7	5	6	5
Government failure to provide permits necessary for construction, maintenance, and operation of the project	4	2	6	4	7	6	7	8	6	5	6	4	5	6
Non-existence of the legal and regulatory system that enforces contracts and provides a framework to resolve disputes	2	2	7	2	5	5	5	7	5	7	5	6	8	6
Outbreak of hostilities (wars, riots, and terrorism)	1	5	8	1	4	5	4	3	3	3	7	2	7	9
Changes in general legislation affecting the project	1	4	3	1	6	5	4	3	3	5	6	3	9	6
Lack of commitment to concession contracts	1	3	4	1	7	7	4	5	2	3	9	2	6	5
Failure to raise finance	1	2	4	1	4	4	4	6	4	2	8	1	8	6
Undeveloped general business environment	1	3	7	1	3	4	4	6	5	5	6	3	6	3
Failure to receive revenues from end user	1	3	3	1	2	6	4	8	6	7	5	6	7	4
Changes in demand for the product or the facility over concession period due to economic downturns or competing facilities.	4	1	2	4	7	4	7	2	6	5	5	4	7	2
Change in economic policies	3	1	4	3	6	2	6	4	5	6	5	5	7	4
Error in forecasting demands for service	3	3	5	3	6	2	6	4	5	8	6	7	9	1
Lack of experience	8	1	7	8	5	5	5	7	6	9	8	8	9	8
Lack of expertise	8	1	6	8	5	7	5	5	9	9	8	8	8	8
Lack of independent management	8	1	8	8	5	8	5	6	6	9	8	8	6	8
Changes in project specifications	7	4	2	7	4	5	4	8	5	5	6	4	6	7
Expensive and long tendering process	4	4	3	5	8	2	8	6	7	3	5	2	9	6
Lack of integrity in the tendering process	1	2	4	1	4	5	4	8	3	7	5	6	8	5
Excessive development cost	7	4	2	7	4	2	3	4	9	8	7	7	7	8
Delays in design approval	3	4	4	8	5	4	5	6	6	8	8	7	8	8
Use of technology that may be proving economically or structurally non-viable	3	8	6	3	7	4	6	2	5	5	3	4	7	6
Changes in design during construction	3	4	6	3	7	4	6	8	5	8	3	6	7	8
Cost-overrun risks	9	3	6	9	6	4	6	9	7	8	9	6	8	7
Performance related risk	7	2	6	7	4	6	4	3	9	6	7	5	7	7

Performance Level Channel Tunnel	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
Unavailability of power supply	7	1	6	7	4	2	4	5	2	6	7	5	7	9
Error in operation and maintenance cost estimate	5	2	7	5	8	5	8	8	3	4	5	3	9	8
Unavailability and quality of personnel to operate the facility	6	2	7	6	9	5	9	7	4	8	6	7	7	9
Inappropriate operating methods	5	2	7	5	5	5	8	6	7	5	5	4	9	9

Table 7-2 Individual's Attributes Performance Level for Each Project Profile

Performance level Marsa Allam	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
Government instability	3	2	5	4	3	6	6	8	5	7	5	6	6	8
Government failure to provide permits necessary for construction, maintenance, and operation of the project	2	3	6	3	2	3	5	5	4	6	7	5	8	7
Non-existence of the legal and regulatory system that enforces contracts and provides a framework to resolve disputes	1	3	5	2	1	6	4	8	2	7	5	6	7	7
Outbreak of hostilities (wars, riots, and terrorism)	1	2	9	2	1	5	4	7	2	4	8	3	6	8
Changes in general legislation affecting the project	1	6	3	3	1	5	4	7	2	7	6	6	7	8
Lack of commitment to concession contracts	2	3	5	4	2	3	5	5	4	3	6	2	7	7
Failure to raise finance	3	2	6	5	3	4	6	6	5	7	3	6	8	6
Undeveloped general business environment	2	1	5	6	2	8	5	6	4	5	5	4	7	5
Failure to receive revenues from end user	3	3	4	7	3	3	6	5	5	7	7	6	7	4
Changes in demand for the product or the facility over concession period	4	1	4	6	4	8	7	6	6	7	8	6	7	4
Change in economic policies	5	1	4	7	5	6	8	8	7	7	5	6	6	5
Error in forecasting demands for service	5	3	4	8	5	8	8	6	7	5	7	4	7	3
Lack of experience	5	1	4	6	5	4	8	6	8	9	3	8	8	7
Lack of expertise	5	1	4	4	5	4	8	6	8	9	3	8	8	7
Lack of independent management	3	1	4	2	3	2	6	4	5	9	3	8	6	8
Changes in project specifications	3	1	5	2	3	2	6	4	5	6	6	5	6	6
Expensive and long tendering process	2	3	4	3	2	7	5	9	6	4	7	3	8	6
Lack of integrity in the (tendering process)	3	2	4	4	3	8	6	6	5	5	8	4	9	4
Excessive development cost	7	4	4	6	7	8	4	6	9	8	7	7	8	8
Delays in design approval	5	5	3	7	5	2	8	4	7	8	5	7	7	8
Use of technology that may be proving economically or structurally non-viable	4	7	5	5	4	4	7	6	6	7	4	6	7	4

Performance level Marsa Allam	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
Changes in design during construction	4	4	6	6	4	4	7	6	6	8	4	7	7	7
Cost-overrun risks	5	5	6	7	5	5	8	7	7	8	5	7	8	6
Performance related risk	4	4	6	6	4	2	8	4	6	7	4	6	8	6
Unavailability of power supply	4	1	6	8	4	6	8	8	6	7	4	6	7	9
Error in operation and maintenance cost estimate	4	3	6	2	4	4	8	6	6	5	4	4	8	6
Unavailability and quality of personnel to operate the facility	6	2	8	8	6	5	9	7	8	8	6	7	8	8
Inappropriate operating methods	5	2	9	9	5	4	8	6	7	6	5	5	8	8

Table 7-3 Individual’s Attributes Performance Level for Each Project Profile

Performance Level Sulaibiya Wastewater Treatment Plant	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10	R 11	R 12	R 13	R 14
Government instability	2	2	3	4	3	5	4	6	6	5	5	7	6	8
Government failure to provide permits necessary for construction, maintenance, and operation	2	6	2	4	3	4	4	5	6	4	7	6	7	8
Non-existence of the legal and regulatory system that enforces contracts	4	2	1	6	5	7	6	8	7	7	6	9	8	5
Outbreak of hostilities (wars, riots, and terrorism)	4	2	4	6	6	5	6	6	7	2	8	4	6	7
Changes in general legislation affecting the project	1	4	5	3	5	6	2	7	4	8	8	6	8	5
Lack of commitment to concession contracts	1	6	5	3	4	5	2	6	4	3	9	5	6	8
Failure to raise finance	1	5	5	3	3	4	5	5	3	6	3	8	8	2
Undeveloped general business environment	1	6	6	5	3	4	5	5	3	5	9	7	7	2
Failure to receive revenues from end user	1	9	6	5	4	5	5	6	4	7	5	9	6	2
Changes in demand for the product or the facility over concession period	1	1	6	5	5	5	2	6	2	2	6	4	6	1
Change in economic policies	5	1	7	8	6	7	7	8	8	5	6	7	8	2
Error in forecasting demands for service	1	8	6	4	2	5	2	6	7	8	6	6	7	1
Lack of experience	4	3	6	7	5	5	6	6	6	9	9	7	6	7
Lack of expertise	4	1	6	7	5	5	6	6	7	9	9	7	6	7
Lack of independent management	4	1	6	7	5	5	6	9	5	9	6	6	8	6
Changes in project specifications	5	3	6	8	6	9	7	5	7	8	9	5	7	7
Expensive and long tendering process	6	3	7	9	7	4	8	7	4	2	5	4	9	6
Lack of integrity in the (tendering process)	2	1	8	7	3	1	4	8	3	8	6	6	9	4
Excessive development cost	7	6	2	9	8	5	9	2	5	8	7	6	8	6
Delays in design approval	4	5	6	6	5	5	9	3	8	8	4	5	8	6
Use of technology that may be proving economically or structurally non-viable	7	9	7	9	8	6	8	8	5	9	7	7	7	4

Performance Level Sulaibiya Wastewater Treatment Plant	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10	R 11	R 12	R 13	R 14
Changes in design during construction	7	3	6	9	8	4	6	6	5	8	7	5	8	5
Cost-overrun risks	6	3	5	7	7	4	7	7	8	8	6	6	8	3
Performance related risk	8	2	4	6	9	7	6	9	7	5	8	7	6	4
Unavailability of power supply	8	1	3	5	9	4	6	2	7	5	8	3	8	9
Error in operation and maintenance cost estimate	9	3	2	7	8	5	7	3	8	2	9	5	8	6
Unavailability and quality of personnel to operate the facility	7	6	4	9	8	6	9	9	3	8	7	6	8	6
Inappropriate operating methods	7	2	6	6	9	4	9	7	2	7	7	9	9	6

Table 7-4 Individual’s Attributes Performance Level for Each Project Profile

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
Government instability	**11.11**	**11.11**	**44.44**	**11.11**	**44.44**	**55.56**	**44.44**	**77.78**	**33.33**	**66.67**	**77.78**	**55.56**	**66.67**	**55.56**
Government failure to provide permits	**44.44**	**22.22**	**66.67**	**44.44**	**77.78**	**66.67**	**77.78**	**88.89**	**66.67**	**55.56**	**66.67**	**44.44**	**55.56**	**66.67**
Non-existence of the legal and regulatory system	**22.22**	**22.22**	**77.78**	**22.22**	**55.56**	**55.56**	**55.56**	**77.78**	**55.56**	**77.78**	**55.56**	**66.67**	**88.89**	**66.67**
Outbreak of hostilities (wars, riots, and terrorism)	**11.11**	**55.56**	**88.89**	**11.11**	**44.44**	**55.56**	**44.44**	**33.33**	**33.33**	**33.33**	**77.78**	**22.22**	**77.78**	**100.00**
Changes in general legislation affecting the project	**11.11**	**44.44**	**33.33**	**11.11**	**66.67**	**55.56**	**44.44**	**33.33**	**33.33**	**55.56**	**66.67**	**33.33**	**100.00**	**66.67**
Lack of commitment to concession contracts	**11.11**	**33.33**	**44.44**	**11.11**	**77.78**	**77.78**	**44.44**	**55.56**	**22.22**	**33.33**	**100.00**	**22.22**	**66.67**	**55.56**
Failure to raise finance	**11.11**	**22.22**	**44.44**	**11.11**	**44.44**	**44.44**	**44.44**	**66.67**	**44.44**	**22.22**	**88.89**	**11.11**	**88.89**	**66.67**
Undeveloped general business environment	**11.11**	**33.33**	**77.78**	**11.11**	**33.33**	**44.44**	**44.44**	**66.67**	**55.56**	**55.56**	**66.67**	**33.33**	**66.67**	**33.33**
Failure to receive revenues from principal (end user)	**11.11**	**33.33**	**33.33**	**11.11**	**22.22**	**66.67**	**44.44**	**88.89**	**66.67**	**77.78**	**55.56**	**66.67**	**77.78**	**44.44**
Changes in demand of the facility over concession period	**44.44**	**11.11**	**22.22**	**44.44**	**77.78**	**44.44**	**77.78**	**22.22**	**66.67**	**55.56**	**55.56**	**44.44**	**77.78**	**22.22**
Change in economic policies	**33.33**	**11.11**	**44.44**	**33.33**	**66.67**	**22.22**	**66.67**	**44.44**	**55.56**	**66.67**	**55.56**	**55.56**	**77.78**	**44.44**
Error in forecasting demands for service	**33.33**	**33.33**	**55.56**	**33.33**	**66.67**	**22.22**	**66.67**	**44.44**	**55.56**	**88.89**	**66.67**	**77.78**	**100.00**	**11.11**
Lack of experience	**88.89**	**11.11**	**77.78**	**88.89**	**55.56**	**55.56**	**55.56**	**77.78**	**66.67**	**100.00**	**88.89**	**88.89**	**100.00**	**88.89**
Lack of expertise	**88.89**	**11.11**	**66.67**	**88.89**	**55.56**	**77.78**	**55.56**	**55.56**	**100.00**	**100.00**	**88.89**	**88.89**	**88.89**	**88.89**
Lack of independent management	**88.89**	**11.11**	**88.89**	**88.89**	**55.56**	**88.89**	**55.56**	**66.67**	**66.67**	**100.00**	**88.89**	**88.89**	**66.67**	**88.89**
Changes in project specifications	**77.78**	**44.44**	**22.22**	**77.78**	**44.44**	**55.56**	**44.44**	**88.89**	**55.56**	**55.56**	**66.67**	**44.44**	**66.67**	**77.78**
Expensive and long tendering process	**44.44**	**44.44**	**33.33**	**55.56**	**88.89**	**22.22**	**88.89**	**66.67**	**77.78**	**33.33**	**55.56**	**22.22**	**100.00**	**66.67**

