A DECISION SUPPORT SYSTEM FOR PERFORMANCE ASSESSMENT AND IMPROVEMENT IN PPP HEALTHCARE PROJECTS

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ABSTRACT

A DECISION SUPPORT SYSTEM FOR PERFORMANCE ASSESSMENT AND IMPROVEMENT IN PPP HEALTHCARE PROJECTS

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With the objectives including the reduction of the whole life costs, increasing construction and operation efficiencies and enhancing service quality, Public-Private Partnership (PPP) schemes have been used for healthcare projects across the world over the past two decades. These large-scale projects comprise a long-term partnership period between the public and private sector stakeholders, with a great deal of costs, risks and opportunities. Considering the large number of the parties involved and the inherent public interest, the vital importance of proper project planning and delivery in accordance with the project objectives becomes prominent.

The major aim of this study was to construct a PPP healthcare project success model considering the interrelations between the success factors and integrate it with a decision support system that provides guidance to construction companies for performance assessment and improvement during the planning and execution phases of the PPP healthcare projects undertaken. At the outset, preliminary interviews were conducted with construction industry practitioners in conjunction with a literature survey to set forth the problem definition for the study. Subsequently, by means of a thorough review of the relevant literature, a conceptual framework was proposed addressing the success of PPP healthcare projects and semi-structured interviews were carried out with experts from the private sector. In light of the findings, the proposed framework was revised and used as a base for the development of the PPP healthcare project success model using the Analytic Network Process (ANP). A discussion session was held with the participation of five project executives for the construction of the model, through which, the relative importance of the elements and components, and the magnitude of the interrelationships inherent in the model were assessed based on the experts' collective judgment. The ANP model was tested on two real cases during the session, which yielded favorable results.

Finally, a web-based decision support system was developed, which performs project performance assessment based on the built-in success model, presents various reports on the assessment and assists in performance improvement. The system was tested and validated on five real projects, and as to the judgment of the experts, the overall performance of the system was regarded as satisfactory. As far as the potential contribution of the system's functions to project processes were considered, guidance with the inherent network of success factors, proposal of performance improvement strategies and generation of alternative project scenarios were pointed out at the first place. The revealed results were discussed, together with the recommendations for the further improvement of the proposed system.

Keywords: Public-Private Partnership, Healthcare PPP Projects, Critical Success Factors, Project Performance Improvement, Analytic Network Process.

ÖZ

SAĞLIK SEKTÖRÜ KÖO PROJELERİNDE PERFORMANS DEĞERLENDİRMESİ VE İYİLEŞTİRMESİ İÇİN BİR KARAR DESTEK SİSTEMİ ÖNERİSİ

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Projenin yaşam döngüsü maliyetlerinin azaltılması, yapım ve işletme verimliliğinin ve hizmet kalitesinin artırılması gibi hedeflerle, Kamu-Özel Ortaklığı (KÖO) modeli son yirmi yıldır tüm dünyada sağlık sektörü projelerinin tesliminde kullanılmaktadır. Kamu ve özel sektör paydaşları arasında uzun vadeli bir ortaklık dönemini kapsayan bu büyük ölçekli projeler, çok ciddi maliyetleri, risk ve fırsatları da beraberinde getirmektedir. Kapsanan çok sayıdaki proje paydaşı ve kamu yararı göz önünde bulundurulduğunda, projelerin planlanan bütçe, süre, kalite gibi proje hedeflerine uygun olarak tamamlanmasının önemi belirginleşmektedir.

Bu çalışmanın amacı, sağlık sektörü KÖO projeleri için başarı faktörleri arasındaki etkileşimlerin de göz önünde bulundurulduğu bir başarı modeli oluşturulması ve inşaat şirketlerine üstlendikleri sağlık sektörü KÖO projelerinin planlama ve yürütme aşamalarında proje performans değerlendirmesi ve iyileştirmesi için yol gösterecek bir karar destek sistemi geliştirilmesidir. Başlangıçta, araştırmanın problem tanımını ortaya koymak amacıyla bir literatür taraması ile birlikte inşaat sektöründen proje yöneticileriyle ön görüşmeler yapılmıştır. Daha sonra, ilgili alanda yapılan geniş kapsamlı bir literatür taraması sonucunda, KÖO hastane projelerinin başarısı için kavramsal bir çerçeve önerilmiş ve bu çerçeve baz alınarak özel sektörden uzmanlarla yarı-yapılandırılmış görüşmeler gerçekleştirilmiştir. Bulgular ışığında, önerilen çerçeve yeniden düzenlenmiş ve bu çerçeve, Analitik Ağ Süreci (AAS) kullanılarak KÖO hastane projeleri için bir başarı modeli geliştirilmesinde temel olarak kullanılmıştır. Modelin geliştirilmesi için proje yöneticilerinin katılımıyla bir toplantı düzenlenmiş ve uzmanların kolektif yargılarına dayalı olarak model kapsamında yer alan faktörler ve faktör gruplarının göreceli önemi ve model bileşenleri arasındaki ilişkiler analiz edilmiştir. AAS modeli, oturum sırasında iki adet gerçek proje üzerinden test edilmiş ve olumlu sonuçlara ulaşılmıştır.

Oluşturulmuş olan model baz alınarak çalışmanın son aşamasında geliştirilen web tabanlı karar destek sistemi, proje performans değerlendirmesi yapmakta ve çeşitli raporlar ortaya koyarak performansın iyileştirilmesi için yol göstermektedir. Sistemin performansı, beş adet gerçek proje kullanılarak test edilmiş ve uzmanlar tarafından tatmin edici olarak nitelendirilmiştir. Sistem fonksiyonlarının proje süreçlerine potansiyel katkısı göz önünde bulundurulduğunda, başarı faktörleri ağının sunulması, performans iyileştirme stratejilerinin önerilmesi ve alternatif proje senaryoları oluşturulması, öncelikli olarak işaret edilmiştir. Elde edilmiş olan sonuçlar tartışılmış ve sistemin geliştirilmesi için sunulmuş olan öneriler sıralanmıştır.

Anahtar Kelimeler: Kamu-Özel Ortaklığı, Sağlık Sektörü KÖO Projeleri, Kritik Başarı Faktörleri, Proje Performans İyileştirmesi, Analitik Ağ Süreci.

To my mother, my father
and
Yavuz

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AHP	Analytic Hierarchy Process
ANP	Analytic Network Process
BLT	Build-Lease-Transfer
BO	Build-Operate
BOT	Build-Operate-Transfer
BOO	Build-Own-Operate
BOOT	Build-Own-Operate-Transfer
BTO	Build-Transfer-Operate
CSF	Critical Success Factor
DB	Design-Build
DBB	Design-Bid-Build
DBFO	Design-Build-Finance-Operate
ESIA	Environmental and Social Impact Assessment
KPI	Key Performance Indicator
LEED	Leadership in Energy and Environmental Design
NHS	National Health Service
PFI	Private Finance Initiative
PPP	Public-Private Partnership
SEM	Structural Equation Modeling
SPV	Special Purpose Vehicle
TOOR	Transfer of Operating Rights
UAE	United Arab Emirates
UK	United Kingdom
USA	United States of America

CHAPTER 1

INTRODUCTION

In this chapter is first presented the background of the research, followed by problem definition. Subsequently, the aim and objectives of the study are presented and the procedure of the study is defined, outlining the scope and principal stages of the investigation. At the end of the chapter, organization of the thesis is explained.

1.1 Background of the Research

Infrastructure development is a major concern in numerous countries (Chou and Pramudawardhani, 2015). Due to several legal, social, political and financial concerns in infrastructure development, governments of several countries have initiated Public-Private Partnerships (PPPs) with the private sector, based upon long-term contractual agreements (Grimsey and Lewis, 2002). PPPs have been implemented in both developed and developing countries, with the objectives including the promotion of infrastructure development, reducing costs, increasing construction and operation efficiencies, and enhancing service quality by virtue of the private sector knowledge, expertise and capital (Zhang, 2006). It has become a major approach for delivering infrastructure projects, with its increased utilization especially at the end of the 1990s and beginning of the 2000s (Li *et al.*, 2005a).

As mentioned by Turner (1999), mega projects are usually commissioned by governments and delivered by private enterprises, involve a large number of partners and are characterized as being uncertain, complex and politically sensitive. This definition is applicable to the PPP projects; as they encompass a long-term partnership period and multiple stakeholders with a broad range of risks and uncertainties involved in the contracts and are under the threat of the problems stemming from the lack of PPP experience and expertise in many countries and regions (Zhang, 2005a). As it was asserted by Flyvbjerg *et al.* (2003), cost and schedule overruns are common in majority of the mega projects, together with the failure in delivery of the terms used to justify the need for the project. Mega projects are characterized by disputes, uncertainty and poor cooperation between the stakeholders (Van Marrevijk, 2005).

Regarding the healthcare PPP projects in particular, Cruz and Marques (2013) opined that PPP schemes have been used for the execution of public healthcare projects across the world over the last two decades, with the objectives of increasing the efficiency and cutting down the overall costs in construction and operation of the facilities. Efficiency gains and enabling a life cycle approach for planning were given as the advantages of PPP arrangements in health sector, which are provided without creating a major burden on the government budget (Cruz and Marques, 2013). The use of PPP model for the delivery of healthcare projects is also a prominent issue for Turkey, due to the undertaking of a restructuring process in the healthcare system since 2004. Accordingly, a great number of large-scale healthcare projects have been planned out across the country, some of which have already been put into operation recently.

Considering the extensive project budgets, various stakeholders involved and the inherent public interest, the vital importance of proper project planning and delivery in accordance with the project objectives becomes apparent for these projects. On the other hand, the success or failure of an infrastructure project in terms of its objectives is shaped by a combination of multiple factors (Zhang, 2005a). In order to achieve the promised benefits of PPPs, it was pointed out that the project stakeholders need to focus on performance improvements in the development process of the projects (Yong, 2010).

1.2 Problem Definition

In the definition of the research problem, both the literature review conducted and the preliminary interviews held with the experts from the private sector were drawn on. With respect to the PPP projects carried out in Turkey within the last decade, a number of deficiencies related to implementation and management, which stem from the greatness of project sizes and complexity of the healthcare projects, were mentioned in the literature. It was reported that these projects include a detailed and heavy workload, are difficult to monitor and control, and therefore require a high degree of specialization and necessitate the improvement of the management capacity both for the public and private sectors. A number of needs were put forth in some studies, which comprise development of a system to pass on the experiences gained from project implementation to future projects; eliminating the ambiguities in management of the projects and in the post-construction process; determining the problem areas; preparing action plans; and development of new management approaches.

In a similar vein, in the preliminary interviews conducted with experts from the private sector, it was pointed out that there are a great number of factors and risks inherent in the projects of this scale and complexity, and their identification, monitoring and control was denoted to be a challenging issue. It was expressed that there are various shortcomings stemming from the project processes, which create a pressure on the companies and on the project teams. As stated in the interviews, not enough time is allocated for the planning stage of these projects due to schedule restrictions, which constitutes the major source of the problems encountered. It was further opined that during the project life cycle, actions are needed to be taken rapidly. The planning and design stages overlap, which also applies to the design and construction stages to an extent. Inexperience with PPP healthcare projects was another disruption noted. As mentioned, there is not a systematic or defined process used for the identification/evaluation of the factors or risks inherent in these projects used by the organizations, but rather, decisions are taken based on an intuitive approach; and for the unforeseen events that emerge during project execution, actions are taken on a responsive basis.

Subsequent to the preliminary literature review carried out and the interviews conducted with the experts at the outset of the study, the problems put forth for the management and implementation of the PPP healthcare projects were attempted to be addressed by examining the concept of project success. As the major aim of the companies is to deliver the projects according to the preset performance criteria, examining the enablers of successful planning and delivery for these projects constituted the point of departure for this study. Due to the growing number of PPP healthcare projects all over the world and also in Turkey, it was considered to be of value to take a standpoint looking into the performance assessment and improvement issues of the relevant projects. For the companies to adopt a proactive management approach rather than a responsive one, and develop a systematic and defined process for the identification/evaluation of the factors or risks inherent in these projects, a specific project success model was deemed to be assistive. For the development of the model, the initial step taken was based on the Critical Success Factors (CSFs).

As pointed out by Cooke-Davies (2002), project success cannot be measured until after a project is completed, whereas project performance can be measured during the life cycle of the project. Although the concepts of Key Performance Indicators (KPIs) and performance measures have been extensively utilized for performance measurement in the construction sector, it was stated that they have limited use for the internal decision-making process as they do not provide insight into performance improvement (Bassioni *et al.*, 2005). KPIs were denoted to have a product-oriented approach, as they are employed after project completion (Liu *et al.*, 2015a). Thus, they cannot be used in performance monitoring and improvement during the course of the project (Kagioglou *et al.*, 2001). On the other hand, determination of success factors plays a key role in achieving the basic objectives of the project through a project management system and especially in the identification of project performance management strategies in the design and implementation phases (Toor and Ogunlana, 2009). As mentioned by Cooke-Davies (2002), performance of a project predicts its success. Accordingly, the ultimate success of the projects is determined by the performance throughout their life cycle, which can be addressed by the use of success factors.

Although the CSFs for PPPs have been well-discussed over the past two decades, there has been limited research undertaken to cover the CSFs in a holistic approach together with the interrelationships between the factors and the relevant performance improvement strategies. As the factors are not independent from each other, it is necessary to identify the inherent links between the factors and weight their degree of influence in order to obtain a realistic reflection of the problem under consideration. Also, to properly address the issues pointed with the CSFs, they should be supported with the identification of corresponding strategies. Furthermore, as also pointed out in the literature (Morledge and Owen, 1998; Tekin and Celik, 2010), CSFs and their importance rankings differ for different types of PPP projects and PPP projects in different sectors necessitate different approaches. On the other hand, regarding the success of healthcare or PPP healthcare projects, no major/comprehensive research has been found in the literature, since the small group of studies conducted reflects a preliminary attempt in this area. Accordingly, a gap was determined in the literature with respect to the identification and assessment of the CSFs for healthcare PPP projects in particular, with a holistic approach. The main aim of this study was shaped around this gap and around the deficiencies mentioned for the projects' planning and management.

1.3 Aim and Objectives of the Research

The major aim of this study was to construct a PPP healthcare project success model and integrate it with a decision support system as a guidance tool for the construction companies, to be used for project performance assessment and improvement. As these projects cover a wide range of constituents to be considered with respect to a number of intricate and integrated project phases and various project stakeholders from the public and private sectors, their planning and management necessitate a particular approach. From this point of view, it was intended to propose a tool to assist the private sector construction companies through the pre-tender, planning and execution phases of the relevant projects by means of guiding for the specification of the most appropriate performance improvement strategies and the necessary precautions and/or corrective actions for the successful planning and delivery of the projects.