Lack of integrity in the (tendering process)	**11.11**	**22.22**	**44.44**	**11.11**	**44.44**	**55.56**	**44.44**	**88.89**	**33.33**	**77.78**	**55.56**	**66.67**	**88.89**	**55.56**
Excessive development cost	**77.78**	**44.44**	**22.22**	**77.78**	**44.44**	**22.22**	**33.33**	**44.44**	**100.00**	**88.89**	**77.78**	**77.78**	**77.78**	**88.89**
Delays in design approval	**33.33**	**44.44**	**44.44**	**88.89**	**55.56**	**44.44**	**55.56**	**66.67**	**66.67**	**88.89**	**88.89**	**77.78**	**88.89**	**88.89**
Use of technology	**33.33**	**88.89**	**66.67**	**33.33**	**77.78**	**44.44**	**66.67**	**22.22**	**55.56**	**55.56**	**33.33**	**44.44**	**77.78**	**66.67**
Changes in design during construction	**33.33**	**44.44**	**66.67**	**33.33**	**77.78**	**44.44**	**66.67**	**88.89**	**55.56**	**88.89**	**33.33**	**66.67**	**77.78**	**88.89**
Cost-overrun risks	**100.00**	**33.33**	**66.67**	**100.0**	**66.67**	**44.44**	**66.67**	**100.0**	**77.78**	**88.89**	**100.00**	**66.67**	**88.89**	**77.78**
Performance related risk	**77.78**	**22.22**	**66.67**	**77.78**	**44.44**	**66.67**	**44.44**	**33.33**	**100.00**	**66.67**	**77.78**	**55.56**	**77.78**	**77.78**
Unavailability of power supply	**77.78**	**11.11**	**66.67**	**77.78**	**44.44**	**22.22**	**44.44**	**55.56**	**22.22**	**66.67**	**77.78**	**55.56**	**77.78**	**100.00**
Error in operation and maintenance cost estimate	**55.56**	**22.22**	**77.78**	**55.56**	**88.89**	**55.56**	**88.89**	**88.89**	**33.33**	**44.44**	**55.56**	**33.33**	**100.0**	**88.89**
Unavailability and quality of personnel to operate the facility	**66.67**	**22.22**	**77.78**	**66.67**	**100.00**	**55.56**	**100.00**	**77.78**	**44.44**	**88.89**	**66.67**	**77.78**	**77.78**	**100.00**
Inappropriate operating methods	**55.56**	**22.22**	**77.78**	**55.56**	**55.56**	**55.56**	**88.89**	**66.67**	**77.78**	**55.56**	**55.56**	**44.44**	**100.0**	**100.00**

Table 7-5 Individual’s Attributes worth Values Vi (Xi) for Channel Tunnel Profile Using ‘P2 =100 Approach’

	R1	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**	**R10**	**R11**	**R12**	**R13**	**R14**
	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	*Vi(xi)*
Government instability	**22,222**	**22,222**	**33,33**	**44,444**	**22,222**	**55,556**	**44,444**	**66,667**	**66,66**	**55,556**	**55,556**	**77,778**	**55,556**	**88,889**
Government failure to provide permits	**22,222**	**66,667**	**22,22**	**44,444**	**22,222**	**44,444**	**44,444**	**55,556**	**66,66**	**44,444**	**77,778**	**66,667**	**44,444**	**88,889**
Non-existence of the legal and regulatory system	**44,444**	**22,222**	**11,11**	**66,667**	**44,444**	**77,778**	**66,667**	**88,889**	**77,77**	**77,778**	**66,667**	**100,00**	**77,778**	**55,556**
Outbreak of hostilities (wars, riots, and terrorism)	**44,444**	**22,222**	**44,44**	**66,667**	**44,444**	**55,556**	**66,667**	**66,667**	**77,77**	**22,222**	**88,889**	**44,444**	**22,222**	**77,778**
Changes in general legislation affecting the project	**11,111**	**44,444**	**55,55**	**33,333**	**11,111**	**66,667**	**22,222**	**77,778**	**44,44**	**88,889**	**88,889**	**66,667**	**88,889**	**55,556**
Lack of commitment to concession contracts	**11,111**	**66,667**	**55,55**	**33,333**	**11,111**	**55,556**	**22,222**	**66,667**	**44,44**	**33,333**	**100,000**	**55,556**	**33,333**	**88,889**
Failure to raise finance	**11,111**	**55,556**	**55,55**	**33,333**	**11,111**	**44,444**	**55,556**	**55,556**	**33,33**	**66,667**	**33,333**	**88,889**	**66,667**	**22,222**
Undeveloped general business environment	**11,111**	**66,667**	**66,66**	**55,556**	**11,111**	**44,444**	**55,556**	**55,556**	**33,33**	**55,556**	**100,00**	**77,778**	**55,556**	**22,222**
Failure to receive revenues from principal (end user)	**11,111**	**100,00**	**66,66**	**55,556**	**11,111**	**55,556**	**55,556**	**66,667**	**44,44**	**77,778**	**55,556**	**100,00**	**77,778**	**22,222**
Changes in demand for the facility over concession period	**11,111**	**11,111**	**66,66**	**55,556**	**11,111**	**55,556**	**22,222**	**66,667**	**22,22**	**22,222**	**66,667**	**44,444**	**22,222**	**11,111**
Change in economic policies	**55,556**	**11,111**	**77,77**	**88,889**	**55,556**	**77,778**	**77,778**	**88,889**	**88,88**	**55,556**	**66,667**	**77,778**	**55,556**	**22,222**
Error in forecasting demands for service	**11,111**	**88,889**	**66,66**	**44,444**	**11,111**	**55,556**	**22,222**	**66,667**	**77,77**	**88,889**	**66,667**	**66,667**	**88,889**	**11,111**
Lack of experience	**44,444**	**33,333**	**66,66**	**77,778**	**44,444**	**55,556**	**66,667**	**66,667**	**66,66**	**100,00**	**100,00**	**77,778**	**100,00**	**77,778**
Lack of expertise	**44,444**	**11,111**	**66,66**	**77,778**	**44,444**	**55,556**	**66,667**	**66,667**	**77,78**	**100,00**	**100,00**	**77,778**	**100,00**	**77,778**

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$Vi(xi)$
Lack of independent management	**44,444**	**11,111**	**66,66**	**88,889**	**44,444**	**55,556**	**66,667**	**100,00**	**55,55**	**100,00**	**66,667**	**66,667**	**100,00**	**66,667**
Changes in project specifications	**55,556**	**33,333**	**66,66**	**100,00**	**55,556**	**100,00**	**77,778**	**55,556**	**77,77**	**88,889**	**100,00**	**55,556**	**88,889**	**77,778**
Expensive and long tendering process	**66,667**	**33,333**	**77,77**	**77,778**	**66,667**	**44,444**	**88,889**	**77,778**	**44,44**	**22,222**	**55,556**	**44,444**	**22,222**	**66,667**
Lack of integrity in the (tendering process)	**22,222**	**11,111**	**88,88**	**100,00**	**22,222**	**11,111**	**44,444**	**88,889**	**33,33**	**88,889**	**66,667**	**66,667**	**88,889**	**44,444**
Excessive development cost	**77,778**	**66,667**	**22,22**	**66,667**	**77,778**	**55,556**	**100,00**	**22,222**	**55,55**	**88,889**	**77,778**	**66,667**	**88,889**	**66,667**
Delays in design approval	**44,444**	**55,556**	**66,66**	**100,00**	**44,444**	**55,556**	**100,00**	**33,333**	**88,88**	**88,889**	**44,444**	**55,556**	**88,889**	**66,667**
Use of technology	**77,778**	**100,00**	**77,77**	**100,00**	**77,778**	**66,667**	**88,889**	**88,889**	**55,55**	**100,00**	**77,778**	**77,778**	**100,00**	**44,444**
Changes in design during construction	**77,778**	**33,333**	**66,66**	**77,778**	**77,778**	**44,444**	**66,667**	**66,667**	**55,55**	**88,889**	**77,778**	**55,556**	**88,889**	**55,556**
Cost-overrun risks	**66,667**	**33,333**	**55,55**	**66,667**	**66,667**	**44,444**	**77,778**	**77,778**	**88,88**	**88,889**	**66,667**	**66,667**	**88,889**	**33,333**
Performance related risk	**88,889**	**22,222**	**44,44**	**55,556**	**88,889**	**77,778**	**66,667**	**100,00**	**77,77**	**55,556**	**88,889**	**77,778**	**55,556**	**44,444**
Unavailability of power supply	**88,889**	**11,111**	**33,33**	**77,778**	**88,889**	**44,444**	**66,667**	**22,222**	**77,77**	**55,556**	**88,889**	**33,333**	**55,556**	**100,00**
Error in operation and maintenance cost estimate	**100,00**	**33,333**	**22,22**	**100,00**	**100,00**	**55,556**	**77,778**	**33,333**	**88,88**	**22,222**	**100,00**	**55,556**	**22,222**	**66,667**
Unavailability and quality of personnel to operate the facility	**77,778**	**66,667**	**44,44**	**100,00**	**77,778**	**66,667**	**100,00**	**100,00**	**33,33**	**88,889**	**77,778**	**66,667**	**88,889**	**66,667**
Inappropriate operating methods	**77,778**	**22,222**	**66,66**	**66,667**	**77,778**	**44,444**	**100,00**	**77,778**	**22,22**	**77,778**	**77,778**	**100,00**	**77,778**	**66,667**

Table 7-6 Individual's Attributes Vi Xi for Salybia P2=100 approach

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$
Government instability	**33.333**	**22.222**	**55.556**	**44.444**	**33.333**	**66.667**	**66.667**	**88.889**	**55.556**	**77.778**	**55.556**	**66.667**	**66.667**	**88.889**
Government failure to provide permits	**22.222**	**33.333**	**66.667**	**33.333**	**22.222**	**33.333**	**55.556**	**55.556**	**44.444**	**66.667**	**77.778**	**55.556**	**88.889**	**77.778**
Non-existence of the legal and regulatory system	**11.111**	**33.333**	**55.556**	**22.222**	**11.111**	**66.667**	**44.444**	**88.889**	**22.222**	**77.778**	**55.556**	**66.667**	**77.778**	**77.778**
Outbreak of hostilities (wars, riots, and terrorism)	**11.111**	**22.222**	**100.000**	**22.222**	**11.111**	**55.556**	**44.444**	**77.778**	**22.222**	**44.444**	**88.889**	**33.333**	**66.667**	**88.889**
Changes in general legislation affecting the project	**11.111**	**66.667**	**33.333**	**33.333**	**11.111**	**55.556**	**44.444**	**77.778**	**22.222**	**77.778**	**66.667**	**66.667**	**77.778**	**88.889**
Lack of commitment to concession contracts	**22.222**	**33.333**	**55.556**	**44.444**	**22.222**	**33.333**	**55.556**	**55.556**	**44.444**	**33.333**	**66.667**	**22.222**	**77.778**	**77.778**
Failure to raise finance	**33.333**	**22.222**	**66.667**	**55.556**	**33.333**	**44.444**	**66.667**	**66.667**	**55.556**	**77.778**	**33.333**	**66.667**	**88.889**	**66.667**
Undeveloped general business environment	**22.222**	**11.111**	**55.556**	**66.667**	**22.222**	**88.889**	**55.556**	**66.667**	**44.444**	**55.556**	**55.556**	**44.444**	**77.778**	**55.556**
Failure to receive revenues from principal (end user)	**33.333**	**33.333**	**44.444**	**77.778**	**33.333**	**33.333**	**66.667**	**55.556**	**55.556**	**77.778**	**77.778**	**66.667**	**77.778**	**44.444**
Changes in demand for the facility over concession period	**44.444**	**11.111**	**44.444**	**66.667**	**44.444**	**88.889**	**77.778**	**66.667**	**66.667**	**77.778**	**88.889**	**66.667**	**77.778**	**44.444**
Change in economic policies	**55.556**	**11.111**	**44.444**	**77.778**	**55.556**	**66.667**	**88.889**	**88.889**	**77.778**	**77.778**	**55.556**	**66.667**	**66.667**	**55.556**
Error in forecasting demands for service	**55.556**	**33.333**	**44.444**	**88.889**	**55.556**	**88.889**	**88.889**	**66.667**	**77.778**	**55.556**	**77.778**	**44.444**	**77.778**	**33.333**
Lack of experience	**55.556**	**11.111**	**44.444**	**66.667**	**55.556**	**44.444**	**88.889**	**66.667**	**88.889**	**100.000**	**33.333**	**88.889**	**88.889**	**77.778**
Lack of expertise	**55.556**	**11.111**	**44.444**	**44.444**	**55.556**	**44.444**	**88.889**	**66.667**	**88.889**	**100.000**	**33.333**	**88.889**	**88.889**	**77.778**
Lack of independent management	**33.333**	**11.111**	**44.444**	**22.222**	**33.333**	**22.222**	**66.667**	**44.444**	**55.556**	**100.000**	**33.333**	**88.889**	**66.667**	**88.889**

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$	$V_i(x_i)$
Changes in project specifications	33.333	11.111	55.556	22.222	33.333	22.222	66.667	44.444	55.556	66.667	66.667	55.556	66.667	66.667
Expensive and long tendering process	22.222	33.333	44.444	33.333	22.222	77.778	55.556	100.000	66.667	44.444	77.778	33.333	88.889	66.667
Lack of integrity in the (tendering process)	33.333	22.222	44.444	44.444	33.333	88.889	66.667	66.667	55.556	55.556	88.889	44.444	100.000	44.444
Excessive development cost	77.778	44.444	44.444	66.667	77.778	88.889	44.444	66.667	100.000	88.889	77.778	77.778	88.889	88.889
Delays in design approval	55.556	55.556	33.333	77.778	55.556	22.222	88.889	44.444	77.778	88.889	55.556	77.778	77.778	88.889
Use of technology	44.444	77.778	55.556	55.556	44.444	44.444	77.778	66.667	66.667	77.778	44.444	66.667	77.778	44.444
Changes in design during construction	44.444	44.444	66.667	66.667	44.444	44.444	77.778	66.667	66.667	88.889	44.444	77.778	77.778	77.778
Cost-overrun risks	55.556	55.556	66.667	77.778	55.556	55.556	88.889	77.778	77.778	88.889	55.556	77.778	88.889	66.667
Performance related risk	44.444	44.444	66.667	66.667	44.444	22.222	88.889	44.444	66.667	77.778	44.444	66.667	88.889	66.667
Unavailability of power supply	44.444	11.111	66.667	88.889	44.444	66.667	88.889	88.889	66.667	77.778	44.444	66.667	77.778	100.000
Error in operation and maintenance cost estimate	44.444	33.333	66.667	22.222	44.444	44.444	88.889	66.667	66.667	55.556	44.444	44.444	88.889	66.667
Unavailability and quality of personnel to operate the facility	66.667	22.222	88.889	88.889	66.667	55.556	100.000	77.778	88.889	88.889	66.667	77.778	88.889	88.889
Inappropriate operating methods	55.556	22.222	100.000	100.000	55.556	44.444	88.889	66.667	77.778	66.667	55.556	55.556	88.889	88.889

Table 7-7 Individual’s Attributes worth Values Vi (Xi) for Marsa Allam Profile Using ‘P2 =100 Approach’

Participation Towards Risks (1-10) Channel Tunnel

Risk Factors	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
Government instability	5	1	4	8	6	4	7	4	8	8	5	8	9	5
Government failure to provide permits necessary for construction, maintenance, and operation of the project	9	2	4	8	7	7	10	7	10	9	9	9	7	7
Non-existence of the legal and regulatory system that enforces contracts and provides a framework to resolve disputes	9	2	4	8	7	5	10	5	10	7	9	7	8	10
Outbreak of hostilities (wars, riots, and terrorism)	4	5	5	5	2	7	6	7	7	5	4	5	7	7
Changes on general legislation affects the project	7	4	5	8	5	5	9	5	9	7	7	7	7	6
Lack of commitment to concession contracts	7	3	4	8	5	7	9	7	9	7	7	7	7	6
Failure to raise finance	6	2	7	7	4	4	8	4	9	5	6	5	6	7
Undeveloped general business environment	6	3	7	7	4	4	8	4	9	7	6	7	8	4
Failure to receive revenues from end user	7	3	3	8	5	6	9	6	9	7	7	7	7	3
Changes in demand of the product or the facility over concession period due to economic downturns competing facilities.	10	1	10	9	8	6	8	6	7	8	10	8	9	5
Change in economic policies	9	1	10	10	7	2	10	2	6	5	9	5	8	3
Error in forecasting demands for service	9	3	9	8	7	2	10	2	6	8	9	8	7	4
Lack of experience	7	1	6	8	5	5	9	5	5	8	7	8	8	2
Lack of expertise	7	1	3	9	5	7	9	7	5	9	7	9	8	8
Lack of independent management	7	1	4	8	5	8	9	8	6	8	7	8	7	8
Changes in project specifications	3	4	5	5	1	5	6	5	8	8	3	8	8	9

Participation Towards Risks (1-10) Channel Tunnel

Risk Factors	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
Expensive and long tendering process	3	4	5	5	1	3	6	3	8	9	3	9	7	7
Lack of integrity on the (tendering process)	7	2	6	9	5	10	9	10	7	6	7	6	7	8
Excessive development cost	10	4	6	8	8	2	8	2	7	8	10	8	7	8
Delays in design approval	10	4	8	9	8	7	8	7	5	7	10	7	8	6
Use of technology that may be proving economically or structurally non-viable	10	8	7	9	8	4	8	4	6	7	10	7	9	5
Changes in design during construction	10	4	10	9	9	7	10	7	9	7	5	7	8	7
Cost-overrun risks	10	3	10	9	9	4	10	4	9	7	4	7	8	7
Performance related risk	7	2	7	8	5	6	9	6	7	8	6	8	6	9
Unavailability of power supply	3	1	3	5	1	4	5	4	8	9	5	9	9	8
Error in operation and maintenance cost estimate	6	2	6	8	4	5	8	5	9	7	7	7	10	8
Unavailability and quality of personnel to operate the facility	7	2	7	6	5	6	9	6	4	8	5	8	10	7
Inappropriate operating methods	8	2	8	8	6	10	10	10	7	7	5	7	8	9
Sum	203	75	173	217	152	152	237	152	209	206	189	206	218	183

Table 7-8 Participant's Value towards Risk for Channel Tunnel

Participation towards Risks (1-10) Sulaibiya wastewater plant (1-10)

Risk Factors	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
Government instability	10	2	3	8	9	8	7	8	5	8	7	8	6	8
Government failure to provide permits necessary for construction, maintenance, and operation of the project	5	6	4	3	9	4	6	4	7	9	6	9	5	5
Non-existence of the legal and regulatory system that enforces contracts and provides a framework to resolve disputes	9	2	4	7	5	7	10	7	6	7	8	7	7	7
Outbreak of hostilities (wars, riots, and terrorism)	7	2	4	5	8	6	8	6	6	8	6	8	5	5
Changes on general legislation affects the project	8	4	5	8	6	6	9	6	10	8	7	8	6	8
Lack of commitment to concession contracts	9	6	4	7	6	5	10	5	10	7	8	7	5	2
Failure to raise finance	9	5	7	7	8	4	10	4	10	8	10	8	4	2
Undeveloped general business environment	6	6	7	4	8	4	7	4	9	7	10	7	4	2
Failure to receive revenues from end user	8	9	4	8	6	5	4	5	10	8	10	8	7	1
Changes in demand of the product or the facility over concession period due to economic downturns competing facilities.	3	1	8	2	5	7	7	7	6	8	7	8	5	8
Change in economic policies	7	1	2	5	9	7	8	7	10	7	6	7	7	8
Error in forecasting demands for service	8	8	8	9	6	5	9	5	9	9	7	9	6	8
Lack of experience	6	3	6	4	8	5	7	5	9	7	8	7	6	8
Lack of expertise	6	1	6	4	8	5	7	5	9	9	5	9	5	7