With the decision support system, it was objected to facilitate project performance improvement by means of revealing a prediction for the performance level of the PPP healthcare project, setting forth the project's strengths and weaknesses, pointing out the most critical factors for the improvement of project performance and visualizing the determinants of project success by virtue of the modeled interrelationships between the success factors. Proposal of performance improvement strategies and generation of alternative scenarios for the project were specified as the other major functions of the system. Through the involvement of the scenario generation component, it was targeted to enable the users to select appropriate project strategies and assess their potential contribution to the project performance rating.

Besides providing a snapshot of the project's performance and assisting to build a roadmap for the improvement of performance through the project's life cycle, it was also anticipated that the system contributes to organizational learning and continuous improvement by virtue of its data storage capability through its utilization in different stages of a project's life cycle and on various projects of the company.

In this respect, following are the objectives of this study:

- Identification of the CSFs for the PPP healthcare projects by an extensive literature survey,
- Provision of insight for the CSFs through expert interviews,
- Development of a framework for PPP healthcare project success,
- To model the interrelationships between the CSFs, determine their degree of

influence and derive the relative importance weights of the factors considering the interrelations,

- Identification of the project performance improvement strategies in accordance with the specified CSFs,
- By means of the interpretation of the data gathered through the testing sessions of the decision support system, provision of a snapshot of the processes of construction companies involved in the study, with respect to the execution of PPP healthcare projects,
- To provide the recommendations of the experts on the proposed performance assessment system.

1.4 Procedure

The procedure of the study was outlined with a flowchart, showing the major steps of research and the relevant outputs (Figure 1.1). At the outset, preliminary interviews were conducted with construction industry practitioners in conjunction with the initial literature survey to construct the problem definition for the study. These were followed by an extensive literature review carried out in line with the context of the research and a conceptual framework was proposed for PPP healthcare project success. Based on the framework, semi-structured interviews were carried out with six project management executives from the private sector, through the utilization of an assistive questionnaire. In light of the interpretation of the gathered data, the proposed framework was revised for it to be used in the following stage of the study. Subsequently, a discussion session was held with the participation of five experts from the private sector to elicit their judgments in the development process of the final model using the Analytic Network Process (ANP). Based on the model, the PPP Healthcare Decision Support System was built. Testing sessions were held separately with three expert groups from three leading construction companies in Turkey, by which, the system was tested and validated on five real PPP healthcare projects.

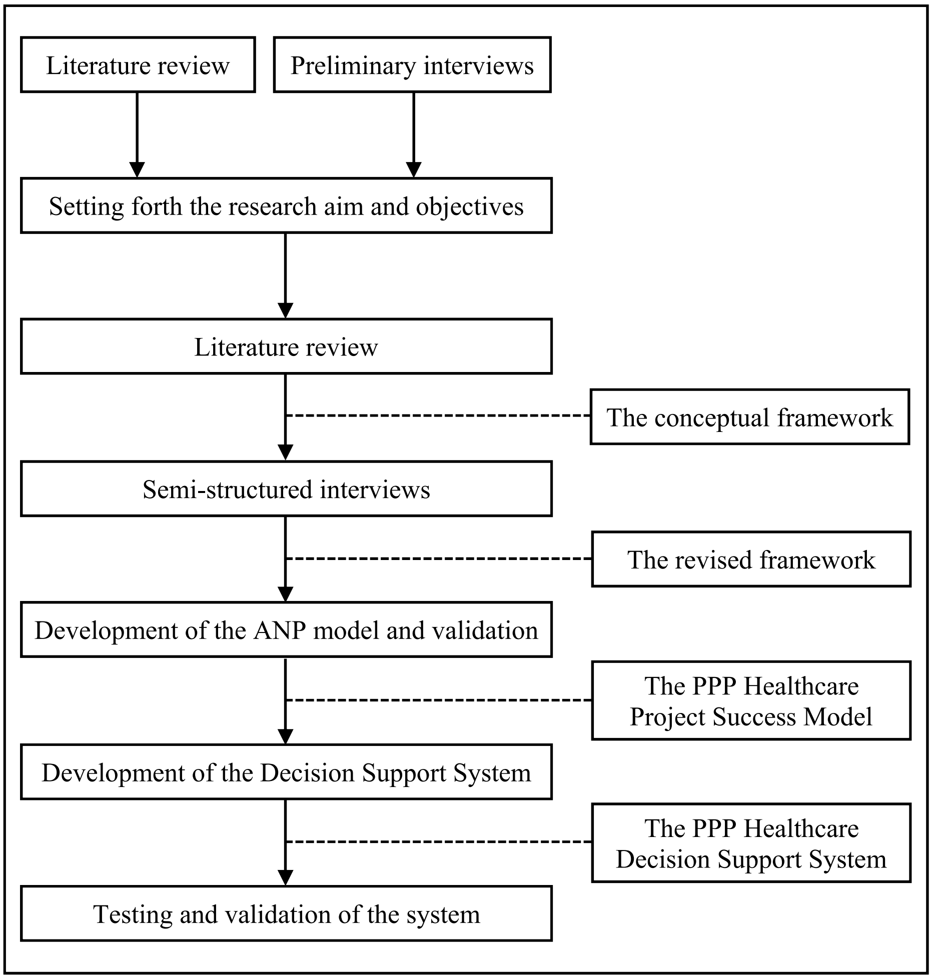


Figure 1.1. The flowchart outlining the major steps of the study and their outputs

1.5 Disposition

The thesis is composed of six chapters, of which, this chapter is the first.

The second chapter introduces the concepts related to the context of the study, in which, the PPP and CSF terms are elaborated with respect to the construction projects and healthcare projects. Relevant studies in the literature are briefly explained, and the chapter is finalized with a discussion of the literature and the identified research gap.

In the third chapter, the materials and methodology of the study are presented. First of all, the preliminary interviews conducted are explained, which provided insight for the problem definition of the study. Subsequently, the proposed conceptual framework is depicted and the semi-structured interviews carried out based on the framework are discussed. The chapter continues with an overview of the ANP and its implementation by means of the experts' judgments obtained through the discussion session held. The constructed model for PPP healthcare project success is presented in detail and the model testing process is explained. Finally, the results revealed through the session are set forth.

In the fourth chapter, the proposed PPP Healthcare Decision Support System is introduced, together with its objectives and capabilities. Each component of the system and the relevant functions are discussed in detail, and presented with the provided snapshots of the system.

The fifth chapter comprises the testing and validation of the developed system. Initially, the material and method used for this process are explained. Subsequently, the data gathered through the testing sessions are provided and the findings are discussed. Finally, the recommendations for the further improvement of the proposed system, which were revealed through the sessions, are covered.

In the final chapter are presented a brief outline of the study, the major findings and contributions, and the research limitations, together with a set of recommendations for future research.

CHAPTER 2

LITERATURE REVIEW

This chapter comprises the elaboration of the various concepts and issues pertaining to the context of the study and thus constitutes a background for presenting the work. In the first section, the PPP term is detailed with its various forms, advantages, the associated problems and drawbacks, country experiences, its implementation in healthcare, together with the development of PPPs in Turkey and in Turkish healthcare sector. In the second section, the CSFs concept is introduced, elaborating on project success and its measures. Various studies that have been carried out in this area are outlined with respect to construction, PPP and healthcare projects. Subsequently, a critical analysis of the literature is presented, which is followed by a discussion of the specified research gap.

2.1 Public-Private Partnership (PPP)

PPP model of project delivery has been implemented in various sectors worldwide, with the intention of balancing public service needs and the financial capabilities of governments (Gurgun and Touran, 2014). Due to several legal, social, political and financial concerns in infrastructure development, governments of several countries have initiated PPPs with the private sector, based upon long-term contractual agreements (Grimsey and Lewis, 2002). Over 20 years, governments have made use of PPPs for the delivery of public infrastructure projects for improved health, education, water supply, transport and electric power services provision (Pongsiri, 2002). Despite the existence of the concept for centuries, PPPs have become more notable in recent decades in local economic development (Keating, 1998). The utilization of PPPs in the development and financing of public facilities and services has increased substantially since the end of the 1990s (Li *et al.*, 2005a).

As expressed by Abdel Aziz (2007), PPPs have come into the picture as alternative delivery systems to eliminate some of the funding problems of public sector, in place of the Design-Bid-Build (DBB) procurement system used traditionally for the delivery of public infrastructure projects. DBB delivery method, which is the most common arrangement for awarding the contract in most countries, frequently leads to problems in terms of achieving project objectives due to its structure not allowing construction team experience to be utilized in the early design stages of the project (Abdou and Al Zarooni, 2011). As mentioned in the study of Jacobson and Choi (2008), this traditional delivery method of public work projects brings about conflicts between project stakeholders and threatens project quality, time and budget. Management-based approach and the Design-Build (DB) approach, and also the PPPs are advantageous in this respect, to achieve project effectiveness by providing the integration of project stages (Abdou and Al Zarooni, 2011). Problems associated with public sector infrastructure delivery such as high construction costs, time overruns, inefficiencies in operation and design, and dissatisfaction of the community are targeted by the PPP approach (Mustafa, 1999). The PPP model is considered to be an effective way to deliver value-for-money public infrastructure or services (Chan *et al.*, 2010) owing to its effective service delivery framework and performance monitoring regime (Robinson and Scott, 2009). Value for money, which is an extensively emphasized concept for the PPP projects, was defined as "the optimum combination of whole-of-life costs and quality (or fitness for purpose) of the good or service to meet the user's requirement" (HM Treasury, 2006).

In PPP model, it is aimed to engage the resources, management skills and technology of the private sector with the public sector's regulatory role and activities to secure public interest (United Nations Economic Commission for Europe, 2007). PPPs constitute long-term partnering relationships between the two sectors, with the aim of optimal use of both sectors' expertise, resources and innovation in effective delivery of public services (Babatunde *et al.*, 2012). Other than the financing of projects in return for an income stream by the private sector, PPP arrangements are designed to take the advantage of private sector involvement in the delivery and operation of public projects over their lifetime in a more efficient manner (Babatunde *et al.*, 2012).

Gurgun and Touran (2014) listed economic recession, inadequate public resources, lack of expert knowledge for a particular project and political factors as the drivers for governments to form partnerships with private sector entities. Both developed and developing countries have undertaken different types of PPPs in infrastructure development with diverse results (Zhang, 2005a). In a wide range of sectors, PPP projects have been successfully executed, which comprise the delivery of roads, bridges, ports, airports and railways, power, water supply and waste disposal systems, telecommunication networks and other services of information technology, schools, hotels, hospitals, prisons and military facilities (Zhang, 2005a). A successful PPP project includes the appropriate allocation of resources, risks and rewards, through the experience of the partners to meet the clearly identified needs and to ensure a net benefit (or value for money) for the general public (Leiringer, 2003).

2.1.1 Definitions for the PPP Term and Basic Features

PPP is used as an umbrella term to reflect a collaborative relationship between the public and private sectors with the objective to accomplish a common goal (Singh and Prakash, 2010). There are various definitions for PPP in the literature. According to the European Investment Bank (2004), PPPs are "the relationships formed between private sector and public bodies often with the aim of introducing private sector resources and/or expertise in order to provide and deliver public sector assets and services". As defined by Koppenjan (2005), PPP is "a form of structured cooperation between public and private partners in the planning/construction and/or exploitation of infrastructural facilities in which they share or reallocate risks, costs, benefits, resources and responsibilities".

PPPs are positioned on an intermediate level between direct government provision and full privatization (Rebeiz, 2012; Torchia *et al.*, 2015). In privatization, there is an irreversible transfer of ownership to the private sector, which provides the private sector with the opportunity of regulating the market (Cruz and Marques, 2011). On the other hand, PPP arrangements involve only a temporary or partial transfer of assets or responsibility for service delivery (Cruz and Marques, 2013). The underlying principle of PPPs is that the responsibility and accountability of the government for delivering services and projects in a way to ensure the protection and enhancement of the public interest continue (Chan *et al.*, 2008).

According to Jamali (2004), the nature of the relationship in PPPs is characterized by cooperation and mutual support, in which, the public sector maintains the control of several key legal and regulatory assets for the implementation of a project as part of an overall development program; and the private sector provides funds, technical expertise and an incentive structure (Jamali, 2004). As claimed by Jamali (2004), in PPP projects, the public sector has the role of setting standards and monitoring product safety, effectiveness and quality, and ensuring that citizens have sufficient access to the products and services they need. In return for lease payments or some other compensation, the private entity is in charge of designing, building, financing, maintaining and/or operating the facility for a specified duration and according to preset performance criteria, and transfers the facility to the public entity at the end of the period (The Construction Management Association of America, 2012).

When compared with other forms of private participation in infrastructure, risk transfer, long-term contract relationships and partnership agreements can be given as the distinctive features of PPPs (Akintoye *et al.*, 2003). In a similar vein, Kwak *et al.* (2009) listed the complexity of contractual relationships between participants and the long partnership period as special features of PPP projects, distinguishing them from traditional infrastructure development projects. In PPP, it is essential to identify the costs and risks inherent in project delivery and allocate the risks to the partner best able to mitigate them, which is based on the ability of public and private sector stakeholders in dealing with each risk item (Babatunde *et al.*, 2012).

Four major phases are defined for a PPP project as follows: (1) Project identification (project selection and definition, and assessment of the PPP option), (2) Detailed preparation (getting organized and conducting the necessary studies before launching the tender), (3) Procurement (carrying out the bidding process, drawing up of the PPP contract and financial close), and (4) Project implementation (contract management and ex post evaluation) (European Investment Bank, 2012). This project life cycle can be also summarized into three major interrelated phases: (1) Initiation and planning, (2) Procurement, and (3) Partnership (construction, operation and maintenance) (European Investment Bank, 2012).

2.1.2 Different Forms of PPPs

As claimed by the United States National Council for Public-Private Partnerships, there are 18 variations of PPPs (The Construction Management Association of America, 2012). Different forms of PPPs involve varied ranges of private sector involvement (Li *et al.*, 2005a). Among the adopted types of PPPs, Build-Operate-Transfer (BOT) type of project procurement is a popular vehicle (Zhang and Kumaraswamy, 2001). Other variants of PPPs include Build-Own-Operate (BOO), Build-Own-Operate-Transfer (BOOT), Build-Operate-Renewal of Concession, Build-Lease-Transfer (BLT) or Build-Rent-Transfer, Build-Transfer-Operate (BTO) and Design-Build-Finance-Operate (DBFO) (United Nations Industrial Development Organisation, 1996).