Risk Factors	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
Lack of independent management	6	1	6	4	8	5	7	5	3	8	6	8	4	6
Changes in project specifications	5	3	6	3	7	9	6	9	8	7	5	7	6	5
Expensive and long tendering process	5	3	6	3	7	4	6	4	8	9	5	9	5	6
Lack of integrity on the (tendering process)	8	1	6	4	5	3	4	3	6	5	8	5	6	8
Excessive development cost	7	6	6	5	9	5	8	5	4	7	7	7	4	6
Delays in design approval	7	5	6	5	9	7	8	7	4	9	7	9	5	6
Use of technology that may be proving economically or structurally non-viable	9	9	6	8	7	5	10	5	6	6	6	6	7	4
Changes in design during construction	3	3	3	2	5	9	4	9	6	8	7	8	5	5
Cost-overrun risks	3	3	3	2	5	4	4	4	6	7	8	7	10	3
Performance related risk	9	2	9	10	7	7	10	7	7	8	6	8	10	4
Unavailability of power supply	3	1	3	6	5	5	4	5	6	9	5	9	10	9
Error in operation and maintenance cost estimate	3	3	3	6	5	5	4	5	6	8	6	8	10	9
Unavailability and quality of personnel to operate the facility	7	6	7	5	9	8	8	8	4	7	4	7	8	6
Inappropriate operating methods	9	2	9	8	9	7	10	7	6	7	4	7	8	7
Sum	185	104	151	152	198	161	202	161	196	215	189	215	176	163

Table 7-9 Participant’s Value towards Risk for Sulaibiya Waste Water Treatment Plant in Kuwait

Participation towards Risks (1-10) Marsa Allam

Risk Factors	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
Government instability	5	2	2	6	7	9	8	9	7	8	8	8	9	9
Government failure to provide permits necessary for construction, maintenance, and operation of the project	5	3	3	6	7	8	8	8	7	9	5	9	8	8
Non-existence of the legal and regulatory system that enforces contracts and provides a framework to resolve disputes	9	3	1	10	8	6	6	6	8	7	9	7	9	8
Outbreak of hostilities (wars, riots, and terrorism)	6	2	4	7	8	5	9	5	8	7	6	7	7	10
Changes on general legislation affects the project	9	6	6	10	8	5	6	5	7	8	9	8	7	8
Lack of commitment to concession contracts	9	3	6	10	9	3	6	3	7	7	9	7	9	8
Failure to raise finance	9	2	10	8	9	4	6	4	7	6	9	6	7	9
Undeveloped general business environment	9	1	7	8	9	8	6	8	7	9	9	9	9	6
Failure to receive revenues from end user	9	3	7	8	9	3	6	3	7	7	9	7	8	7
Changes in demand of the product or the facility over concession period due to economic downturns competing facilities.	9	1	7	8	9	9	6	9	7	8	9	8	9	7
Change in economic policies	9	1	5	8	7	6	6	6	6	6	9	6	8	7
Error in forecasting demands for service	9	3	5	8	7	8	6	8	7	7	9	7	8	8
Lack of experience	6	1	5	7	8	4	9	4	8	9	6	9	8	9
Lack of expertise	6	1	3	7	8	4	9	4	7	9	6	9	9	7
Lack of independent management	6	1	4	7	8	3	9	3	7	8	6	8	8	8

Risk Factors	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
Changes in project specifications	**6**	**1**	**5**	**7**	**6**	**2**	**9**	**2**	**8**	**9**	**6**	**9**	**9**	**8**
Expensive and long tendering process	**7**	**3**	**5**	**8**	**9**	**7**	**4**	**7**	**9**	**9**	**7**	**9**	**7**	**8**
Lack of integrity on the (tendering process)	**9**	**2**	**5**	**10**	**7**	**8**	**6**	**8**	**8**	**7**	**9**	**7**	**9**	**7**
Excessive development cost	**4**	**4**	**5**	**5**	**6**	**8**	**7**	**8**	**6**	**9**	**4**	**9**	**6**	**5**
Delays in design approval	**4**	**5**	**5**	**5**	**6**	**4**	**7**	**4**	**6**	**8**	**4**	**8**	**8**	**6**
Use of technology that may be proving economically or structurally non-viable	**4**	**7**	**5**	**5**	**6**	**4**	**7**	**4**	**6**	**7**	**4**	**7**	**8**	**7**
Changes in design during construction	**5**	**4**	**5**	**6**	**7**	**6**	**8**	**6**	**7**	**9**	**5**	**9**	**7**	**6**
Cost-overrun risks	**4**	**5**	**4**	**5**	**6**	**5**	**7**	**5**	**6**	**6**	**3**	**6**	**8**	**8**
Performance related risk	**8**	**4**	**8**	**9**	**10**	**2**	**5**	**2**	**7**	**8**	**4**	**8**	**8**	**8**
Unavailability of power supply	**5**	**1**	**5**	**6**	**7**	**8**	**8**	**8**	**9**	**9**	**5**	**9**	**8**	**9**
Error in operation and maintenance cost estimate	**5**	**3**	**5**	**6**	**8**	**4**	**8**	**4**	**9**	**8**	**6**	**8**	**10**	**6**
Unavailability and quality of personnel to operate the facility	**7**	**2**	**7**	**8**	**9**	**7**	**4**	**7**	**6**	**9**	**6**	**9**	**9**	**7**
Inappropriate operating methods	**7**	**2**	**7**	**7**	**9**	**7**	**4**	**7**	**6**	**9**	**6**	**9**	**8**	**8**
Sum	190	76	146	205	217	157	190	157	200	222	187	222	228	212

Table 7-10 Participant's Value towards Risk for Marsa Allam Airport in Egypt

7.2 Risk framework decision factors evaluation results

The proposed framework needs to be evaluated to demonstrate the usability of the framework to anyone who might consider employing it in their business practice. As Adler and Winograd (1992) point out usability is the main consideration as to whether a particular design will be effective in use. One of the most important stages in achieving the research objectives is the evaluation of the proposed framework. The evaluation will also supersede previous frameworks that have been designed as explanatory or guidance frameworks and would therefore be difficult to implement. The proposed framework will be evaluated to test its applicability and usability, and feedback provided.

The attributes contribution to the project risk can now be found for each approach by multiplying their "Worth scores", (Tables 7-5, 7-6 and 7-7), by their composite weights, (Table 8-1), and the total project value (index) will be the result of the decomposed evaluations according to equation (4-11).

The holistic evaluation is described below using respondent, R1, as an example:

For Sulaibiya Waste Water Treatment Plant the holistic evaluation was "44.26", and this is how it is calculated:

$$W_i = \frac{Respondent's, R1, evaluation\ of\ risk\ for\ \text{Government Instability}}{\sum of\ all\ participant's, R1, values\ towards\ all\ riskfactors}$$

$$W_i = \frac{10}{185} = 0.05406 \quad \text{[See Table 7-9]}$$

Next, $V_i\ X_i$, is calculated as a percentage from Table 7-4, Individual's Attributes Performance Level for Each Project Profile, for R1, the value for "Government Instability":

$$V_i\ X_i = \frac{Respondent's, R1, evaluation\ of\ risk\ for\ \text{Government Instability}}{Maximum\ Value\ allowed\ (=\ 9)} \times 100$$

$$V_i\ X_i = \frac{2}{9} \times 100 = 22.22\%$$

Next, $W_i \times V_i X_i$ is calculated,

$$W_i \times V_i X_i = 0.05406 \times 22.22 = 1.201$$

Where:

W_i is the Weighting" for Government Instability risk Factor as a decimal of the total sum of all Risk Factors.

$V_i X_i$ is the "weighting" using the Individual's Attributes Performance Level for Each Project Profile from Table 7-4, calculated as a percentage.

The above calculations were performed for each and every Risk Category/attritbute, (i.e. Government failure to provide permits…., Non existance of legal and regulatory system…., etc).

Finally, for respondent, R1, all of the values for $W_i \times V_i X_i$ are added together for the holistic evaluation.

The individual holistic evaluations and the decomposed evaluation by EM of the P2 = 100 approach for each project profile provided are shown in Tables: 7-11, 7-12 and 7-13. The average results of the project profiles decomposed evaluations for each of the respondents were calculated for the P2 = 100 approach and plotted against the average holistic evaluation; the results are given in Figure 7-1.

The group results of the holistic and decomposed evaluations for each project profile were calculated by taking the averages of the individual evaluations and the results are shown in Table 7-14. In order to validate the framework, the holistic and the decomposed evaluation were compared by Pearson's product moment correlation coefficient, (r), which is a measure of the correlation, (linear dependence), between two variables x and y, giving a value between +1 and −1 inclusive.

It is widely used as a measure of the strength of linear dependence between two variables. The correlation process compared the individual holistic evaluations and decomposed evaluations which were obtained from the model. The results, as shown in Table 7-11, 7-12 and 7-13, indicate that the framework correlates well with the holistic approach, (the correlations range between (0.71and 0.81).

Salybia	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
P2=100	33.68	53.53	56.59	53.86	69.53	55.88	56.99	68.64	44.36	70.40	76.68	66.36	83.44	56.01
holistic	44.26	58.97	57.62	53.75	67.21	50.99	70.45	59.70	63.00	79.64	76.64	78.56	78.14	52.07
Pearson Coefficient		0.77												

Table 7-11 Holistic and Decomposed Evaluations Performed By Individuals on the Project Profiles with Pearson Coefficient.

Chanel Tunnel	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
P2=100	25.31	31.52	63.47	23.66	48.61	47.32	56.06	65.33	41.80	64.09	63.38	44.33	84.54	71.23
holistic	49.85	20.30	53.09	53.03	53.03	45.41	65.95	54.05	67.39	76.34	70.21	62.28	96.82	73.69
Pearson Coefficient		0.71												

Table 7-12 Holistic and Decomposed Evaluations Performed By Individuals on the Project Profiles with Pearson Coefficient.

Marsa Alam	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
P2=100	35.04	27.41	65.54	45.47	43.07	52.78	70.01	68.22	39.50	71.97	62.22	60.49	82.21	74.19
holistic	39.34	16.70	46.85	62.10	46.19	51.47	73.93	60.48	66.85	89.01	61.68	75.68	99.76	82.52
Pearson Coefficient		0.81												

Table 7-13 Holistic and Decomposed Evaluations Performed By Individuals on the Project Profiles with Pearson Coefficient.

Project	Holistic approach	P2 =100 Approach
Sulaibiya	**63.64**	**60.42**
Channel Tunnel	**60.10**	**52.19**
Marsa Allam	**62.33**	**57.01**

Table 7-14 Risk Average Indices for Project Profiles (Group Results)

The above differences between the P2 approach and the holistic evaluation in Table 7-14, are compared in Fig 7.1. The P2 = 100 approach curve is found to be very close to the holistic curve, which means that it analogous to the holistic approach.

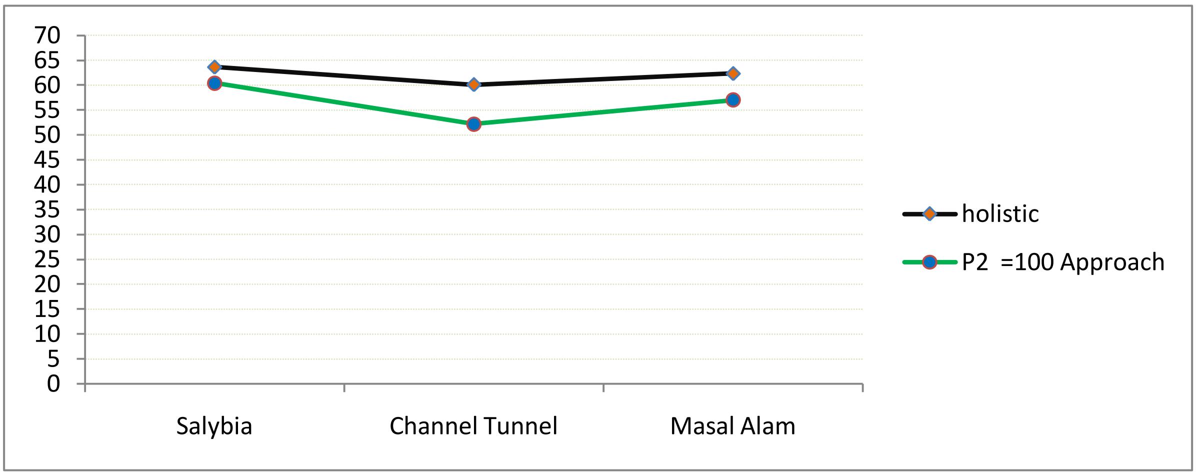


Figure 7-1 Comparison between Average Holistic and Decomposed Evaluations Approaches

7.3 Using the Risk Framework in the Project Risk Study

The identified results and the participants' feedback were used to assess the current BOT risk management framework and to advise concerning the amendments that need to be made to the framework. Feedback from the participants in the field study indicated that many aspects of the proposed framework would be a helpful aid to decision-makers in both the public and private sectors.

The main reason for the development of the Risk Framework was to help the decision-maker in evaluating the risk of their infrastructure project during the preliminary stages, before proceeding with the project. In this way, both the private sector and the Government of Kuwait should have a fuller picture of the most important BOT risks that they will face when considering the initiation of BOT projects in Kuwait. Having a more informed "picture" will facilitate the process of risk management, (risk allocation, mitigation and management), in the early stages of procurement of BOT projects.

Using the Risk Management Framework involves the assignment of the Risk Factor weights and their performance, (quality), levels, developing Risk Factor value curves, (P2=100), and computing the project risk index. When the risk Factor indexes, which form the total project risk index, have been determined, those Risk Factors that affect the total project risk, will be apparent and the decision-maker can then implement strategies to manage these risks and re-evaluate them, so that their effect on the project can be mitigated and/or minimized.

For example, considering the use of the P2 approach in the Sulaibiya Waste Water Treatment Plant Project, the resulting value indices for the 28 risk Factors, as shown in Table 7- 15 indicate that the 'Use of Technology", (UOT), Risk Factor is the highest weighed Risk Factor in the project with a value index of 3.30. Whereas, "Inappropriate Operating Methods", (IOM), Risk Factor is the second highest weighted Risk Factor with a value index of 3.0. "Unavailability and quality of personnel to operate the facility", had a weighted Risk Factor of 2.98, closely followed by "Performance Related Risk", (PRR), with a weighted Risk Factor with a value index of 2.95. "Excessive Development Costs" has a weighted Risk Factor with a value index of 2.52. Therefore, the decision-makers should pay more attention to the above Risk Factors than to the others, because their effect on project risk/viability is more critical and risk management techniques are required in order to mitigate and/or minimize their effect by allocating the risks to a party which is capable of handling them.

For the developed countries of France and UK and considering the P2 approach for the Channel Tunnel, the highest Risk Factor was "Cost Over runs" was with a value index of 3.29, and this proved to be true as the cost over runs were in the region of £7.6 billion Sterling. Next was "Delays in Design Approval", at 3.17, as this was one of the longest undersea tunnels in the world, engineers wanted to be sure that it was right first time. "Lack of Expertise", Risk Factor was next with a value index of 3.03, and not many tunnels of such length have been built, most in Hong Kong. Closely following was the "Lack of Independent Management", at 2.95, where companies and sub-contractors were following their own instructions but not sufficiently cooperating/communicating with each other. "Excessive Development Cost" came fourth with a value index of 2.92, indicating that designers were concerned not only by the change in specification by the government but also due to factors outside their control, i.e. geological issues. "Inappropriate Operating Methods", at 2.79 indicating that even after underwater surveys were carried out, engineers were never 100 % sure about the rock structure to be drilled.

In developing Egypt, the Marsa Allam Airport Project, posed completely different significant Risk Factors: First was the "Unavailability and quality of personnel to operate the facility" at 2.95, which for an airport was a considerable problem. The next four Risk Factors were closely grouped together and next was "Inappropriate Operating Methods" at 2.70, relating to the unavailability of trained personnel, i.e. whoever was operating the airport, would they do it right? And this posed major concerns regarding safety. There was also a significant concern about the "Lack of Experience", at 2.67, during the Promoting and Procurement stage, i.e. will the project get off the ground? The "Unavailability of Power Supply" at 2.66, would slow the construction down and if there was a power failure during operation then the results could be catastrophic. Finally, the Risk Factor, "Error in Forecasting Demand for Service" at 2.57, has proved, so far, to be to be false, with over 800,000 people using the Airport in 2010.

Risk Factors (Attribute)		P2 =100 Value Index
Government instability	GI	2.03
Government failure to provide permits	GFP	1.85
Non-existence of the legal and regulatory system	NLS	2.46
Outbreak of hostilities (wars, riots, and terrorism)	OH	1.93
Changes in general legislation affecting the project	CGL	2.20
Lack of commitment to concession contracts	LCCC	1.85
Failure to raise finance	FRF	1.87
Undeveloped general business environment	UGBE	2.01
Failure to receive revenues from principal (end user)	FRRFP	2.50
Changes in demand for the facility over concession period	CIDP	1.41
Change in economic policies	CIEP	2.49
Error in forecasting demands for service	EIFDS	2.50
Lack of experience	LOE	2.48
Lack of expertise	LE	2.43
Lack of independent management	LIM	2.10
Changes in project specifications	CIPS	2.52
Expensive and long tendering process	ELTP	1.96
Lack of integrity in the (tendering process)	LOI	1.65
Excessive development costs	EDC	**2.52**
Delays in design approval	DIDA	2.46
Use of technology	UOT	**3.30**
Changes in design during construction	CIDDC	2.06
Cost-overrun risks	COR	1.96
Performance related risk	PRR	**2.95**
Unavailability of power supply	UOPS	2.06
Error in operation and maintenance cost estimate	EIO	2.11
Unavailability and quality of personnel to operate the facility	UPO	**2.98**
Inappropriate operating methods	IOM	**3.00**

Table 7-15 Risk index value for the Sulaibiya Wastewater Treatment plant project in Kuwait.

Risk Factors (Attribute)		P2 =100 Value Index
Government instability	GI	1.36
Government failure to provide permits	GFP	2.45
Non-existence of the legal and regulatory system	NLS	**2.13**
Outbreak of hostilities (wars, riots, and terrorism)	OH	1.33
Changes in general legislation affecting the project	CGL	1.45
Lack of commitment to concession contracts	LCCC	**1.51**
Failure to raise finance	FRF	1.27
Undeveloped general business environment	UGBE	1.42
Failure to receive revenues from principal (end user)	FRRF P	1.71
Changes in demand for the facility over concession period	CIDP	**2.15**
Change in economic policies	CIEP	1.72
Error in forecasting demands for service	EIFDS	2.15
Lack of experience	LOE	2.70
Lack of expertise	LE	**3.03**
Lack of independent management	LIM	**2.95**
Changes in project specifications	CIPS	1.62
Expensive and long tendering process	ELTP	1.30
Lack of integrity in the (tendering process)	LOI	1.87
Excessive development costs	EDC	2.92
Delays in design approval	DIDA	**3.17**
Use of technology	UOT	2.25
Changes in design during construction	CIDDC	**2.49**
Cost-overrun risks	COR	**3.29**
Performance related risk	PRR	2.46
Unavailability of power supply	UOPS	1.70
Error in operation and maintenance cost estimate	EIO	2.18
Unavailability and quality of personnel to operate the facility	UPO	2.72
Inappropriate operating methods	IOM	2.79

Table 7-16 Risk index value for the Channel Tunnel project in UK and France.

Risk Factors (Attribute)		P2 =100 Value Index
Government instability	GI	2.39
Government failure to provide permits	GFP	1.98
Non-existence of the legal and regulatory system	NLS	**1.91**
Outbreak of hostilities (wars, riots, and terrorism)	OH	1.71
Changes in general legislation affecting the project	CGL	2.00
Lack of commitment to concession contracts	LCCC	1.69
Failure to raise finance	FRF	**2.00**
Undeveloped general business environment	UGBE	2.18
Failure to receive revenues from principal (end user)	FRRF P	2.01
Changes in demand for the facility over concession period	CIDP	**2.70**
Change in economic policies	CIEP	2.25
Error in forecasting demands for service	EIFDS	2.57
Lack of experience	LOE	2.67
Lack of expertise	LE	2.50
Lack of independent management	LIM	1.95
Changes in project specifications	CIPS	1.82
Expensive and long tendering process	ELTP	2.11
Lack of integrity in the (tendering process)	LOI	2.35
Excessive development costs	EDC	2.51
Delays in design approval	DIDA	2.12
Use of technology	UOT	**1.97**
Changes in design during construction	CIDDC	**2.24**
Cost-overrun risks	COR	2.16
Performance related risk	PRR	2.24
Unavailability of power supply	UOPS	2.66
Error in operation and maintenance cost estimate	EIO	1.98
Unavailability and quality of personnel to operate the facility	UPO	2.95
Inappropriate operating methods	IOM	2.70

Table 7-17 Risk index value for the Marsa Allam Airport project in Egypt

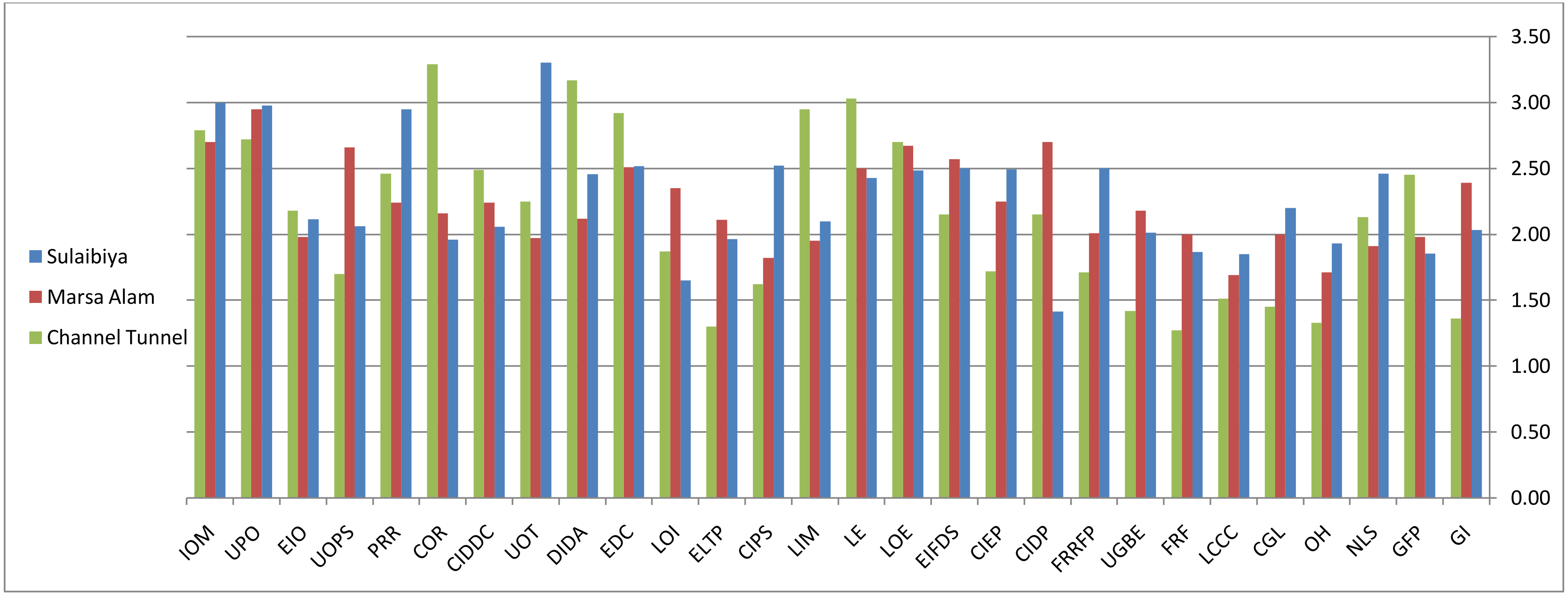


Figure 7-2 Risk index value for the Sulaibiya Wastewater Treatment Plant project in Kuwait, Marsa Allam Airport project in Egypt and Channel Tunnel project in UK and France.