Abdel Aziz (2007) mentioned two general governmental approaches to implement PPPs. The first one is the finance-based approach, which takes advantage of private financing to meet the infrastructure needs and relies on user fees and project demand for funding projects. The initial PPP arrangements like BOT, BTO and BOO are predominantly finance-based (Kumaraswamy and Morris, 2002). As further explained by Abdel Aziz (2007), the second approach is service-based, which utilizes the skills, innovations, integration and collaboration of the private sector in project design, construction, financing, operation, marketing and management to achieve better performance in service delivery. DBFO arrangements of the United Kingdom (UK) and British Columbia were given as examples to this approach, in which, the upfront capital cost is covered by private finance, relieving the governmental budget in such a way that the government payments are made throughout the contract period (Abdel Aziz, 2007). The most typical form of PPPs consists of a DB team, a maintenance firm and a lending firm as the private entity (The Construction Management Association of America, 2012).

2.1.3 Advantages of PPPs

According to Walker *et al.* (1995), drivers for using the PPP approach are three-fold. The first one is related to the cost savings, avoidance of bureaucracy and reduction of administrative burden provided by means of better mobility of the private sector. The second one is associated with the improved services and a more balanced risk-return structure maintained through the participation of the private sector. The last one leans on the potential of PPP arrangements to alleviate the governments' financial burden, as the government budgets fail to meet the required funds for the large-scale infrastructure projects. PPPs enable the government to focus on the primary areas such as policymaking, planning and regulation (World Bank Group, 2018). As an alternative way to provide the required capital for public programs and projects, the PPP model enables that the public funds remain available for core economic and social programs (Chan *et al.*, 2008).

The benefits offered by PPPs were listed by European Commission (2003) as follows: infrastructure provision realized in shorter periods, through enabling the public sector to incur the expenditures as a flow of on-going service payments instead of one-time capital expenditure; faster implementation by virtue of design and construction responsibility undertaken by the private sector; improved service quality and introduction of innovation in service delivery; reduced whole life cost and enhanced performance and management over a project's life-cycle, achieved in virtue of the structure that allocates the responsibility of operational and maintenance service provision to the private sector along with design and construction; better risk sharing through the allocation of risk to the party best able to manage it at least cost; generation of additional revenues; and enhanced public management.

In a similar vein, the advantages of PPPs were given by The Construction Management Association of America (2012) as follows: creation of an alternative revenue and funding source to close the funding gap; low cost tax allowance or taxable financing; transfer of risk to the private sector; independence from capital budget allocations; speeding up of construction start and minimization of construction cost and interest rate risks; benefiting from efficiency and innovation of the private sector in construction, scheduling and financing; efficiencies in long-term operations and maintenance; and enabling to combine public and private uses in mixed-use developments to foster economic growth.

Other mentioned benefits offered by PPPs include better-defined contracts (Spackman, 2002); better defined project objectives, design innovation and flexibility, superior planning, competitive tendering incentives provided and greater value for money (Al-Saadi and Abdou, 2016).

2.1.4 Problems and Drawbacks of PPPs

In spite of its promised advantages, many handicaps of PPPs have also showed up through the large number of projects delivered using this method, which were mentioned by several authors. According to Levy (1996), public opposition and stakeholder opposition due to various factors such as a low level of awareness of the concept of PPP, having insufficient information and education on PPP and having no access to detailed information of the PPP proposals are some of the problems reported with respect to PPP initiatives around the world.

Total life cycle costs may be higher for the owner in PPPs, which was mentioned among the main drawbacks of the model, together with high costs of the proposal process for all involved parties and the necessity of a high level of experience for the execution of the project (The Construction Management Association of America, 2012). As stated by Akintoye *et al.* (2001), the problems with PPP procurement involve high costs in tender process, complex negotiation, innovation threatened by the cost restrictions, and varying and incompatible goals of the project parties. According to Kagiannas *et al.* (2003), the major barrier for the negotiation process is concerned with the lack of expertise in managing the PPP projects, which is rather valid for the public sector. Spackman (2002) discussed the disadvantages of the model, which are related to the extra costs incurred, absorbed senior staff time, risk premia for financiers, consultancy and legal fees, tendering costs, new risks, central support structures and distortion of priorities in expenditure allocation. Besides the high transaction costs, Li *et al.* (2005b) listed lengthy procurement process, lack of appropriate skills, unattractive financial market, incomplete risk transfer and higher end user charges among the obstacles encountered in PPP implementation. In a similar vein, barriers to PPPs in infrastructure development were classified by Zhang (2005b) as follows: social, political and legal risk, unfavorable economic and commercial conditions, inefficient public procurement framework, lack of mature financial engineering techniques, problems related to the public sector and problems related to the private sector.

2.1.5 Other Countries' Experiences with PPPs and the Private Finance Initiative Model of the UK

According to Chowdhury *et al.* (2011), in some countries, the reason behind the adoption of PPPs is concerned with fiscal deficit, budgetary pressure, demand-supply gap and inefficient public services, while for the others, the reasons rather have a basis of enhancing operational efficiency, employing innovative technological and management skills, and providing more active involvement of private players in public services. The economic, legal, social and environmental circumstances and needs in public infrastructure and services within a country mainly determine the extent and type of projects to be performed on a PPP basis (Gurgun and Touran, 2014). In various regions of Europe, the United States of America (USA) and Australia, PPPs have been extensively used for delivering construction and building projects (Cheung *et al.*, 2012) since 1990 (Chou and Pramudawardhani, 2015). Besides the developed countries, 139 developing countries have also initiated PPP programs to foster infrastructure development (Chou *et al.*, 2012). International financial institutions such as the World Bank and the International Monetary Fund have steered the governments of developing countries to adopt a more efficient and facilitative role and embark on principles of market liberalization and privatization (Jamali, 2004). The model offers efficiency savings and a reduced burden on public resources, which appeal to countries operating under tight budgets (Jamali, 2004).

It is possible to categorize the European Union countries in three groups in terms of the extensity of their PPP implementations and experience: the UK, France, Germany and Italy, which are in an advanced level; Spain, Portugal and the Netherlands in the intermediate level; and Luxembourg, Sweden, Belgium and Greece, which are late comers in terms of implementing PPP projects except for certain sectors (Renda and Schrefler, 2006). In the USA, PPPs possess a large variety involving almost all sectors of government, and joint capital investment is strongly supported in sectors such as energy, water and transportation (Li and Akintoye, 2003). Although the most influencing countries in the implementation and spreading of PPP projects were given as the USA and the UK in the literature, the model of the UK is elaborated in detail in this study since it was the scheme adopted for the restructuring process in the Turkish health sector.

According to Abdel Aziz (2007), the UK is regarded as a model country for its utilization of PPPs to develop various types of projects such as schools, hospitals, prisons, roads and defense facilities. Large-scale public capital projects executed with the Private Finance Initiative (PFI) in the UK include defense, healthcare, public transport, highway, education, social housing and waste management projects (Torchia *et al.*, 2015). Amongst the signed PFI projects, almost 70 percent belong to the health sector (Akintoye, 2007). Most of the projects are contracted for a duration longer than 25 years (Torchia *et al.*, 2015). Many projects delivered through the PFI were regarded as successful (Zhang and Kumaraswamy, 2001; Li *et al.*, 2005a; Ke *et al.*, 2009).

Most of the PPPs in the UK were undertaken with the PFI model, which was first introduced by the then Conservative Government in 1992 and has continued by Labour Government since 1997 under its own PPPs policy, with the aim of providing better public services with private sector participation (Li *et al.*, 2005a). Up to 1997, PFI was primarily used for transport projects, and as from 1997, the model's area of influence has expanded and it has been utilized for various types of projects such as hospitals and schools (Broadbent and Laughlin, 2003). Since then, PFI has been the preferred method of public infrastructure procurement for the UK government (Handley-Schachler and Gao, 2003). There is no specific law on PPP/PFI in the UK (Islamoglu, 1998); all of the established PPP/PFI projects in the UK are based on a number of diverse laws put together (Payne, 1997). According to Broadbent and Laughlin (2003), PFI is a DBFO system, in which, a private sector consortium provides property-based services for a period of 30 to 60 years to the public sector and public sector pays monthly lease cost to the private sector supplier over this time horizon, which is revised periodically during the contract period. The service package provided by the private sector includes the design of the building, its operational management and aligned services; and the management of the overall financing of the project, including high capital costs incurred at the outset is also among the private sector supplier's responsibilities (Broadbent and Laughlin, 2003). In PFI, a private consortium bids for an infrastructure (and other privatized) project, builds and operates the facility, and receives annual service payments from the public client in return (Morledge and Owen, 1998).

2.1.6 PPPs in Healthcare

The rapid increase in healthcare costs has prompted the governments all over the world to find a solution for their limited governmental budgets (Blanken and Dewulf, 2010). As opined by Cruz and Marques (2013), due to a global tendency of governments to limit their direct participation in healthcare infrastructure and public service delivery, private sector has initiated to undertake a more active role in system management and financing. Thus, PPP schemes have brought the public and private sectors together for the execution of public healthcare projects over the past two decades (Cruz and Marques, 2013). The formation of PPPs for healthcare projects can be regarded as unavoidable and imperative due to the mentioned necessities (Torchia *et al.*, 2015). The advantages of PPPs in healthcare are parallel to those of PPP arrangements in other sectors, which include enabling a life-cycle approach for planning, and the provided benefits and efficiency gains through the profit-oriented approach of private sector, without creating a major burden on the government budget (Cruz and Marques, 2013). Javed *et al.* (2013) mentioned that PPPs for healthcare projects enable to maximize design and operational efficiencies by means of the strong collaboration of technical advisors including healthcare planners, construction contractor and operator, to provide innovative solutions through design, construction and operation integration.

As elaborated by Cruz and Marques (2013), a hospital system includes infrastructure (the building itself and the systems required such as air conditioning, elevators, ventilation, water and energy), clinical services (the personnel, materials and activities for the provision of medical treatment) and soft facilities (*e.g.* cleaning, laundry, security, parking and catering) delivery. Medical equipment might fall into the scope of infrastructure or clinical services, depending upon the project. One of the distinctive issues between the healthcare projects and other types of facilities is the difficulty in monitoring, measuring and verifying the quality standards to ensure the success of a healthcare project, due to the greater complexity and wider scope of health services. Therefore, the precise definition of quality standards for healthcare services is required to facilitate effective control.

Another difficulty for healthcare PPP projects is related to carrying out effective risk sharing between the public and private sectors, as the uncertainty inherent in healthcare is vague due to difficulties in forecasting demand (*e.g.* disease patterns and population profiles) and supply (*e.g.* available medical treatments, equipment and drugs); and therefore, changing demand, technology and patterns in medical care constitute the principal risks (Cruz and Marques, 2013). Hashim *et al.* (2016) also pointed out the challenges of implementation for PPP healthcare facilities management, among which, complex project development, difficulty in reaching agreement, difficulty in fulfilling diversified design specification, change in demand for design, limitation in design innovation and difficulty in incorporating flexibility can be listed as the ones particularly specific to healthcare project type.

Several countries have employed the PPP arrangement for the delivery of healthcare projects all over the world (Abdou and Al Zarooni, 2011). Although the features of PPP projects differ by country, some general types of models exist, sharing a similar structure (Cruz and Marques, 2013). Forms of PPPs in the health sector vary with regards to the degrees of responsibility and risk undertaken by public and private sectors (Torchia *et al.*, 2015). Traditional PPP schemes for healthcare focus on building construction and maintenance, together with selected secondary services included (Cruz and Marques, 2013). PPPs are used solely for infrastructure delivery in most countries, and the management of clinical services is undertaken by their National Health Services (NHSs) (Cruz and Marques, 2013).

The UK and the USA were the first countries to undertake PPP arrangements for the healthcare sector (Torchia *et al.*, 2015). In the USA, a full privatization is undertaken for the healthcare system, to take the advantage of full cost recovery and price affordability guaranteed by public health insurance (Galvin, 2003). The UK, France and Italy have employed a PPP model that transfers the management of nonclinical activities to private companies, whereas new PPP models developed in Spain and Portugal differ from the traditional ones with the inclusion of clinical management services in the scheme (Cruz and Marques, 2013). Other countries that employ PPPs for healthcare delivery include Canada, Australia, Latin and South America, South Africa and Lesotho (Cruz and Marques, 2013). In addition to these, there are PPP healthcare initiatives in India and Singapore (Torchia *et al.*, 2015).

The PFI adopted by the UK Government was developed with the aim of providing a greater investment in healthcare facilities (Akintoye and Chinyio, 2005). The NHS of the UK is the largest single market for healthcare PPPs (Torchia *et al.*, 2015). Almost all of the NHS hospitals constructed in the UK since 1997 were financed by the PFI (Shaw, 2003). In the UK model, the private sector undertakes the risks pertaining to infrastructure and soft facilities delivery, together with the maintenance and management of some complex medical equipment, whereas the public sector maintains the responsibility of clinical management (Cruz and Marques, 2013). The UK model has been preferred by many other governments due to its moderate risk-sharing arrangement (Cruz and Marques, 2013).

2.1.7 Development of PPPs in Turkey

Turkey has three decades of experience in PPP projects, with an active PPP market (Gurgun and Touran, 2014). In the development of PPP laws, Turkey is regarded as one of the pioneer countries in the world and the aim was to provide integration with international markets and boost the private sector participation in the economy (Yondem, 2012). The BOT projects, conducted in the mid-1980s for the funding and construction of large-scale infrastructure and power plants projects, were associated with a privatization plan (Algarni *et al.*, 2007). In the following years, highway construction and maintenance services projects were carried out with the BOT, Transfer of Operating Rights (TOOR) and Build-Operate (BO) methods; and in the 1990s, the PPPs became a controversial issue due to the political, economic and legal basis, political instability and errors in contract design (Tekin and Celik, 2012).

Despite being one of the first countries to implement PPP projects, the private sector participation had not reached to the desired level in Turkey through the approximately 25 years period starting from the mid-1980s, and a variety of problems had emerged, especially stemming from the risk sharing arrangements (Uz, 2007). Except for the applications within the scope of air transportation and energy, the PPP model had not been widely used and had not succeeded in Turkey (Uz, 2007). On the other hand, the PPP model has been once again brought to agenda in 2003 by virtue of the concrete arrangements and funds provided by the European Union (Tekin and Celik, 2012). Notedly over the past decade, PPP projects have been prioritized in Turkey with the established government policies (Gurgun and Touran, 2014).