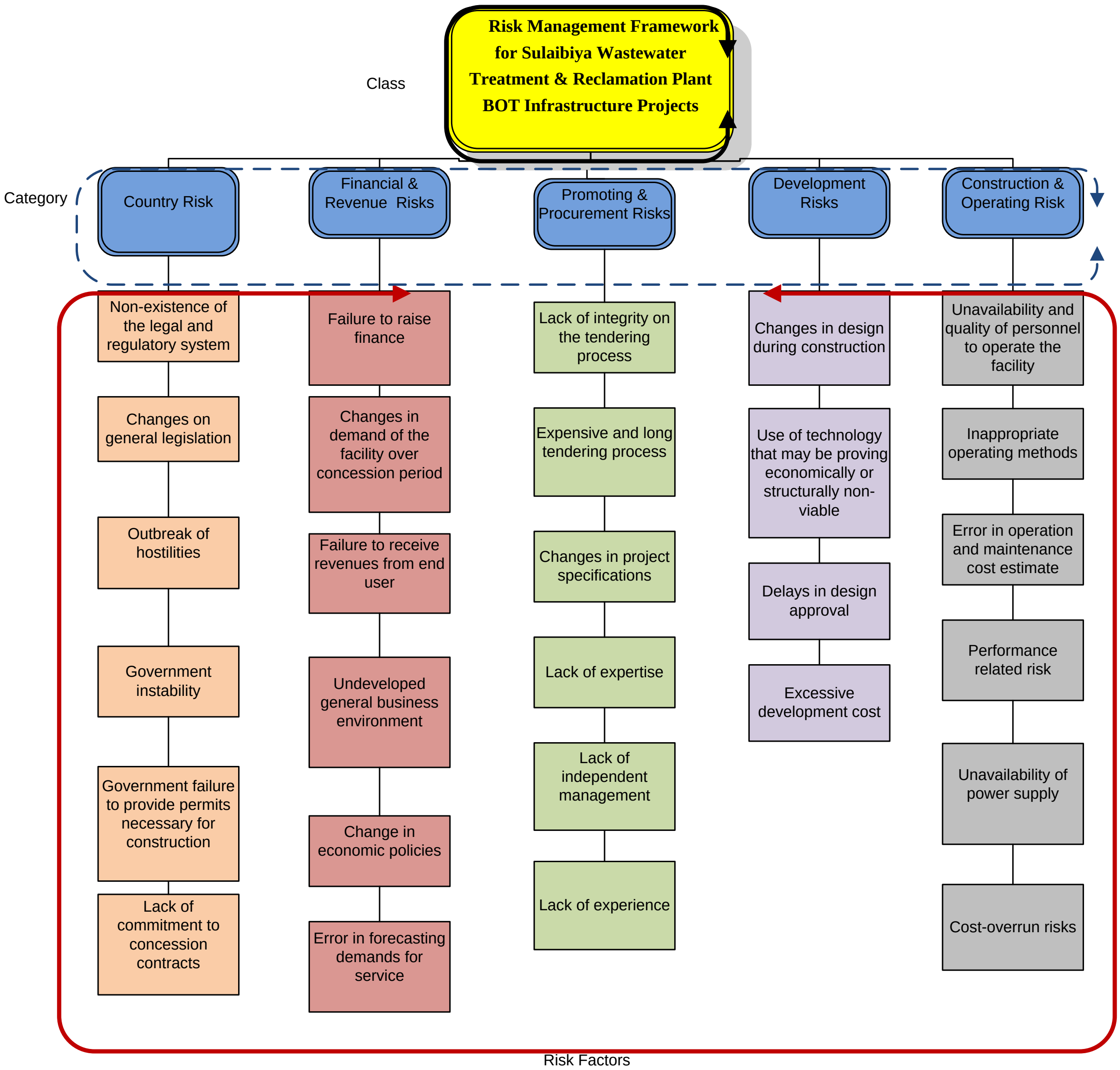


Figure 7-3 Risk Management Framework for the Sulaibiya Wastewater Treatment plant project in Kuwait.

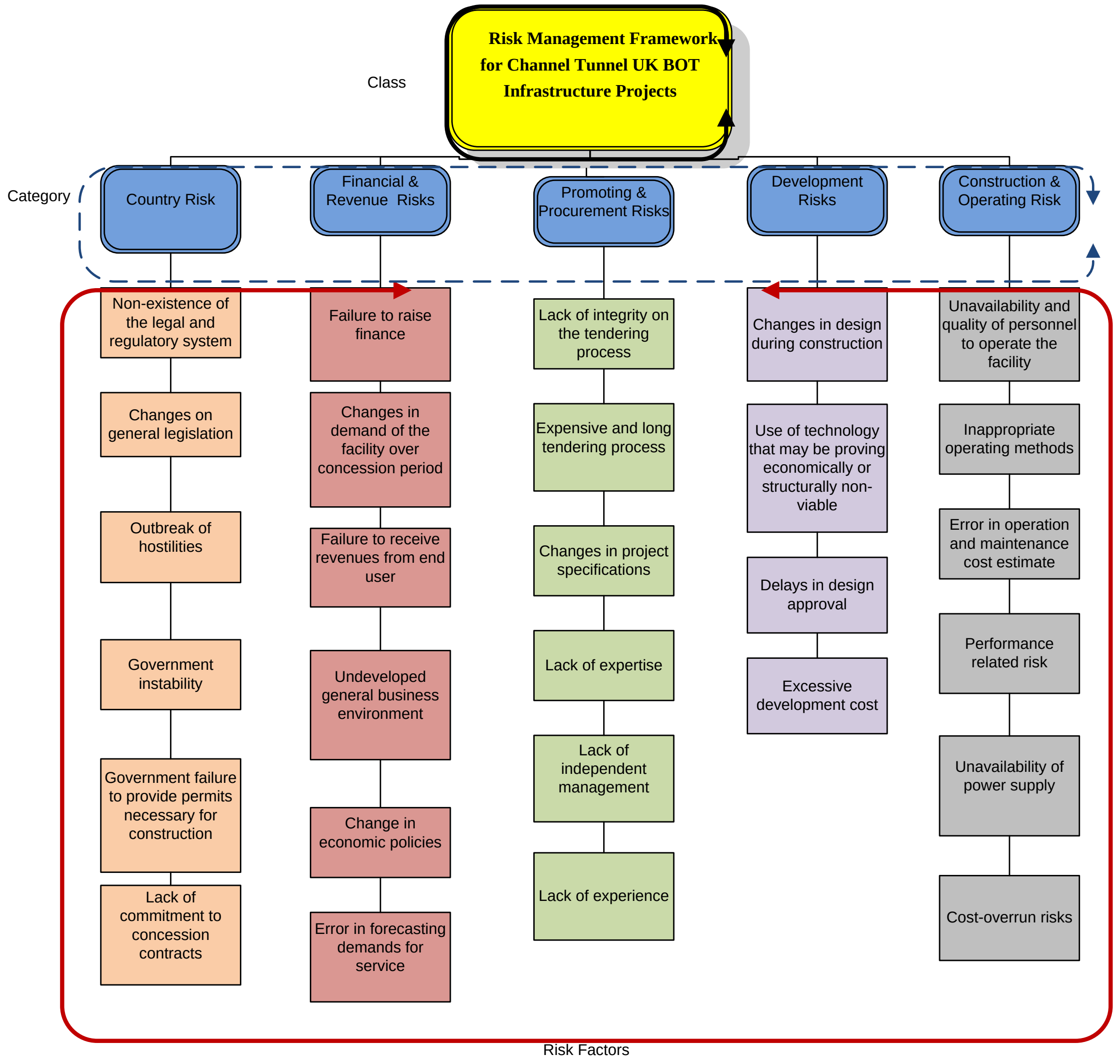


Figure 7-4 Risk Management Framework for the Channel Tunnel project in UK and France.

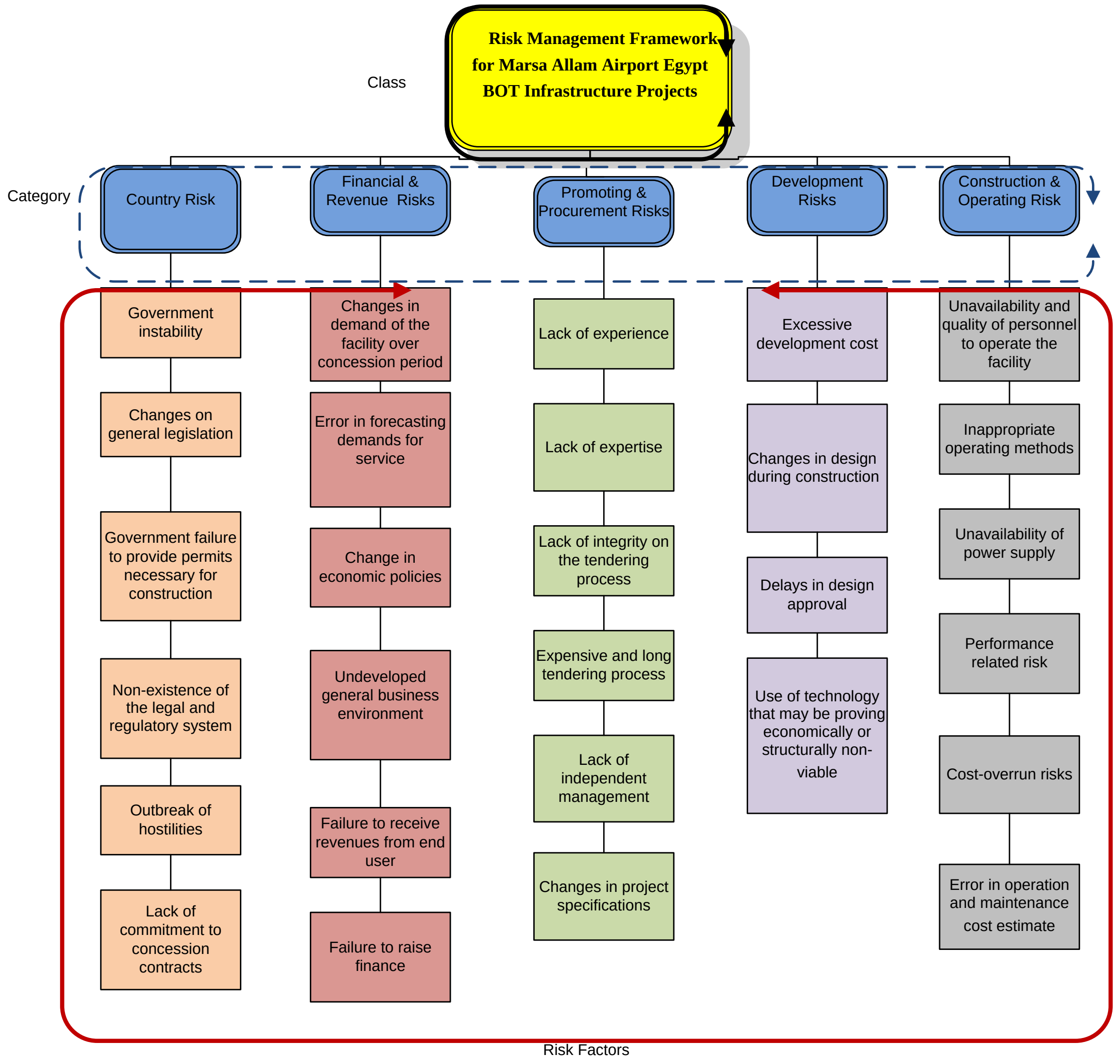


Figure 7-5 Risk Management Framework for the Marsa Allam Airport project in Egypt.

With reference to the four figures above, fig7.2, 7-3, 7-4 and 7-5, bar chart comparing Risk Factors between the three case studies; and the three Risk Management Frameworks generated from the "P2 = 100" approach for the same case studies, respectively, it can be seen that each case study has different salient Risk Factors.

Risk Category	Sulaibiya Waste Water Treatment Plant	Channel Tunnel, UK & France	Marsa Allam Airport Egypt
Construction and Operating	Performance Related Risk Factor	Cost Overrun Risk Factor	Unavailability of Power Supply risk Factor
Development	Use of Technology Risk Factor	Delays in Design Approval Risk Factor	
Promoting and Procurement	Change in Project specification Risk Factor	Lack of Independent Management Risk Factor Lack of Expertise Risk Factor	Lack of Integrity Risk Factor
Financial and Revenue	Failure to Receive Revenue Risk Factor		Changes in Demand Risk Factor
Country Risk			Government Instability Risk Factor

Table 7-18 Comparison of Risk Factors between the case studies.

The first four most salient Risk Factors for each case study can be seen in the above table and are completely different from each other. Considering these first four most important Risk Factors for the three case studies the results indicated: Risk Factors within the "Construction and Operating" Risk Category were all different for the three case studies. For the Sulaibiya Waste Water Treatment Plant in Kuwait, it was the "Performance Risk Factor" indicating that there is a perception that the monitoring of the BOT infrastructure facility during the concession period is not carried out correctly by the host government. Proper monitoring of performance during the concession period is essential, not only for the success of the project and its' continued operation after the concession period, but to ensure that the consumer is getting "value for money".Whilst in the Channel Tunnel, UK and France the Risk Factor was the "Cost Overrun" Risk Factor which turned out to be very real as the project cost over runs are presently at approximately £7.5 billion Sterling, (2012). And in Marsa Allam Airport in Egypt the Risk Factor was "Unavailability of Power Supply" as the airport was built on a "greenfield" site, in the middle of the desert but near the sea. Not only did the equipment used in the construction needed to be brought to the site, but the whole site itself had to be self-supporting and ancillary services had to be in place first in order to support the construction, (i.e. provide electric power), and later the Airport itself.

Next, Risk Factors for the "Development" Risk Category were considered. For the Sulaibiya Waste Water Treatment Plant in Kuwait it was the "Use of Technology" Risk Factor indicating that there was public concern that the water, (collected from sewage), was not being treated correctly, nor thoroughly enough, to be acceptable as drinking water. The second part to this was that the equipment used in the filtering and cleaning processes was not up to date and not operated correctly. For the Channel Tunnel the Risk Factors were "Delays in Design and Approval" which are understandable as the Channel Tunnel is one of the longest undersea tunnels in the world and improper design could have been catastrophic in terms of human life as well as costs. For Marsa Allam Airport the most important risk Factor was "Changes in Design" during construction but this Risk Factor was not in the top four as listed in Table 7-18, above.

The "Promoting and Procurement" Risk Category also highlighted differences in Risk importance between the three case studies. For the Sulaibiya Waste Water Treatment Plant in Kuwait it was the "Change in Project Specification" Risk Factor, -a Risk Factor taken very seriously by the private sector but not so seriously by the public sector, (-as Fig. 6.2 demonstrates where the "group composite weights" of the importance of this Risk Factor were completely opposite to each other depending on the respondent place of work, i.e. Private company and very important; or Public Sector and not so important). For the Channel Tunnel, two Risk Factors shared equal importance in this Risk Category. Firstly, a Lack of Independent Management" to oversee the whole project and the many contractors and sub-contractors working on it. Secondly, a Lack of Expertise in constructing such a long undersea tunnel as these are very large BOT infrastructure projects, of which very few have been built and not many long tunnels. Whilst in Marsa Allam Airport, the most important Risk Factor was the "Lack of Integrity", - a suspicion that there was wrong doing going on between suppliers, construction firms and government officials.

For the Finance and Revenue, Risk Category, the private sector in Kuwait listed this one as most significant. It is common practice in Kuwait not to pay utility bills as the prevailing public attitude is: "As Kuwait is such a rich country, then the government can afford to pay". There have been various efforts by past governments to make people pay their utility bills, including discounts, and even amnesties to make a fresh start, but nothing has worked so far. The present government has recently taken a tougher stance in that: if a citizen of Kuwait has an outstanding utility bill then they are not allowed to leave the country without paying the utility bill first, -and the government has opened offices in Airports and border crossings to enable citizens to pay their utility bills before being allowed to leave the country. The Channel Tunnel did not have any Risk Factors in this Risk Category that were ranked in the top four. For Marsa Allam, it was a different story. Marsa Allam Airport being built in the desert did not have a "captive audience" of nearby potential customers, so private investors were most concerned about being paid a return on their investments. As it has turned out, Marsa Allam Airport is a popular Airport and the area of Marsa Allam has become a thriving holiday resort, popular with Europeans.

For the Country Risk, surprisingly only the Marsa Allam Airport listed this as a Risk Factor in the top four. Even Kuwait with its' political upheaval and regular change in government did not register Country Risk in the top four, however, it is a significant Risk Factor for the respondents with respect to Egypt as the Egyptian people were not content with their own government at the time of the project build.

The index value listing of the Risk Factors, determined by the Kuwaiti respondents, may have been due to their perception of, and attitude to, risk based on experience gained mainly in Kuwait. Furthermore, the questionnaire was answered after all of the respective BOT infrastructure projects had been completed and "hindsight" may have played a significant part in their evaluation of the risks; "Experience is something one gains a second after it is needed". Although the Risk Management Frameworks were constructed after the completion of each case study, they do still provide a valuable insight into the potential risk areas of each case study within their respective countries.

"It should be noted that each and every BOT infrastructure project will have its' own characteristics of risk depending on the type of project and the location".

7.4 Chapter Summary

This chapter presents the results provided by the respondents who participated in this study and also an analysis of the P2 = 100 approach model. It also presents the assessment of the three existing case study projects: the 'Channel Tunnel', the 'Sulaibiya Waste Water Treatment Plant' and the 'Marsa Allam Airport' by using the adopted Risk Management Framework. The outcomes, after the analysis of the data collected from the two questionnaires in this chapter, are as follows:-

1. The Risk Management Framework using the P2 = 100 decomposed evaluations approach is very close to the experts holistic evaluations for BOT infrastructure projects.
2. The Risk Management Framework, via the Expert Choice 2000 software, clearly identifies the complex inter-relationships between different decision factors.
3. The Risk Management Framework is more sensitive to a single Risk Factor, (quality), than the Risk Factor importance weighting.
4. The outcomes of the analysis in this chapter can increase the ability of decision-makers to:-
5. Break down the project into well structured and clear managerial related decision factors.
6. Determine the decision Risk factors which will have the greatest impact on the project.
7. Understand their project well and to determine the viability of the project.
8. Compare the individual's decisions and make an appropriate and realistic group decision concerning the project.
9. Investigate and perform strategies which will clarify the risk(s) magnitude and extent and increase their contributions towards minimizing these risk(s).

10. Prepare all tendering and negotiation documents necessary when dealing with the other participants in the project with respect to risk allocation, so that all parties involved are aware of their responsibilities and duties towards these risks.

11. Compare the project risk with similar ones already in existence.

12. Gain a comprehensive database for future reference.

Chapter 8 Conclusions and Recommendations

8.1 Introduction

This chapter contains a summary of the research, followed by a description of the way in which it adds to the existing body of knowledge. The limitations of the research are outlined, followed by the conclusions of the thesis. Finally, the author gives suggestions and recommendations for further work and future investigation.

8.2 Research Summary

The Build, Operate and Transfer, (BOT), scheme has now become established worldwide, and particularly in developing countries. This new contractual system of building is particularly suited to the construction of large-scale infrastructure facilities. It has become increasingly popular due to its' many advantages and successful application. It provides Governments with an ideal solution for the development of infrastructure without increasing the Government's financial and managerial burdens. Whilst this scheme has been welcomed by the private sector, as it provides new potential markets and a good source of potential revenue, unfortunately, many of the BOT infrastructure projects have not been developed due to a lack of feasibility studies in the particular project. One reason for this is that host governments now expect the private promoters to conduct a feasibility study which could be drawn out and very expensive, (sometimes in the order of millions of dollars, US). However, the host Government and private promoters very often have different objectives. The host Government's aim is to have the private promoter provide all the finance and bear all the risks, as well as improving the quality and efficiency of the infrastructure, shortening the concession period and then minimizing their return on investments, after which, they expect the facility transferred back to them in a good working order. In contrast to this, the private promoters need to recover their investment costs and would like to maximize their profits as quickly as possible. The private companies prefer that the risk be shared with the host Government from whom they would also like proof of political and financial stability, the provision of appropriate documents that would guarantee a reasonable return on their investments, and to ensure that no other project(s), which would compete with theirs, is/are considered during the concession period.

The increasing economic growth in Kuwait, and other developing countries, has created a need for basic infrastructure such as power plants, transportation, and telecommunication networks. In order to meet these needs, the Government of Kuwait has adopted the BOT approach and so it is very important that appropriate and effective risk identification and assessment techniques are used to ascertain the particular risks associated with the various different activities throughout the life of the project. It is particularly important also, when implementing the BOT projects, to ensure that the project objectives are met, including cost, on-time, quality, safety and environmental sustainability.

At the beginning of any BOT project, the promoters need to ensure that all risks are controlled, including the political, legal, social, environmental, economical and financial risks. It is essential, for both the host Government and private promoters, to carry out a project risk study to ensure that there are benefits for both parties and share the work needed, and the costs required, for completion. A list of recommendations is given below:-

1. The private promoters need to produce an accurate and effective project risk study, without the possibility of large financial losses, or even bankruptcy, particularly if the same private promoters do not win the bid; meaning that companies which have a substantial financial stability and backing are the only ones with a chance of being awarded the contract for the project.