Since its introduction, PPPs have been established in the Turkish construction sector for the implementation of power plant, highway, airport, harbor, marina, hospital and finally health campus projects (Gurgun and Touran, 2014). To ensure the successful execution of the PPP projects, a number of laws and regulations have been enacted between the years 1984 to 2005 in Turkey; but still, an inclusive PPP law does not exist (Gurgun and Touran, 2014). The enacted laws include Law No. 3096, 3465, 3996, 4046, 4283 and 5335, which target BOT, BO and TOOR projects, and finally Law No. 5396 was established for the execution of BLT projects. It is anticipated that the PPP investment and service production model, which has been introduced in the health sector, will be extended to other public services, especially education, in the following years (Karahanogullari, 2012).

2.1.8 Healthcare PPP Program of Turkey

As a developing country, there has been a high level of demand for new infrastructure construction and rehabilitation of the existing infrastructure in Turkey, with a need of diverse public services to meet this demand, and cooperation with the public sector was regarded as a solution to relieve the financial burden on the government budget (Gurgun and Touran, 2014). Due to the budgetary considerations and limitations, Ministry of Health has intended to take the advantage of the dynamism and financial ability of the private sector for the reconstruction and renovation of healthcare facilities in Turkey (Tekin and Celik, 2010). Thus, Turkey has been undertaking a restructuring process in its healthcare system since 2004 and a great number of healthcare projects have been planned to be delivered across the country. Based on the Health Transformation Program launched in 2004, Ministry of

Health adopted a model similar to the PFI model of the UK (Tekin and Celik, 2010) and determined the delivery system as BLT (Gurgun and Touran, 2014). Over time, the policy has been supported by countries such as the UK and Spain, as well as by grants provided by the World Bank (Tekin and Celik, 2012).

A total of 30 healthcare complexes of different sizes and different bed capacities have been planned to be built in 22 cities (Republic of Turkey Ministry of Health, 2011). Proposed healthcare projects cover a wide range of services including specialization hospitals, emergency and intensive care units, high technology laboratories, research centers and health technoparks, hotels and medical hotels, shopping centres, administrative centres, central pharmacy and storage, and parking lots (Tekin and Celik, 2010).

The first legal alteration in the delivery of healthcare services in Turkey was through insertion of an item to the Health Services Basic Law No. 5396 in year 2005 (Tekin and Celik, 2010). The law comprises regulation on the implementation of healthcare construction projects on a BLT basis and the restoration of the service areas other than the medical parts on a Restore-and-Operate basis (Gurgun and Touran, 2014). As designated with this item, private sector was entitled to carry out healthcare projects on treasury lands with the approval of the Supreme Planning Council (Tekin and Celik, 2010).

In 2006, further regulations were enacted, empowering private sector to operate non-medical services and areas of the healthcare facilities (Gurgun and Touran, 2014). Elaborations on the construction, renovation, furnishing, supply, maintenance and operation (other than medical services) of health facilities were included in the framework, while limiting the maximum concession period with 49 years (Gurgun and Touran, 2014). Consultations were held with experienced international project firms for the adaptation of the model (Tekin and Celik, 2010). To provide the final elaborations on the issue, another law has been enacted in 2013 and accordingly, the maximum duration of the contract has been regulated as a maximum of 30 years excluding the period of fixed investment (Boz, 2013).

As mentioned by Sozer (2013), the private sector undertakes the design, construction, operation and maintenance of the facility and is in charge of transferring the facility in a well-maintained condition at the end of the contract period, while the duties and responsibilities of the Ministry include deciding on the scope of the service areas and commercial areas to be transferred to the private sector, determining the lease period and annual payment amount, preparation of the concept project, regulation, supervision, providing assurance and taking preventive measures. As the payment period commences with the operation phase, no expenditures are incurred from the government budget until construction completion and this releases public resources to be used for other public needs (Tekin and Celik, 2010).

Unlike other PPP models subject to administrative law, the PPP contracts in this area are subject to private law, which increased the interest in healthcare projects by the private sector (Gurgun and Touran, 2014). As denoted by Delmon and Delmon (2010), in private law contracts, the public and private sector parties have equal status and more flexibility is provided when compared to the contracts based on administrative law.

According to the General Directorate of Health Investments in Turkey (Republic of Turkey Ministry of Health General Directorate of Health Investments, 2018), among the PPP healthcare projects initiated, five projects have reached construction completion and put into operation, and 14 projects are in the design/construction period as of June 2018, while there are other projects in the pipeline to be tendered.

2.1.9 Problems Reported for the PPP Healthcare Project Implementations in Turkey

Through the review of the relevant literature, it was observed that most of the studies focusing on healthcare PPPs in Turkey examined the subject with respect to deficiencies in the legal framework, the political, administrative and financial concerns and governmental immaturities that are needed to be addressed for the improvement of the model administration. On the other hand, in line with the context of this research, only the studies touching on the PPP project planning and delivery processes are mentioned in this sub-section.

Tekin and Celik (2010) looked into the implementation of PPP policy for the healthcare projects carried out in Turkey and mentioned a set of problems stemming from the political framework. Other than the higher-level concerns, some deficiencies put forth for the project-level comprise the need for developing a system to pass on the experiences gained from project implementation to future projects, need for eliminating the ambiguities in the management of projects and in the post-construction process, need for determining the problem areas and preparing action plans, and need for developing new management approaches. Karasu (2011) pointed out the problems associated with the management of PPP healthcare projects carried out in Turkey, which stem from the greatness of project sizes and complexity of the healthcare project type. As stated, these projects include a detailed and heavy workload and are difficult to monitor and control. In a similar vein, it was reported by the Republic of Turkey Ministry of Development (2012) that these projects necessitate the improvement of the management capacity both for the public and private sectors and require a high degree of specialization.

Moreover, the Republic of Turkey Ministry of Development (2014) focused on the PPPs in Turkey within the Tenth State Development Plan and published a report prepared by the PPP Specialized Commission. The aim of the study was to analyze the then-current situation of the PPPs, determine the problems and propose respective solutions for the 2014-2023 period. Problems mentioned in the report include issues related to the inadequate pre-planning of projects, inadequacies in preparing realistic and detailed feasibility studies, the need for better coordination of the projects by the public agency, the necessity of stakeholder analysis for the projects, the need for the review of international experiences on PPP, inadequate preparation for tenders and negative effects of addendums, and lack of coordination in the project implementation phase.

2.2 Project Success and Critical Success Factors (CSFs)

The concept of project success is associated with setting forth the criteria and standards, by which, projects can be completed with the most favorable outcomes (Chan and Chan, 2004). As expressed by Lim and Mohamed (1999), the perception of project success and failure, and the expectation on the outcome of the project may differ for different project parties, *i.e.* the owner, developer, contractor, user and the general public. In a similar vein, Chan and Chan (2004) mentioned that project objectives and criteria for measuring success are different for owners, designers, consultants, contractors and subcontractors. In studies focusing on the attributes of projects with respect to project success, it is assumed that by virtue of certain success attributes, project success is repeatable (Ashley *et al.*, 1987).

As defined by Tuman (1986), project success is to have everything ended up as expected, through the anticipation of all project requirements and provision of sufficient resources in due course. Ashley *et al.* (1987) claimed that a project is considered to be successful if it meets/exceeds performance expectations in terms of cost, schedule, quality, safety and participant satisfaction. As argued by De Wit (1986), in a successful project, the key stakeholders from the parent organization, the project team and end users have a high level of satisfaction of the project outcome and the project meets the technical performance specifications and/or mission to be performed.

According to Sanvido *et al.* (1992), although a project's performance is influenced by a vast number of factors, certain factors are more critical for a project's success when compared to others, and by examining these factors, the success of the project can be predicted. Identification of the CSFs assists in the more precise prediction of success (Hwang and Lim, 2013). As pointed in the study of Li *et al.* (2005a), the CSFs concept was first appeared in the context of project management and has been utilized since 1970s in information systems (Rockart, 1982), financial services (Boynton and Zmud, 1984) and manufacturing industry (Mohr and Spekman, 1994). There are many definitions in the literature for the CSFs. As defined by Rockart

(1982), CSFs are the "few key areas of activity in which favourable results are absolutely necessary for a particular manager to reach his/her goals". To quote Boynton and Zmud (1984), CSFs are "those managerial or enterprise areas that must be given special and continual attention to bring about high performance". According to Lim and Mohamed (1999), project success factors are "influential forces which either facilitate or impede project success" and defined as "the set of circumstances, facts, or influences which contribute to the project outcomes". CSFs were also mentioned as "factors predicting success on projects" (Sanvido *et al.*, 1992). A CSF denotes a certain element which "significantly contributes to, and is vital for, the success of a project" (Toor and Ogunlana, 2009). In providing the successful development of any project, CSFs can be regarded as vital enablers (Al-Saadi and Abdou, 2016).

Therefore, to achieve project success, the factors affecting project success and the factors leading to the failure of the project are needed to be identified in the first place (Toor and Ogunlana, 2009). CSFs are effective in avoiding project failure, determining promising projects worth undertaking and ascertaining problematic project areas to take corrective action (Hwang and Lim, 2013). To make an efficient resource allocation for a project, it is important to identify the CSFs in terms of project objectives (Chua *et al.*, 1999; Zhang, 2005a) and to focus on these key factors (Chen *et al.*, 2012). As stated by Chan *et al.* (2001), the evaluation of CSFs can contribute significantly to the selection of project team members, determination of development needs and estimation of the performance level of the project before it commences.

2.2.1 Success Criteria for Construction Projects

Although this research adopted a focused view on the identification and assessment of the CSFs, discussion of the project success criteria, together with the project performance indicators and performance measures was also regarded as complementary, since these concepts are intertwined. The distinction between success criteria and the success factors was made clear by Cooke-Davies (2002), asserting that criteria are “the measures by which success or failure of a project or business will be judged”, whereas success factors are “those inputs to the management system that lead directly or indirectly to the success of the project or business”. The concept of KPIs is also extensively used for performance measurement in the construction sector (Chan and Chan, 2004). KPIs are general indicators of performance, which designate critical aspects of outputs or outcomes (Collin, 2002). According to Mbugua *et al.* (1999), performance indicators are referred to as measures when it is possible to obtain a precise measurement with the indicators to some extent.

Time, cost and quality, which are considered to be the basic criteria to project success were in the focus of several studies (*e.g.* Belassi and Tukel, 1996; Walker, 1995, 1996; Hatush and Skitmore, 1997). Although these are accepted as the three fundamental measures for project success, success outcomes are changing and expanding to include issues such as functionality, environmental friendliness and low accident rates; and yet, there is no general agreement on project success measures (Chan *et al.*, 2005). In this study, the measures identified by Chan and Chan (2004) and Chan *et al.* (2005) were adopted as the basis for the criteria to be used in defining project success, to provide a holistic approach.

Chan and Chan (2004) aimed to develop a consolidated framework for measuring the success of construction projects, constructed by the use of the dimensions identified by several researchers. The framework is comprised of a set of KPIs, which are time, cost, value and profit, health and safety, environmental performance, quality, functionality, user expectation and satisfaction, and participants’ satisfaction. Chan *et al.* (2005) investigated the success criteria for healthcare projects in Hong Kong. A questionnaire was built with 11 success measures identified through literature review and implemented to the client and the contractor groups in order to reveal the relative importance of the measures for running healthcare projects. According to the results, the most important criteria for carrying out healthcare projects, in order of importance were: client satisfaction with the performance of the project, project completion to the required standard of quality, project achieving its purpose/function, project completion with a low accident rate and project completion on budget. Following those are the criteria of end-users' satisfaction with the performance of project, project completion on time and participants' satisfaction with project performance. On the other hand, project profitability, project's capacity to produce further/long-term gains and environmental friendliness of the project were revealed to be the least important criteria for the success of healthcare projects.

2.2.2 CSFs for Construction Projects

Construction industry is dynamic in nature, involves ever increasing uncertainties in technology, budgets and development processes and is characterized by temporary, fragmental and short-term projects (Chan and Chan, 2004). A construction project requires the assemble of planned or unplanned events or interactions and changing participants and processes in a constantly changing environment (Sanvido *et al.*, 1992). Due to the rapid technology alterations and increasing quality demands, together with complex contractual obligations, regulatory protocols and project financing, the criteria for success evolve constantly in the construction industry (Hwang and Lim, 2013). Since the construction projects involve diversity by nature, provision of a single comprehensive list of success factors for construction projects was regarded as unattainable (Toor and Ogunlana, 2009). On the other hand, a great development in CSFs has taken place in the last two decays, and several research studies have been conducted to identify the CSFs for project success in general, CSFs related to different aspects of project performance or for different types of projects (Chen *et al.*, 2012).

Studies that proposed a conceptual CSFs framework for the construction projects

Parfitt and Sanvido (1993) developed a checklist for the use of construction professionals as a guideline to evaluate the success of a project, which was presented as a management and planning aid in determining the potential pitfalls and taking corrective actions in advance. Chan *et al.* (2004) proposed a conceptual framework on CSFs for a construction project, drawing on previous studies of the same scope.

Studies that employed statistical analysis regarding the CSFs in construction projects

Jaselskis and Ashley (1991) analyzed the key success factors focusing on the project team and project control effort to find out how they relate to the project outcomes, *i.e.* the achievement of overall project success, better-than-expected schedule performance and better-than-expected budget performance in construction projects. Sanvido *et al.* (1992) put forth a set of factors to enable project parties to rapidly evaluate the possibility of a successful project and tested the proposed set on 16 construction projects. In their study targeting various sectors including the construction industry, Belassi and Tukel (1996) classified the CSFs with respect to the characteristics of the project, organization, project manager and team members, and external environment, and explored the interaction between the factor groups to describe their impacts on project performance, which revealed that environmental factors take the lead for the construction industry. Nguyen *et al.* (2004) aimed to identify the project success factors for large construction projects in Vietnam with a survey and employed factor analysis to define a set of common underlying dimensions among the factors. Toor and Ogunlana (2008) investigated the CSFs for large-scale construction projects through a survey carried out among industry practitioners in Thailand and examined the underlying relationships of factors through factor analysis. As a continuation of this study, Toor and Ogunlana (2009) explored the perception of construction stakeholders (*i.e.* client/developers, consultants, designers and contractors) on CSFs for large-scale construction projects in the context of Thailand, through the conducted survey and interviews. Cho *et al.* (2009) aimed to analyze the overall relationship between a project's characteristics and project performance, and revealed the degree of influence between the 17 project characteristics and five project performance indices using Structural Equation

Modeling (SEM). The final model developed was offered to assist the decision-making process in the early planning stage of a construction project. Tabish and Jha (2011) objected to identify and evaluate the factors key to successful completion of public construction projects. Via the analysis of the data gathered through a survey conducted in India, four success factors were revealed, and each factor's relative significance for overall performance was derived with multivariate analysis. Chen *et al.* (2012) identified a comprehensive set of CSFs for construction projects and explored the interrelationships among the factors using SEM. The constructed framework consisted of three categories, *i.e.,* participant-related factors, project-related factors and environment-related factors, together with ten subcategories. Employing a post construction evaluation perspective, Alzahrani and Emsley (2013) looked into the impact of contractors' attributes on construction project success. Using factor analysis and regression analysis, models were developed to evaluate the probability of project success based on the contractors' attributes.