2. Both parties need to have an in-depth understanding of the project characteristics and criteria.

3. The time and costs of negotiations of the contract should be reduced as far as is practicable. Project risks mitigation and management should be handled proficiently.

4. Both parties should be encouraged to build a professional relationship between them but one that does not create suspicions of wrong doing.

Although, host Governments usually wish to transfer all the project risks to the private promoter, experience has proved that this often leads to disruption or failure of the project. It is important therefore, that host Governments are prepared to share those risks for which they have access to suitable mitigation techniques. For example, the political and regulatory development risks, (i.e. country related), would be best allocated to the host Government as it is the best suited to manage or mitigate them. It is also true that, when a host Government agrees to share some of the economic and financial risks associated with the project, (e.g. foreign exchange fluctuation, inflation, interest rate and changes in economic policies) this increases the project’s viability. The risk study lists the major Risk Categories and the various Risk Factors which have a detrimental impact on BOT infrastructure projects at different levels. The risks that have the most significant consequences are suggested to be the financial, revenue, political, and operating risks. The areas which have a lower level of consequence on the projects are "force majeure" and "physical" and "development" risks. Risk Factors were also assigned to each project type and found to have a different priority depending on the type of project and location.

This research aim is to develop a framework that will enable decision makers in the private and public sectors decide how to deal with the risks that affects BOT infrastructure projects in Kuwait and allow decision makers to investigate ways to decrease or prevent them.

The research objectives were developed to provide meaningful detail to the research aim and also more focus to the investigation. The research objectives were achieved within this thesis as follow:

1. To develop a better understanding of the basic and essential concepts involved in the BOT infrastructure projects and the characteristics of the risks involved, (Chapter 2).
2. To identify the most important risk factors involved when implementing BOT infrastructure projects in Kuwait, (Chapter 2and 3).
3. To categorize and group the various risk factors facing the implementation of BOT infrastructure projects in Kuwait, (Chapter 5).
4. Using expert opinion, to list each risk factor/group according to its' significance within the BOT infrastructure project, (Chapter 6).

5. To consider and propose a risk-management framework for BOT projects having evaluated, validated and justified the results so that decision-makers and consultants are more easily able to overcome, or at least minimize, the impact of risk factors on BOT infrastructure projects in Kuwait, (Chapter 6and7).

8.3 BOT Project Risk Factors and their Inter-relationships

This research has identified 28 major risk decision factors in BOT infrastructure projects and these have then been classified under their main relative categories, ("Financial & Revenue Risks", "Country Risks", "Construction & Operating Risks", "Development Risks" and "Promotion & Procurement Risks"), in order to determine their inter-relationships and their effect on the project.

The project risk decision factors were individually evaluated by means of the first questionnaire given to expert participants and once the results collected, the Risk Factors were evaluated collectively to form an initial Risk Management Framework.
Each Risk Category is taken to be of equal significance with respect to the others whilst the Risk Factors were "graded" in descending order of importance within their Risk Category.

The expert participants were asked to complete a second questionnaire, using pairwise comparisons and the importance of the decision factors were "weighted" by means of ‘Expert Choice’ software, which is based on the Analytical Hierarchy Process (AHP) technique developed by Saaty (1980).

The results indicated, (Table 6.2), that the "Financial & Revenue" category was the most important, (31.10%), followed by "Country Risks", (23.40%), and then "Construction & Operation", (17.10%), next in importance was "Development", (17.00%), and finally, "Promoting & Procurement", (11.40%). From these results, it can be deduced that the project viability is mainly dependent on the management of the financial and the commercial risk decision factors. It is important that, during the project risk study stage, the crucial sensitive risk factors are taken into consideration and evaluated. In an effort to determine the contributions of the decision factors to the project risk index, the decomposed, "P2 = 100", approach was applied to three case study projects, ("Channel Tunnel Project" linking the UK with France, the "Sulaibiya Wastewater Treatment Plant" in Kuwait and the "Marsa Allam Airport Project" in Egypt). The outcomes were correlated to the direct holistic evaluation of the three project profiles and the indications are that the outcomes of the "P2 = 100" approach are very close to the holistic evaluations, (the Pearson coefficient lies between 0.71 and 0.81, which indicates strong correlation, Tables 7-8/9/10).

The use of the Risk Management Framework in clarifying the risk decision factor contributions and potential Risk Factors offers a tool to make informed and sensible decisions to minimize the risks or even preferably, eliminate them all together.

The four most important Risk Factors concerning the three case studies were discussed in detail and it must be acknowledged that hindsight and a "Kuwaiti perspective" may have played a part in the relation of each Risk Factor with respect to the others.

It must be noted that in the first questionnaire there were originally eighty Risk Factors. These eighty Risk Factors were identified from previous studies, as mentioned in chapter four). The eighty Risk Factors were streamlined to twenty-eight and the remainder made redundant but as each project is different with its' own characteristics, any of the redundant Risk Factors can be re-employed.

Strategies that could be useful for managing the performance of these Risk Factors are given below:-

1. The development of an accurate and reliable risk study.
2. Decreasing the Government's involvement in the design and construction processes.
3. Introducing new construction technologies and methods which would decrease the construction time and cost and be appropriate to the stage of the project.
4. Improving the present legislation for BOT procurement in Kuwait to the benefit of both the government and private promoters.
5. Increasing the involvement of the community by explaining the benefits of the project on the local environment.

Preparing all the necessary resources, whilst ensuring, as far as is possible, that the use of local resources is maximized and the costs and length of procedures for the imported resources for the project are minimized.

8.4 Contribution of the thesis to the body of knowledge

After reviewing relevant literature, it became clear that there is an apparent lack of published studies on the subject of risk management for BOT Infrastructure projects in Kuwait. Once the Government has decided to adopt the BOT method of delivering future infrastructure projects, knowledge will be needed regarding the major and most important risks and challenges involved in such projects and it will be necessary to have an understanding of how best these risks and challenges can be managed. The contribution to the current state of risk study analysis of BOT infrastructure projects are provided by this research is presented below in terms of the following points:

1. This study makes a contribution to the literature about BOT projects in the context of Kuwait, as it is one of the very few studies regarding Kuwait that have been conducted in this area.

2. The research provides a comprehensive account of the environment in which the Kuwait BOT Infrastructure projects are carried out and also notes the risks involved. This study will assist foreign investors, contractors, lenders, sponsors and insurance companies when considering BOT Infrastructure Projects in Kuwait.

3. The study will be of help to private sector companies who have insufficient knowledge concerning the environment involving BOT Infrastructure Projects within the country and it will also benefit the public sector which has limited experience of partnerships with the private sector.

4. This study provides a list identifying the most important qualitative decision factors involving risk, which have been carefully identified, selected and then screened by a group of experts from Kuwait.

5. This study provides a Risk Management Framework which can be used to assess the risk of qualitative Risk Factors for large-scale BOT infrastructure projects in Kuwait.

6. This research will assist decision makers in investigations regarding the options available regarding risks and then to determine which of these options present

more risk and which present less risk. And provides an appropriate decision support tool which should help the decision maker to determine those decisions which would prove most effective in minimizing and/or prevent any project risk and also put forward strategies to decrease the risk factors.

7. This study provides criteria which would help in the preparation and evaluation of BOT Infrastructure Risk Management depending on the circumstances at the time of the Project which would be of benefit during tendering process.

8. The study provides a flexible means to evaluate Risks at the beginning of a project or at any time during the project depending on the (new), prevailing circumstances.

9. The “P2=100” approach provides in depth analysis of the qualitative decision factors that were commonly evaluated arbitrarily. This could change the typical concerns of decision makers from both parties’ government and private sector who only concentrate on the project quantitative decision factors.

8.5 Limitations of the research

During the research, several limitations were discovered. It is important that the decision maker is aware of these limitations when using the Risk Management Framework and these are given below:-

1. Although the Risk Factors were chosen from various different types of existing infrastructure projects and generalizations made, it is important that, for a particular project in a specific country, other additional project-related Risk Factors should be taken into account.

2. Expert Choice uses an Analytical Hierarchal Analysis (AHP) process. An approach which uses pairwise comparisons and has the disadvantage that the number of pairwise comparisons to be made may become very large and so a lengthy task, indicating that the AHP process has its' limitations. The consequences of these limitations are such that only five "Risk Categories" and a maximum of six "Risk Factors" were used for the Risk Management Framework. If more than six Risk Factors are used within their respective Risk Category, then the "pairwise'

comparisons become complicated and inconsistent results may be obtained. Another important disadvantage of the AHP method is the use of the 9 point scale. Sometimes the decision maker may have difficulty in distinguishing between Pairs of Risk Factors, i.e. whether one Risk Factor is 5 or 6 or 7 times more significant than another.

3. There is a shortage of published data concerning Risk Management for BOT Infrastructure projects and for the construction industry in Kuwait.

4. Each BOT infrastructure project has a different risk structure, since there are many different ways to finance, design procure and build the project. Therefore, the knowledge and expertise obtained from BOT infrastructure projects in other countries, is not always appropriate for BOT projects in Kuwait.

8.6 Recommendations for future research

The purpose of this study is to begin a process of objectively categorizing the project Risk Factors affecting BOT Infrastructure projects and to construct an effective Risk Management Framework to show the significance of each Risk Factor in a BOT infrastructure project.

This study is the beginning of the investigation of the evaluation of Risk Factors in a BOT infrastructure projects. Further dedicated and extensive research is required in order to obtain a deeper understanding of both qualitative and quantitative risk factors involved. Researchers should track relevant Risk Factors throughout the whole life of various BOT infrastructure projects. Appropriate computer software should be employed in order to process large combinations of Risk Factors. After processing these Risk Factors, their relationships to each other can be analyzed from appropriate and easily understood data sheets, (including graphs and tables). The analysis of the Risk Factors would be a great help to decision makers in order to facilitate more efficient project management of BOT infrastructure projects and services, providing a saving on time and costs.

8.7 Concluding remarks

The concept behind this thesis was to develop a clear and implementable Risk Management Framework which could be used by the private sector and public sector for BOT infrastructure projects whenever they want to evaluate risks in BOT infrastructure projects. The target that the author tried to accomplish was to represent holistic and decomposing methods in the Framework that could make the picture clearer behind any decision which carries risk. The private sector and public sector of BOT infrastructure projects are cautious and fearful of risks when making a decision because in most cases, the risk is their responsibility and generally, they cannot afford failure. These concerns were important to the author during the period of this research. Such a Risk Management Framework could be useful in offering “stepping-stone” knowledge to build support tools, such knowledge-based systems or expert systems, (or extend the data base in software such as "Expert Choice"). The Risk Management Framework can be used as a support tool alongside project management of the BOT. When new stages of the project are about to begin, with the aid of the Risk Management Framework, potential Risk areas will be identified. The decision makers, armed with this knowledge, can now allocate resources to relevant areas in order to minimize these risks. The proposed Risk Management Framework, in its current form, offers a positive example of how the private sector and public sector engaged in BOT infrastructure projects can evaluate alternatives and make favorable decisions to minimize risk. This assistance will not be a magic recipe for success, but would, however, be a practical tool to evaluate influential risk factors in order to increase the probability of making the right decisions using the right procedures.

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