Pointing out the rapidly increasing use of DB projects in the public sector, Songer and Molenaar (1997) explored the critical project characteristics for successful public-sector DB projects, targeting the improvement of public agency project implementation. Molenaar and Songer (1998) developed a model for public sector DB project selection, embodying five performance criteria that correlate specific project characteristics to success. Chan *et al.* (2001) aimed to determine a set of project success factors for DB projects and examined the relative importance of these factors on project outcome with a multivariate analysis. Ling *et al.* (2004) investigated the factors that may affect the performance of DB and DBB projects and constructed models to predict the project performance in terms of cost, time, quality and owner satisfaction using multivariate analysis. Lam *et al.* (2008) proposed a project success index for DB projects in the context of Hong Kong construction industry, using the key project performance indicators of time, cost, quality and functionality, and applied multiple regression analysis to identify the CSFs for DB projects.

Studies that employed a multi-criteria decision-making method regarding the CSFs in construction projects

Chua *et al.* (1999) intended to identify the CSFs for construction projects with respect to project objectives of budget, schedule and quality, and accordingly, constructed an Analytic Hierarchy Process (AHP) model through grouping the factors under project characteristics, contractual arrangements, project participants and interactive processes to determine the relative importance of the factors. Hwang and Lim (2013) investigated key factors that determine overall construction project success and the CSFs for the construction projects with regards to different project players, *i.e.* owners, contractors and consultants, and their objectives. The model was built with the AHP and the CSFs addressing budget performance, schedule performance, quality performance and overall project success were set forth. Gudiene *et al.* (2013) explored the CSFs for construction projects in Lithuania. External, institutional, project related, project management/team related, project manager related, contractor related and client related factors were grouped into a hierarchic structure and their priorities were revealed using the AHP.

Studies that employed an artificial intelligence technique regarding the CSFs in construction projects

Chua *et al.* (1997) adopted a neural network approach to identify the key management factors for construction budget performance and built a model for the construction projects accordingly. Kog *et al.* (1999) identified the key determinants for the schedule performance of construction projects and developed a neural network model of schedule performance.

Studies that explored the CSFs regarding the green building projects

CSFs for green building projects were also explored for this study, as the *green building performance* criterion was regarded as critical for the healthcare facility construction project success. In several studies (*e.g.* Korkmaz *et al.*, 2010; Korkmaz *et al.*, 2011; Swarup *et al.*, 2011; Gultekin *et al.*, 2013), project delivery attributes in relation to performance metrics for high-performance green buildings were investigated. Robichaud and Anantatmula (2011) suggested modifications to conventional project management practices in green building projects. Li *et al.* (2011) conducted a research to identify the critical project management factors, which are controllable by the architecture, engineering and construction firms, for delivering Green Mark certified projects with higher Green Mark ratings. Ofori-Boadu *et al.* (2012) looked into the management practices necessary to achieve the successful implementation of Leadership in Energy and Environmental Design (LEED) projects.

2.2.3 CSFs for PPP Projects

PPPs are difficult to structure and implement (Torchia *et al.*, 2015). It was claimed by Chan *et al.* (2010) that identification of the CSFs assists in the decision-making stage of selecting suitable PPP projects and in effective management of the projects undertaken. Chan *et al.* (2010) further mentioned that the identification of CSFs also paves the way for developing corresponding strategies to enhance the delivery of future PPP projects. Zhang (2005a) regarded the identification, analysis and categorization of the CSFs for PPPs as the initial significant step towards preparing an efficient PPP procurement protocol.

There are many factors shaping the development of a PPP project including local geography, political environment, the sophistication of the capital market, the forces activating the formation of partnerships and enabling their formation (Yitmen *et al.*, 2012). The conditions for the success and sustainability of PPP projects are needed to be evaluated on a case-by-case basis to reveal the costs, benefits and the likelihood of success of such an approach (Nikolic and Maikisch, 2006). Liu *et al.* (2015b) pointed out the complex nature of PPP projects, with a life cycle encompassing initiation, planning, design, operation and maintenance, and mentioned that the project process management performance of a PPP cannot be addressed by the sole focus of construction cost and time. PPP projects are needed to be considered with the attributes of a variety of project's processes adopting a life-cycle approach and CSFs should be identified accordingly (Liu *et al.*, 2015b). Owen (1997) provided a definition of CSFs particular to PFI projects as follows: "those few factors which, when judiciously applied to a PFI scenario, have led to, and/or will actively contribute to, a profitable conclusion for one or more of the parties involved". Despite the barriers and problems faced in PPP implementation, there are many PPP projects worldwide which are regarded as successful, and the factors behind their successful delivery have been in the focus of various studies.

Studies that discussed the CSFs, principles or guidelines for PPP projects

Morledge and Owen (1998) investigated the factors considered to be crucial to the success of PFI projects in the UK, drawing on expert opinion from various parties (*i.e.* clients, contractors, financiers, operators and others) involved in PFI projects. It was suggested that ignorance of the extracted factors makes the project more inclined to fail. Abdel Aziz (2007) suggested a number of principles for the successful implementation of PPPs at the program level, drawing on the examination of the service-based PPP approaches in the UK and British Columbia, and comparing these approaches to the finance-based approach. Jacobson and Choi (2008) looked into the principal factors that contribute to successful PPPs and focused on public works projects through in-depth interviews, observation and collection of archival data with respect to two case studies. Gurgun and Touran (2014) explored the common success factors, risks, limitations and challenges of PPP implementations in Europe, the UK, China, the USA and Turkey, and discussed the major factors pertaining to the successful execution of PPP projects.

Studies that proposed a conceptual CSFs framework for PPP projects

Jefferies *et al.* (2002) suggested a conceptual CSFs framework for the BOOT projects, through the examination of a large-scale case by means of reviewing the necessary documentation and interviews conducted with key senior project participants. Zhang (2005a) aimed to identify, analyze and categorize various factors that are critical to the success of PPPs in general, based on a win-win principle for public and private sectors, drawing on examination of case studies from developed and developing countries, literature review and interviews/correspondence with international experts and practitioners. Zhang (2005b) identified the barriers to PPPs in infrastructure development through a questionnaire survey; explored measures for removing these barriers by means of a literature review, case studies and interviews/correspondences with experts and experienced practitioners; and finally proposed a PPP protocol for the success of infrastructure projects in general. Liu *et al.* (2015b) developed a life-cycle CSFs framework for PPP infrastructure projects employing a project management success perspective. The study adopted a phase-based approach, which was built by grouping the key managerial activities for process management of PPP infrastructure projects in three project phases, *i.e.* Initiation and Planning, Procurement, and Partnership. Using this study as a basis, Liu *et al.* (2015a) suggested a conceptual framework for dynamic life-cycle evaluation of PPPs. Besides the aforementioned three main project phases, the framework consists of a set of core indicators under five measurement facets.

Studies that employed quantitative methods to explore the CSFs for PPP projects

Qiao *et al.* (2001) explored the CSFs for different phases of BOT projects, *i.e.* preliminary qualification evaluation, tendering, concession award, construction, operation and transfer. Via a questionnaire survey and in-depth interviews addressing BOT project companies and government authorities in China, a framework was proposed and the CSFs of BOT projects were ranked with respect to their attached importance. Li *et al.* (2005a) examined 18 potential CSFs for PPP/PFI construction projects in the UK with a questionnaire survey among organizations with PFI experience, with regards to their perceived importance at the project development stage; as strategic decisions addressing project success are employed in the early stages of a project. Besides ranking the factors according to their relative importance, factor analysis was employed to reveal appropriate factor groupings. Wang *et al.* (2007) aimed to develop a CSFs model for infrastructure projects delivered with the PPP model. The CSFs were identified through a questionnaire survey carried out in China, and using the system engineering method, the links between the factors were explored based on whether or not the factor has the potential to affect the other factors. An interpretive structural model was suggested, showing that five factors have the potential to affect the realization of other success factors. Chan *et al.* (2010) looked into the factors pertaining to the success of PPP infrastructure projects in China, adopting the CSFs framework proposed by Li (2003). Subsequent to the conduct of an empirical questionnaire survey among Chinese industry practitioners from the public and private sectors, the results were statistically analyzed and grouped by using factor analysis. Babatunde *et al.* (2012) examined the suitability of the PPP model with respect to the execution of different types of infrastructural projects and also aimed to identify the CSFs for PPP infrastructure projects in Nigeria. Through the administration of a questionnaire survey, no significant difference was found in the suitability of using PPPs for the implementation of different project types. Notwithstanding, projects that involve a huge financial outlay such as provision of electricity and water, transportation and provision of health and social services were determined to be the most suitable for the use of the model and this was attributed to the required expertise and financial capability of the private sector to ensure the effective execution of these projects.

Cheung *et al.* (2012) aimed to analyze the perceptions of respondents from Hong Kong and Australia on the importance of 18 factors which were adapted from Li (2003). An empirical survey was carried out comprising the public and private sectors to rank the factors according to the respondents' perceptions of the factors' contribution to the successful delivery of PPP projects. Ng *et al.* (2012) looked into the factors influencing the success of PPP projects at feasibility stage with respect to the public sector, private consortium and the general community, through a questionnaire survey and a series of expert interviews conducted in Hong Kong. Yuan *et al.* (2012) examined the PPP stakeholders' perceptions of performance indicators in PPPs and developed a conceptual model for performance management and measurement with 48 indicators. Tang and Shen (2013) investigated the factors that affect the effectiveness and efficiency of analyzing the needs of the stakeholders at the PPP projects' briefing stage. The data obtained with a questionnaire survey conducted in Hong Kong were analyzed with a custom-made weighted ranking method and an exploratory factor analysis. Chou and Pramudawardhani (2015) compared the key drivers, CSFs and preferred risk allocation in PPPs carried out in Taiwan, Singapore, China, the UK and Indonesia. Mean value analysis, confirmatory factor analysis and dimensional importance were used in the comparison of the categories. Al-Saadi and Abdou (2016) explored the experts' perception of the key success factors of PPP infrastructure projects in the United Arab Emirates (UAE) and examined their relative importance with semi-structured interviews conducted with experts. Almarri and Boussabaine (2017) focused on the association between the CSFs and ex-post performance indicators of PPP projects through administering a questionnaire survey among experts in PPP from the UK and the UAE. The collected data were analyzed using descriptive statistics and the multiple regression method. Osei-Kyei *et al.* (2017) looked into the CSFs and their groupings for managing PPP projects at the operational stage via an empirical questionnaire survey among international PPP experts and analyzed the survey responses using factor analysis and fuzzy synthetic evaluation technique. Based on the same research study, Osei-Kyei and Chan (2017) investigated the perceptual differences of the stakeholders on the factors that contribute to the successful management of PPP projects at the operational stage.

2.2.4 CSFs for Healthcare Projects

Through the exploration of the literature, it was seen that studies pertaining to the successful delivery of healthcare projects were rather limited. Abdou and Al Zarooni

(2011) intended to develop a preliminary list of possible CSFs for the UAE public healthcare projects, which was reported as the first stage of an ongoing research project. It was based upon the study of Abdou *et al.* (2005), which targeted to identify and rate risk factors/events that affect the development of the UAE healthcare projects with deviations from the initial cost estimate. The antecedent study prioritized the risk factors affecting UAE healthcare projects, and in light of the identified risk factors, Abdou and Al Zarooni (2011) established a list of the potential success factors of PPP healthcare projects in the UAE. As mentioned by Abdou and Al Zarooni (2011), this preliminary work requires additional research and validation.

Ozcan (2015) compared Turkey and the UK with respect to the efficiency and successful applicability of PPPs. Through the conducted literature review and examination of two case studies, the study highlighted the CSFs, possible causes of risk and important contractual considerations for the two countries and pointed out the similarities and differences between their implementation policies.

Doulabi and Asnaashari (2016) objected to identify the success factors of healthcare facility construction projects in Iran, through interviewing experienced construction practitioners. The study adopted a qualitative approach with the conduct of open-ended interviews and provided a discussion of the results.

2.3 Critical Analysis of the Literature

To obtain a multi-dimensional view on the relevant research area, the concept of PPP, its different forms, advantages and drawbacks were explored, together with the issues concerned with its implementations for the healthcare projects. Country experiences with PPPs were examined, followed by focusing on the PPP healthcare project implementations in Turkey. As mentioned in the relevant sources, healthcare PPP projects in Turkey have been carried out with an intense agenda, without the allocation of the required time and effort for the proper planning of these projects.

Several projects are carried out simultaneously, and these projects have fairly strict timeframes. Problems have been reported in the literature concerning the deficiencies in the management capacity of the public and private sectors, difficulties in the provision of proper monitoring and control for the projects and deficiencies in capturing the lessons learned from the implemented projects to be used for the future ones. On the other hand, the vast majority of the researchers have so far focused on the shortcomings concerning the legal framework, policies, financial model and governmental immaturities with respect to the PPP healthcare project implementations in Turkey. The issues associated with the delivery and management of these projects and their potential solutions has remained rather unexplored.

The rest of the literature search was focused on the concept of project success and the CSFs to address the successful planning and delivery of PPP healthcare projects. The review of the relevant literature was performed in three parts, which comprised the exploration of the studies focusing on the success and CSFs for: (1) construction projects, (2) PPP projects and (3) healthcare projects. Studies pertaining to the identification/analysis of the CSFs in construction projects date back to early 1990s and the literature can be regarded as rather mature in this area. There are studies in the literature showing diversity in terms of scope and in terms of the methods applied for the exploration of CSFs in construction projects, including:

- a few studies that suggested a conceptual framework using a theoretical approach,
- a number of studies that conducted industry surveys and derived statistical inferences in relating the CSFs to performance outcomes,
- a few studies that employed the AHP to define the relative importance weights of the factors using a number of performance outcomes,
- a few studies that exploited SEM to find out the overall relationship between a project's characteristics and performance, and to explore the interrelations between the CSFs.

When the studies carried out on project success and on CSFs in relation to PPPs were examined, it was seen that a considerable number of studies carried out in this area rather adopted a theoretical approach, such as discussing a set of CSFs for the successful implementation of PPP projects or suggesting a conceptual framework for PPP project success without validation. The others used empirical industry surveys, in which, the vast majority employed statistical analysis to rank the CSFs in terms of their importance and grouped them via factor analysis. In this context, the only study that considered the interrelationships between the success factors for PPP projects was performed by Wang *et al.* (2007). The study was intended to construct an interpretive structural model by using the system engineering method, based on the existence/non-existence (1 or 0) of an influential relationship between the factors of the model. This attempt was considered to be beneficial as a preliminary step to look into the interrelationships between the CSFs. On the other hand, a more robust analysis of the interrelationships between the factors and of their degree of influence was regarded as necessary, in order to obtain a more realistic reflection of the real-world circumstances.

When the literature concerned with healthcare project success was investigated, it was observed that only three studies had been carried out on this particular issue. The first study in this group was reported as the first stage of an ongoing research project, and provided a preliminary list of potential factors for PPP healthcare project success. As it was also mentioned by its authors, the study requires further work and validation. Another one is a theoretical study comparing two case studies and drawing inferences on the CSFs, possible causes of risk and important contractual considerations for the PPP healthcare implementations in Turkey. This research was intended to provide a theoretical basis for the successful implementation of PPP healthcare projects executed in Turkey. The last study reviewed was aimed at exploring the success factors for healthcare facility projects, which adopted a qualitative approach leaning on open-ended interviews with the experts and provided a preliminary discussion regarding the CSFs of healthcare construction projects.

2.4 Research Gap

There is a number of theoretical studies in the literature looking into the problems with regards to the legal framework, policy implementation, financial model and governmental immaturities and deficiencies for the PPP healthcare projects carried out in Turkey. Only a few studies reported on the current situation with respect to PPP healthcare project planning and delivery, and the encountered problems. The mentioned problems for PPP healthcare project implementation in some sources have remained unexplored and unaddressed within the literature. To target this issue, exploiting the concepts of project success and CSFs was considered to be appropriate.

Although the literature can be regarded as well-built with respect to the studies conducted on the CSFs and success of construction projects in general, a research gap was determined considering the examination of PPP project success with a holistic approach covering the inherent interrelationships between the factors and also encompassing the aspect of project performance improvement. After looking into the theoretical studies that suggested a conceptual framework and the studies that were intended to make statistical inferences from the practitioners' perceptions on the importance of the CSFs for PPP projects, it was deemed to be crucial to target the multidimensionality of project performance assessment, through a better understanding of the links between its different dimensions and exploration of the corresponding performance improvement strategies for the factors.

Another point, which was also mentioned by Morledge and Owen (1998) is that, CSFs and their importance rankings vary for different types of PPP projects. As also denoted by Tekin and Celik (2010), PPP projects in different sectors necessitate specific approaches. Subsequent to the detailed examination of the literature sources, it was inferred that no major/comprehensive studies had been carried out addressing the successful planning and delivery of PPP healthcare projects, although it was believed to be critical when the growing number of PPP healthcare projects being executed throughout the world was considered. Thus, the development of a success model for healthcare PPP projects in particular, with a robust approach of modeling the interrelationships between the factors, was regarded as of value. Furthermore, the integration of the model into a decision support system, enriching it with project performance improvement strategies and relevant performance assessment and improvement guidance, was expected to fill the identified research gap in the literature.

CHAPTER 3

MATERIALS AND METHODOLOGY

This chapter comprises the presentation of the materials and methodology used for the research, except the steps regarding the development of the decision support system and its testing and validation, which are explained in Chapters 4 and 5, respectively. Accordingly, this chapter mainly covers a discussion of the preliminary interviews conducted with the experts at the outset of the study; presentation of the conceptual framework; exposition of the semi-structured interviews which were conducted to enhance the framework and carried out with the guidance of a questionnaire; and finally, the development of the PPP healthcare project success model together with a detailed explanation of the method used and model testing.

3.1 Preliminary Interviews

The aim of the preliminary interviews was to explore the current processes of the construction companies with regards to ensuring the successful planning and delivery of the PPP healthcare projects undertaken. To this end, separate interview sessions were held with three companies and a set of questions were prepared to be directed to the experts. To interpret the responses, content analysis was employed, which was facilitated by voice records and notes taken during the interview sessions. The questions used in this phase were open-ended, which were concerned with examining the maturity of the performance assessment processes of the companies. The processes used to evaluate the factors that may affect the success of the project both positively and negatively, information about the people or units carrying out this assessment, the way that the results of the assessment are being used and the decisions triggered by the results of the assessment were among the focused issues.

Whether or not a software/tool/system is used in this process, the experts' satisfaction level with the process, the problems that are encountered during the process and the measures that are taken for the factors that have arisen in the project life cycle and have not been foreseen in advance were the other items questioned. The interviews were conducted in April 2017 and each interview lasted for approximately one and a half hour.

3.1.1 Information about the Respondent Companies

The implementation of healthcare PPP projects in Turkey is still in its infancy stage, with only a few projects having reached to the stage of construction completion and moved into the operation phase recently. Accordingly, companies and experts with the utmost experience in healthcare PPP projects were targeted to be included in this research. The companies involved in the preliminary interviews were selected among the applicable construction companies in Turkey, based on the extent of their PPP healthcare project portfolio. Due to the confidentiality issues, the names of the participated companies were coded as Company A, Company B and Company C, and the information about the companies presented in this chapter was delimited. All of the participated companies had been involved in more than one PPP healthcare project, some of which were being executed in partnership with another company. The companies have more than 25 years of experience in the construction sector.

Company A can be listed among the leading construction firms of Turkey, active both in domestic and international markets. Its affiliates serve in the areas of energy, natural gas, infrastructure and manufacturing. Company B is one of the fastest growing construction firms in Turkey within the last decade. With its domestic and foreign affiliates, the company executes large-scale building and infrastructure projects, together with the construction of industrial complexes. Company C is a pioneer company for the Turkish construction industry, operating in fields such as construction, energy and real estate development. Delivering a wide range of projects, the company has a high level of activity in both domestic and international markets, together with its branches.

3.1.2 Information about the Experts

Each interview session included three experts engaged in the management and execution of PPP healthcare projects. The experts to be involved in the sessions were determined based on their knowledge of the executed healthcare projects and experience with the relevant projects. The information about the experts attended the interview sessions is given in Table 3.1.

Table 3.1. Information about the experts participated in the preliminary interviews

Company	Expert	Position and Expertise	Years of Experience in	
			Construction Sector	Healthcare PPP Projects
A	A	Member of the Executive Board, Civil Engineer (MSc, MBA)	20	1
	B	Deputy Project Manager, Civil Engineer (PhD)	20	6
	C	Technical Office Manager, Civil Engineer (BSc)	18	7
B	D	Project Coordinator, Architect (MSc)	20	3
	E	Coordinator, Electrical and Electronics Engineer (BSc)	30	6
	F	Coordinator, Mechanical Engineer (BSc)	22	4
C	G	Coordinator, Civil Engineer (MSc)	15	4
	H	Design Manager, Architect (MSc)	15	3
	I	Executive Assistant to CEO, Civil Engineer (PhD)	8	5

3.1.3 Questions Directed to the Experts

In order to obtain information on the current processes of the companies pertaining to project performance assessment including the evaluation of the factors and risks that may affect the success of the projects, seven questions were posed to the experts. The gathered responses regarding each question and the relevant commentaries of the experts in relation to the mentioned issues are presented herein.

3.1.3.1 How/Through Which Processes the Factors That May Affect the Success of the Project Positively/Negatively are Identified and Evaluated by the Company?

The experts of Company A denoted that the primary project success criteria for their company include the completion of the project within the targeted budget, within schedule, in conformity with the defined scope and provision of a positive contribution to the company's reputation by completion. As mentioned, in order to achieve these objectives, the project processes are monitored by the relevant departments in accordance with a project management plan. As opined by the respondents, the procedures are defined in the project management plan, which includes cost and schedule control, scope management, quality management and health, safety and environment management. It was expressed that monthly reports are prepared and presented to the top management, and the critical factors are evaluated through this process. Fluctuations in the foreign exchange rates, changes in the project personnel (both within the organization and within the public agency) and the established relationships with the public agency were listed among the factors considered, which were regarded as the potential sources that might have a negative effect on project success. It was denoted that the factors which are considered to be critical are continuously monitored and evaluated at the meetings attended by the responsible units and decisions are taken accordingly. The stages of design development were regarded as critical; and how these stages are connected to other disciplines and the management of the relationships with the public agency during these stages were pointed out as other crucial issues within the process.

The experts of Company B mentioned that a detailed work plan is prepared at the beginning of each project and the risks are attempted to be foreseen using the experience from the past projects and reflected in the work plan. As stated, if deviations from the work schedule are observed during the delivery processes, the risks are examined in more detail and responsive actions are taken against the unforeseen events that emerge during the execution of the project.

As asserted by the experts of Company C, there is no defined process of the organization aimed to identify or assess the factors or risks that may affect the success of the project. On the other hand, the factors that are considered to be critical for the success of the project are looked into and evaluated in the tendering stage, without using a formal procedure. Furthermore, it was denoted that there is a dedicated project management department within the organizational structure, which utilizes risk matrices to capture the relevant risks at project initiation and presents the outputs to the top management. As mentioned, this procedure assists top management in taking the critical decisions. There are lessons learned from the completed PPP healthcare projects, some of which being recorded and some of which being engaged to the experience of the personnel. It was stated that these lessons learned are used for the anticipation of what may be encountered during the execution of the project and the project teams perform their work accordingly. Other problems confronted are attempted to be solved as soon as they emerge during the project delivery processes, by taking the appropriate responsive actions.

3.1.3.2 By Whom/Which Units the Assessment is Conducted?

As opined for Company A, the monitoring of a number of factors encompasses all of the relevant departments in the process, such as the Technical Office, Budget and Planning Units, Department of Financial and Administrative Affairs, Internal Audit Department and the field team as necessary. As expressed, these units report the critical items to the senior management. The project management team, the Executive Board and the Assembly of Shareholders were reported as the units that interpret the results and take action on the relevant issues.

The experts from Company B denoted that the evaluations are carried out by the Board of Directors and project coordinators.

As reported for Company C, there are assessments conducted by the project management office, which rather involve the evaluation of risks that threaten the project budget and schedule. For the items related to the schedule, design groups are also engaged in the process and give feedback on the issues such as the design progress and approval processes. It was expressed that all of the relevant units and disciplines are responsible with respect to their tasks and the ultimate assessment is carried out by the senior management.

3.1.3.3 In Which Way the Results of the Assessment are Used? Which Decisions are Triggered by the Results of the Assessment?

As stated for Company A, the results of the assessment are used in taking measures and corrective actions. As pointed out, a wide range of decisions regarding the project processes might be triggered by the assessment, involving changes in the project management plan and risk management plan, rearrangement of contract items, changes in the organizational structure and changes in the relevant personnel, slowing down or accelerating the processes against fluctuations in foreign exchange rates, using a shift system at the construction site against delays in project schedule or commissioning additional subcontractors, changes in contract management against obstacles related to the financing, reorganization of the work hours and taking the decision to continue without the approval of the public agency in times of delay.

According to the experts from Company B, considering the significant risks that may arise in the project life cycle, it is attempted to integrate the necessary precautions into the work plan. On the other hand, it was mentioned that the company adopts a rather reactive approach for the majority of the risks, holding the belief that the risk events can be managed by taking the proper responsive actions during the project flow.

As pointed out by the experts of Company C, first and foremost, the results of the assessment affect the selection of the projects to bid for and the bid/no-bid decision-making in the tender process. The results also affect the bid price, by showing which project is advantageous to undertake and which project is rather risky. In initiating a project, the data of previous projects were mentioned to be utilized, especially for the decisions related to the project budget. Monthly, weekly or quarterly meetings are conducted and the decisions taken at the meetings are directly reflected in the production process. It was stated that the assessment results may also trigger design changes and changes in the project management plan.

3.1.3.4 Is There a Software/Tool/System Used by the Company in This Process?

The experts of Company A opined that a project management plan and a construction documentation management system are utilized, which may help for the mentioned process; but there is not such a tool devoted to the identification or assessment of the critical factors or risks, used by the company.

As denoted by the experts from Company B, there is no such system used for the assessment of factors or risks for the projects undertaken by the organization. As stated, the organizational attitude does not lean towards the usage of tools and other implementations of information technology.

For Company C, it was pointed out that various tools are utilized for project management, but there is not a specific tool or system used for project performance assessment or risk management by the company.

3.1.3.5 Are You Satisfied with the Process?

Experts from Company A stated that they were partially satisfied with the process, as there are a great number of factors inherent in the projects of this scale and their identification, monitoring and control was mentioned to be a challenging issue. It was expressed that the management of these projects requires a specific approach, due to the considerable project sizes and the inherent complexities. On the other hand, it was pointed out that the top management and the other units of the company attach importance to taking the necessary measures and responsive actions for the successful delivery of the projects.

According to the experts of Company B, when the end results are considered, it can be said that they achieve to manage the projects successfully, despite the encountered obstacles that mostly arise from the immature processes of the public agency. The experts opined that a great number of unforeseen events and factors had been faced in their initial PPP healthcare project; but as stated, with the experience gained in time, the project teams were then providing better solutions. When considered as a whole, the experts evaluated the process as partially satisfying.

As stated by the experts from Company C, the management of these complex and large-scale projects also comprises various opportunities for the company besides the inherent challenges. On the other hand, it was expressed that there is a great number of critical factors and shortcomings stemming from the project processes, which create a pressure on the company and on the project teams. But still, the outcomes of the projects were regarded as successful. It was made clear that that there are no defined and formal systems used for the risk management and performance management processes, and that the factors are managed as much as possible using a reactive approach throughout the project life cycle.

3.1.3.6 What Kind of Problems are Being Encountered During the Process?

By the experts of Company A, it was mentioned that a number of factors arise within the project life cycle, some of which can be anticipated and some of which cannot. As opined, one major obstacle is the delays in approvals, which hinders the design process to stay on track. Some other issues were listed as follows: the drawbacks stemming from the project stakeholders not fulfilling their contractual obligations, obstacles in processes related to the public agency and its consultant, communication problems with the public agency.

As mentioned by the experts of Company B, the project design is subject to a great number of changes and this is the main obstacle against the seamless execution of the projects. The deficiencies and errors in the work breakdown structure and change orders result in an unexpected increase in the project area; and as a result, a financial risk emerges, directing the company to form an additional financial model or use equity financing. As pointed out, project revisions also stem from the late involvement of the end-users of the facility in the project life cycle. Consequently, their requirements bring about a great amount of rework and cannot be properly fulfilled. Therefore, it was opined that most of the dissatisfaction with regards to the process takes its source from the design phase. It was expressed that all of the disruptions in the design process affect the construction phase, and all of the design defects and deficiencies are reflected in the operation phase. Another obstacle mentioned was related to the shortage of experienced and competent manpower at all levels of the project organizational structure, which hinders the quality and timely delivery of the projects. Other obstacles stated can be listed as follows: the deficient procedures of the public agency regarding the project approval process; short construction periods hindering high-quality construction; obstacles encountered in testing and commissioning of the buildings; obstacles encountered during the first months of the operational period due to the insufficient preliminary work; and service problems confronted stemming from the inadequacy of the feasibility studies with regards to demand projection in the region. Although defined in the contract, it was denoted that the public agency representative is not active in the decision-making process; and therefore, problems emerge due to the ambiguities in conflict resolution and inadequate correspondence. Some of the contractual items have not been put into effect, and it was expressed that there are some gaps in the mechanism that negatively affect the processes of the company as a result.

According to the experts of Company C, there is not much time allocated for the initial planning stage of the projects, which brings about problems such as budgetary issues. Also, during the project life cycle, actions are needed to be taken rapidly. The planning and design stages overlap, and the same applies to the design and construction stages to some extent. Although the planning process is initiated with the guidance of the lessons learned, it was stated that problems had still been encountered with respect to the unrealistic preparation of project plans. As the projects cover a wide range of stakeholders and various disciplines in different management processes, one of the major impediments mentioned was related to the communication issues. Although the company had had extensive experience in construction projects of other types, inexperience in PPP healthcare projects was pointed out as another disruption encountered. Lack of lessons learned; lack of knowledge about the production issues, material selection, operational issues and their reflections in the design decisions; and lack of a network for appropriate consultants were put forth as some of the shortcomings of inexperience. Other obstacles stated include the problems related to the subcontractors at the construction site; long approval periods arising from the immature processes of the public agency; a great number of project revisions; and the obstacles related to the operation phase, such as problems stemming from the subcontractors of the operator and revisions originating from the issues related to procurement.

3.1.3.7 What Kind of Measures Are Taken Regarding the Factors That Arise in the Project Life Cycle and Have Not Been Foreseen in Advance?

It was mentioned for Company A that the risks and unpredictable factors are attempted to be minimized with a more proactive approach. The stocking of material against an unpredictable increase in prices and the contracts being signed based on the local currency instead of other currencies against an increase in foreign exchange rates were stated among the measures taken for the unexpected factors.

As the experts from Company B stated, in their initial PPP healthcare project, they had attempted to overcome the problems as soon as they had emerged. On the other hand, it was pointed out that the project teams are then more capable of predicting some of the risks in their following projects. As denoted, they are aware of the possible design changes and accordingly, hold some of the activities to prevent rework or take the decision to continue without a design approval to avoid delays in project implementation. The risk of scope creep in projects was mentioned, and it was stated that the company acts according to the possibility that the additional cost may be compensated using the internal resources.

As reported for Company C, there is a contingency held in reserve to deal with the unforeseen circumstances in these projects. In addition to this contingency, there is also a management reserve, as a second barrier against the unexpected events that may occur in the project delivery process. A number of risks are transferred, and insurance policies and risk hedging are utilized against exchange rate risk to prevent budget overruns. For the issues regarding the public sector stakeholders, the only solution mentioned was taking an early action considering the experiences acquired in the previous projects. For the elimination of the bureaucratic issues, regular meetings are held with the public agency and the project requirements are reviewed through direct interaction. To overcome the problematic issues with regards to project design, various disciplines are attempted to be integrated during the design process. Competent consultants are commissioned and continuous feedback is received on various topics.

3.1.4 Discussion of the Commentaries Derived from the Preliminary Interviews

Through the preliminary interviews conducted with the three leading construction companies that have undertaken PPP healthcare projects in Turkey, it was revealed that the companies do not have a defined process to identify or assess the factors that may affect the success of the project positively or negatively. It was expressed by the experts that responsive actions are taken for the problems or risks that emerge during the project life cycle, rather than adopting a proactive approach. There is no software, tool or system used for the performance assessment process in any of the companies. The large number of known and unknown factors and risks within the project life cycle were pointed out by the experts, which stem from the wide range of stakeholders involved, difficulties in coordination and communication, complexity of the design schemes and their implementation, immature processes and incompetency of the public agency, immature legal framework and contractual deficiencies associated with these projects. The management of these factors was mentioned to be a challenging issue, which requires a rigorous approach. Other than the listed challenges, schedule pressure was regarded as a major barrier to successful planning and delivery of these projects, which results in drawbacks such as a great amount of rework, claims and disputes among the stakeholders, and deviations from the project budget and schedule.

3.2 The Conceptual Framework

In light of the research gap determined through the review of the relevant literature and the preliminary interviews carried out with the experts from the private sector, it was believed to be of value to look into the successful planning and delivery of PPP healthcare projects; and focusing on the concepts of project success and the CSFs with respect to these projects was designated as the point of departure for this study. On the other hand, instead of identifying the CSFs individually, the emphasis was given to develop a holistic model with the analysis of the interrelationships between the relevant success factors and the compilation of the respective strategies for their proper implementation in the project. Through the tripartite literature review carried out focusing on success factors specified for construction projects, for PPP projects and for healthcare projects, the applicable factors were extracted and synthesized to obtain a complete set in accordance with the context of the research, as an initial step. Drawing from this set, the CSFs to be included in the preliminary framework were determined and grouped to reflect the major spots with regards to the project characteristics and delivery of PPP healthcare projects. Accordingly, the conceptual framework proposed for PPP healthcare project success consisted of 64 CSFs organized in eight groups, which are: (1) External Environment, (2) Financial Characteristics, (3) Project Management, (4) Project Stakeholders, (5) Initiation and Planning, (6) Procurement, (7) Design and Construction, and (8) Operation (Figure 3.1). The CSFs included in the framework are outlined in Table 3.2, whereas the complete version of the CSFs can be seen from the assistive questionnaire used for the semi-structured interviews, which is presented in Appendix A.

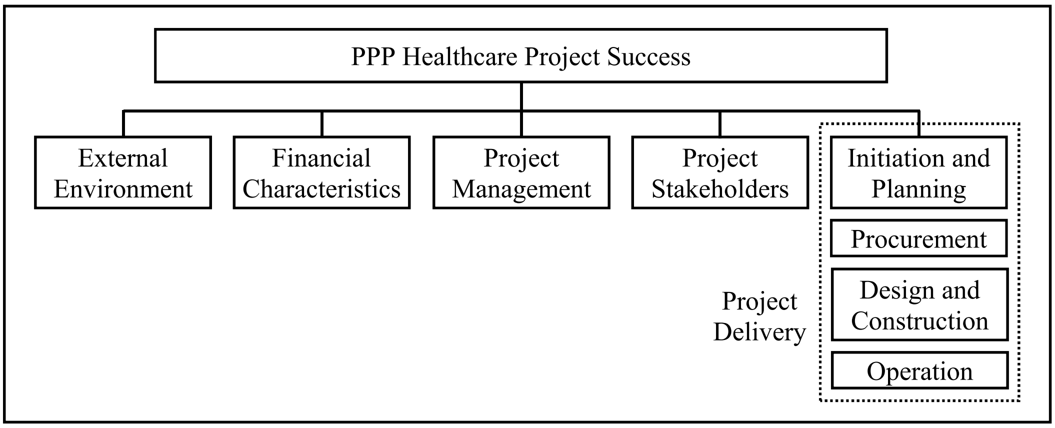


Figure 3.1. Structure of the conceptual framework

Among the eight clusters of the framework, the factors included within the *External Environment* cluster are exogenous factors, which are rather uncontrollable by the project teams. The financial factors, which can be the source of instability and risk in projects, are grouped under a separate cluster (*i.e. Financial Characteristics*). *Project Management* cluster comprises factors related to the management processes, whereas factors related to the characteristics and capacity of the stakeholders are involved in the *Project Stakeholders* cluster. On the other hand, factors pertaining to specific project delivery phases are grouped under *Initiation and Planning*; *Procurement*; *Design and Construction*; and *Operation* clusters.

Since project success is a complex and multidimensional concept, measuring the success of a project has been a controversial issue. Through the literature review conducted, it was seen that the terms *success criteria*, *KPIs* and *performance measures* refer to the variables used to define or evaluate project success. In various studies, different variables were applied, in a number of combinations. These studies adopted an “outcome” perspective, attempting to measure the success of the project after completion. Another perspective is to assess the attributes that can be referred to as the factors that shape the performance of the project, which directly or indirectly determine the project outcomes. In this study, project success is used as a broad term encompassing on-time and on-budget delivery, conformity to quality specifications, profitability, green building performance, conformity to health and safety requirements, functionality, participants’ satisfaction, meeting design goals, contribution to stakeholders’ reputation and conformity to users’ expectations; and the assessment and improvement of project performance to ensure project success was the main focus.

Table 3.2. Proposed CSFs for PPP healthcare projects

1. External Environment

E1. A stable political and economic environment
E2. A transparent and mature legal and regulatory framework
E3. A mature and available market (contractors and suppliers) in and around the region
E4. Strong government support
E5. Convenient location, weather and site conditions
E6. Public support for the project

2. Financial Characteristics

F1. High equity/debt ratio
F2. Fixed and low interest rate financing, low financial charges
F3. Sufficiency of domestic financial resources
F4. Favorable exchange rates and a predictable level of exchange risk
F5. Sufficient profitability of the project to attract investors
F6. High credit rating of the investors

3. Project Management

PM1. An efficient system for controlling changes and resolving disputes
PM2. Effective control and supervision of the public agency throughout the project life cycle
PM3. The usage of collaborative tools between the stakeholders for effective communication/coordination
PM4. Maintaining an up-to-date risk management plan and effective contract management
PM5. Using formalized procedures, tools and techniques for green building project delivery
PM6. Regular control meetings, project schedule and budget updates
PM7. Availability of a proper documentation system and a lessons learned database

4. Project Stakeholders

PS1. Early collaboration of the project stakeholders and assuring their continuous involvement through all project phases
PS2. Sufficient public agency staffing and well-established organizational structure of the agency
PS3. Technical and project management competencies of the contractor
PS4. Adequate financial, labor and equipment resources of the contractor
PS5. Sufficient knowledge and experience of the public agency in healthcare projects and BLT model
PS6. Sufficient knowledge of the consortium members in healthcare projects and BLT model
PS7. Design firm's competition-based selection and green building experience
PS8. Subcontractors' experience, competencies and financial credibility
PS9. Suppliers' experience, reliability and convenient location
PS10. Public agency consultant's experience, competencies and adequate staffing
PS11. Operator's competencies and reliability
PS12. Clarity in stakeholders' responsibilities

5. Initiation and Planning

IP1. A comprehensive feasibility study
IP2. Selection of site with stakeholder involvement
IP3. Clear definition of the project scope and public agency's requirements
IP4. Proper integration of end users' needs and inputs of all interest groups in preparation of project brief
IP5. Defining clear and assessable output specifications including performance requirements
IP6. Determination of the targeted green building certification level early in the project life cycle
IP7. Defining the process for performance monitoring and evaluation systems
IP8. Effective risk identification and assessment
IP9. Life cycle-based budget planning

6. Procurement

P1. Transparent, competitive and clearly defined tender process
P2. Tender evaluation based on a combination of price and qualifications
P3. Prequalification of potential tenderers
P4. Inclusion of project's green specifications in the request for proposal
P5. Stipulations for minimum number of bids and a maximum of four bidders to prepare a full tender
P6. Adequate government guarantees
P7. Reasonable risk allocation in the contract
P8. Payment mechanism linked to services availability and performance
P9. Incentives for exceeding sustainability goals

7. Design and Construction

DC1. Providing the built-in flexibility of design and reserved land for future growth and changes
DC2. Use of prefabrication, modularization and automation in the project
DC3. Providing the integration of design with the construction and operation phases
DC4. Using energy and lighting simulations and envelope mock-ups during the design phase
DC5. Conducting constructability analyses
DC6. Charging an independent works checker
DC7. An effective governmental approval process and no major changes in government's requirements during the construction phase
DC8. Effective site management
DC9. Effective quality, environment, health and safety control and supervision
DC10. Training sessions on green building for on-site construction personnel and for subcontractors

8. Operation

O1. Monitoring of the energy performance during the operation phase and updating design simulations
O2. Training end users on energy efficiency measures, systems operation and repair reporting
O3. Use of appropriate metrics and monitoring methods for performance measurement
O4. Specific record keeping requirements
O5. Effective transfer mechanism

3.3 Semi-Structured Interviews Based Upon the Conceptual Framework

With semi-structured interviews conducted with experts from the private sector, it was intended to examine the importance of the factors in order to refine the framework by eliminating the relatively less critical ones and to make the necessary revisions. An assistive questionnaire was used as part of the interviews and filled in by the experts, evaluating the impact of factors on project success on a 1-5 point Likert scale, in which the scores refer to: 1) Very low, 2) Low, 3) Medium, 4) High, 5) Very high. The importance of the success criteria for PPP healthcare projects was also assessed. The point to be noted here is that it was not intended to gather statistical data and draw generalizable inferences on the importance of the CSFs and the success criteria. Instead, by the help of the questionnaire survey and its analysis, it was aimed at obtaining more robust interpretations of the expert opinion on the most critical factors, and determine the irrelevant ones and the misleading statements, to provide a basis for the model to be developed in the subsequent stage of the research.

3.3.1 Information about the Respondent Company and the Experts

Although three companies were involved in the preliminary interviews conducted at the outset of the study, in-depth interviews of this subsequent phase were carried out with the participation of one company selected from among the three. The identified company was Company C, which is described in detail in Section 3.1.1. Besides its extensive PPP project portfolio and experience in this specific project type, the other reasons for the selection of the respective company can be given as follows: its mature project partnership structure by means of cooperating with strong financiers; tripartite organization structure covering the investment, construction and operation of the projects; inclusive implementations regarding the issues such as information technology, sustainability and green building; and the cooperation of the company with competent consultants focusing on the relevant areas. In virtue of its mature structure and organizational culture, and its extensive contributions on the covered issues, the company was asked to participate not only in the preliminary interviews but also in the subsequent stages of the research.

For the in-depth assessment, face-to-face interviews were conducted in May 2017, separately with six experts responsible for the management of the PPP healthcare projects carried out by the company. It was attempted to include experts specialized on various areas such as design, finance, planning and operation. Each interview lasted for approximately one and a half hour. The average total years of experience of the experts was 16 years in construction sector and 3.5 years in healthcare PPP projects. The general information about the experts is presented in Table 3.3.

Table 3.3. Information about the experts participated in the semi-structured interviews

Expert	Position and Expertise	Years of Experience in	
		Construction Sector	Healthcare PPP Projects
A	Director, Civil Engineer (MSc)	17	4
B	Director of Project Management Office, Civil Engineer	15	3
C	Technical Office Director, Civil Engineer (PhD)	19	5
D	Facilities Management Director, BBA	20	3
E	Project Executive, Architect (LEED AP BD+C)	12	3
F	Project Executive, Architect	12	3

3.3.2 Content of the Questionnaire

The developed questionnaire to assist the interviews was composed of three main sections. In the first section, it was targeted to obtain general information about the company and the respondent. In the second section, the success factors were presented under the eight clusters of the framework. The respondents were asked to evaluate the level of impact that each factor has on the success of a PPP healthcare project, using the 1-5 point Likert scale. Following the evaluation of the factors within a cluster, the respondents were also asked to assess the level of impact of the relevant cluster on project success. At the final section of the questionnaire, the respondents evaluated the relative influence of the 11 project success criteria (previously listed in this section) on PPP healthcare project success. The assistive questionnaire utilized in the interviews is presented in Appendix A.

3.3.3 Analysis of the Data Obtained from the Semi-Structured Interviews

The gathered data through the assistive questionnaire of the interviews were analyzed and the mean values were revealed for the factors and criteria, which were obtained in accordance with the level of importance assigned by the six experts (Table B.1). Some of the experts preferred not to evaluate the sections that they considered to be out of their expertise; and therefore, for those sections, the mean values were revealed with the use of the fewer evaluations attained. The standard deviation was also calculated for each factor to check for the discrepancies between the assessments of the respondents. Experts' evaluation for the impact of the clusters on the success of a PPP healthcare project and evaluation on the importance of success criteria for a PPP healthcare project were also analyzed and the obtained results are presented in Tables B.2 and B.3, respectively.

As the analysis results suggest, factors with the highest importance for PPP healthcare project success (*i.e.* factors with a mean rating value of 5.00) were determined as follows:

- PS3 (Technical and project management competencies of the contractor),
- PS4 (Adequate financial, labor and equipment resources of the contractor),
- PS6 (Sufficient knowledge of the consortium members in healthcare projects and the BLT model),
- I5 (Defining clear and assessable output specifications with performance requirements),
- P6 (Adequate government guarantees),
- DC3 (Providing the integration of design with the construction and operation phases),

- DC7 (An effective governmental approval process and no major changes in government's requirements during the construction phase).

Within the **External Environment** cluster, E1 (A stable political and economic environment) and E4 (Strong government support) were the highest-rated factors with a 4.83 mean value, followed by E2 (A transparent and mature legal and regulatory framework). On the other hand, E5 (Convenient location, weather and site conditions), E6 (Public support for the project) and E3 (A mature and available market in and around the region) were rated below 4.0. As denoted by the respondents, strong government support is a prerequisite to enable the seamless execution of PPP projects. A well-developed legal and regulatory framework was pointed out to be critical to attract strong project financiers and sponsors. The high weight assigned to the factor concerning a stable political and economic environment was an expected judgment, as the instability of the host government and economic volatility may put the investment at risk. Political and economic situation in terms of the global context was also mentioned by the experts, together with the host country's high credit rating for the provision of project finance rapidly and with favorable terms. The factor concerning the convenient location, weather and site conditions attained a low importance weight since it was considered to be manageable with proper planning and implementation processes. Public support for the project was not regarded as a CSF for this specific project type as it is for some other project types (*e.g.* power plant projects), as long as environmental protection is provided. The market in and around the region was not considered to be critical, as the experts stated that it is feasible to work with any subcontractor and supplier irrespective of their location, for a company with an extensive subcontractor and supplier portfolio.

Within the **Financial Characteristics** cluster, factors F2 (Fixed and low interest rate financing, low financial charges), F4 (Favorable exchange rates and a predictable level of exchange risk) and F6 (High credit rating of the investors) were determined to be equally important with the highest mean rating of 4.83 in this group, followed by F5 (Sufficient profitability of the project to attract investors). On the other hand, factor F3 (Sufficiency of domestic financial resources) had a mean rating lower than 3.0. Accordingly, fixed and low interest rate financing with low financial charges, favorable exchange rates and a predictable level of exchange risk were regarded as the enablers of the financial effectiveness of the project. High credit rating of the investors was considered to be critical to provide the required loan for these projects and sufficient profitability of the project was regarded as necessary to attract reliable investors and sponsors. As these projects require a great amount of budget, utilization of foreign financial resources was mentioned as a necessity, and accordingly, factor F3 received a low score. As opined by the experts, the proper equity/debt ratio for a project is dependent on the characteristics of the consortium, financial effectiveness of the project and interest rates. Therefore, the experts could not correlate F1 (High equity/debt ratio) with project success.

Within the **Project Management** factor group, factors PM1 (An efficient system for controlling changes and resolving disputes) and PM6 (Regular control meetings, project schedule and budget updates) had an equal mean rating of 4.67, followed by PM2 (Effective control and supervision of the public agency throughout the project life cycle). For factors PM3 (The usage of collaborative tools between the stakeholders for effective communication and coordination), PM7 (Availability of a proper documentation system and a lessons learned database) and PM5 (Using formalized procedures, tools and techniques for green building project delivery), mean rating values lower than 4.0 were calculated. According to the experts, efficiency in controlling changes and resolving disputes, as well as regular control meetings and schedule and budget updates are key to successful management of the project. As denoted, effective control and supervision of the public agency throughout the project life cycle is an enabler for the continuous project flow. As mentioned by the experts, effective risk management is a must for these projects and the identification and analysis of risk factors in early project phases by stakeholders and utilization of regularly updated risk registers were pointed as a necessity. The usage of collaborative tools between the stakeholders such as project management and building information modeling systems and online databases was considered to be assistive for effective project execution; but their utilization was not regarded as a CSF for the project.

Within the **Project Stakeholders** factor group, PS3 (Technical and project management competencies of the contractor), PS4 (Adequate financial, labor and equipment resources of the contractor) and PS6 (Sufficient knowledge of the consortium members in healthcare projects and the BLT model) were determined to be the most influential ones, followed by PS2 (Sufficient public agency staffing and well-established organizational structure of the agency), PS5 (Sufficient knowledge and experience of the public agency in healthcare projects and the BLT model), PS10 (Public agency consultant's experience, competencies and adequate staffing) and PS11 (Operator's competencies and reliability) with equal mean rating values. Two factors that were rated below 4.0 in average within this group are PS9 (Suppliers' experience, reliability and convenient location) and PS7 (Design firm's competition-based selection and green building experience). As the results suggest, the importance attached to the factors regarding the capabilities and competencies of the public agency, contractor, operator and consultants, and ensuring their involvement through all project phases is significant. Rather than proximity, the experience, capability, resource competence and knowledge of PPP and healthcare projects were regarded as critical for subcontractors. For suppliers, experience, capacity, coordination and transfer ability, market share and long-term availability were among the mentioned parameters. Design firm's competition-based selection was considered to be infeasible as it may extend the process, but as stated, sufficient experience, competencies and staff adequacy of the design firm should be ensured.

Within the **Initiation and Planning** cluster, IP5 (Defining clear and assessable output specifications including performance requirements) was the highest ranked factor, followed by IP1 (A comprehensive feasibility study) and IP3 (Clear definition of the project scope and public agency's requirements) with equal mean rating values, and IP9 (Life cycle-based budget planning), respectively. Except IP6 (Determination of the targeted green building certification level early in the project life cycle), all factors within this group were rated above 4.0 in average. Preparation of output-based and measurable specifications is regarded as a key factor for these projects to ensure that the targeted level of performance is attained, especially for the operation phase. Alongside of a comprehensive feasibility study conducted by the public agency, encompassing technical, financial, economic, legal, social and environmental issues, it was regarded as indispensable for the contractor to detail the technical and financial dimensions. The level of clarity in government's requirements determines the effectiveness of project finance. The respondents put emphasis on budget planning with a life cycle approach, as the consortium is also in charge of the operation of the facility. The government's proper integration of end users' needs, inputs of operational staff, healthcare experts and all other interest groups at the beginning of the project leads to the enhancement of the project brief. Selection of site with the participation of stakeholders was regarded as beneficial, as the location may affect the occupancy rate of the hospital. On the other hand, this factor was considered to be invalid for most of the projects due to the lack of available construction sites within cities.

Within the **Procurement** factor group, P6 (Adequate government guarantees) was the factor with the highest mean rating, followed by P7 (Reasonable risk allocation in the contract) and P8 (Payment mechanism linked to services availability and performance) with equal mean rating values. Factors P1 (Transparent, competitive and clearly defined tender process), P2 (Tender evaluation based on a combination of price and qualifications) and P3 (Prequalification of potential tenderers), which are related to the attributes of the tender phase, were also evaluated with a mean rating higher than 4.0. The lowest ranked factors within this group were P4 (Inclusion of project's green specifications in the request for proposal) and P5 (Stipulations for minimum number of bids and a maximum of four bidders to prepare a full tender) respectively, with mean rating values lower than 4.0. Government guarantees were regarded as the essential components for a PPP project, together with appropriate risk allocation between the public and private sectors. The use of performance specifications and associated penalty points in terms of failure to perform according to these specifications were considered to be the distinctive features of the PPP model. According to the experts, prequalification criteria for the tender phase of these projects are needed to be enhanced in proportion to the considerable size and complexity of these projects.

Within the **Design and Construction** cluster, DC3 (Providing the integration of design with the construction and operation phases) and DC7 (An effective governmental approval process and no major changes in government's requirements during the construction phase) were the highest-rated factors, followed by DC8 (Effective site management) and DC9 (Effective quality, environment, health and safety control and supervision) with equal mean ratings. In this group, DC4 (Using energy and lighting simulations and envelope mock-ups during the design phase), DC1 (Providing the built-in flexibility of design and reserved land for future growth and changes) and DC10 (Training sessions on green building for on-site construction personnel and for subcontractors) had mean ratings lower than 4.00. According to the experts, the integration of design, construction and operation is of crucial importance to provide the proper coordination. Effectiveness of the governmental approval process, stability and clarity in government's requirements and effective site management provide the seamless flow in project execution. Quality, health, safety, and environment control and supervisions were regarded as critical in terms of reputation. Provision of built-in flexibility of design and reserved land for future growth and changes was attached a high importance by some of the respondents, but it was also considered to be partially invalid as the provision of reserved land is difficult to achieve in terms of the contract and due to the limited site area available in and around the cities.

Within the **Operation** cluster, O2 (Training end users on energy efficiency measures, systems operation and repair reporting), O3 (Use of appropriate metrics and monitoring methods for performance measurement) and O4 (Specific record keeping requirements) had the highest mean rating of 4.83. As the private sector is in charge of operating the facility for a long-term, it is imperative that the private sector stakeholders keep up with the specifications properly and take the necessary measures during the operation phase to ensure making enough profit and maintain their reputation. Accordingly, the operation phase and the CSFs within this group were attached a high importance by the experts, with all factors rated above 4.00 in average.

When the evaluation of the success criteria was considered, it was seen that all criteria received ratings with close values which are higher than 4.0 in average, except the *green building performance* criterion with a 3.83 mean rating. Although green building implementations were regarded as important for the reputation of the company and for public interest by the experts, most of the factors in the framework related to green building attained relatively low ratings. Accordingly, it can be inferred that experts did not consider issues on green building implementation as CSFs for PPP healthcare projects in Turkey. Successful green building implementation was deemed to be achievable by taking the necessary measures at the beginning of the project, such as the early adoption of green principles and specifications in the design phase, working with an experienced and competent design firm as well as green building consultants. This finding is consistent with the analysis results of Chan *et al.* (2005), which revealed that *environmental friendliness* was considered among the least important criteria for the success of healthcare projects.

Additionally, it was denoted in the interviews that the opportunities promised by these projects for the private sector stakeholders are concerned with turnover, employment, company growth and permanency.

3.3.4 Discussion of the Results Revealed from the Semi-Structured Interviews

Through the in-depth interviews conducted, it was revealed that the crucial factors for PPP healthcare project success are related to:

- The contractor’s experience and competencies,
- The consortium members’ knowledge and experience on healthcare projects and the BLT model,

- Proper determination of output specifications,
- Provision of adequate government guarantees,
- Integration of design, construction and operation phases,
- The government’s contribution with an effective approval process and clear project requirements.

Regarding the framework, it turned out that some of the factors were overlapping with each other and needed to be banded together, in order to eliminate duplicates or vagueness, and obtain the elaboration and integrity of each factor. It was also inferred that factors related to green building performance were not regarded as critical for the achievement of overall project success but rather considered as factors adding to the project’s value and company’s reputation. According to the results of the analysis, almost all of the factors pertaining to green building performance were revealed among the lowest-ranked factors with respect to their impact on PPP healthcare project success. In a similar manner, the *green building performance* criterion was revealed as the lowest-ranked success criterion among the other criteria, with the only mean rating lower than 4.0. Therefore, it was concluded that the issues related to green building implementation were not considered to be critical as the other factors involved in the proposed framework, and therefore can be eliminated in the formation of the final framework. Other factors identified to be excluded in the revision of the framework comprised other relatively low-rated factors or the factors evaluated as not-applicable, such as a mature and available market (contractors and suppliers) in and around the region; public support for the project; high equity/debt ratio; sufficiency of domestic financial resources; the usage of collaborative tools between the stakeholders for effective communication and coordination; design firm’s competition-based selection and green building experience; selection of site with stakeholder involvement; inclusion of stipulations for minimum number of bids and a maximum of four bidders to prepare a full tender; and use of prefabrication, modularization and automation in the project.

3.4 Development of the PPP Healthcare Project Success Model

Subsequent to the assessment of the qualitative and quantitative data gathered through the in-depth interviews, it was aimed to refine the proposed conceptual framework by means of restructuring the clusters, combining the overlapping factors, paraphrasing the misleading or unclear ones, and eliminating the factors which were determined to be rather insignificant when compared to the others. The objective of the revision was to obtain a robust framework to be used for the construction of the PPP healthcare project success model. Also, when the revealed mean rating values for the impact of factors on PPP healthcare project success were normalized, it was seen that the values were rather close to each other (see Table B.1). Although the obtained scores and their ranking were assistive in the revision of the framework, the used rating technique was not regarded as sufficient to provide an in-depth analysis of the factors. Therefore, in conjunction with the revision process, an appropriate method to be utilized in the development of the model was also explored, to guide in the formation of the ultimate framework.

3.4.1 Selection of the Method

In the selection of the most appropriate method to be used to analyze the relative importance weights of the factors and develop the project success model, the interdependencies inherent between a number of success factors of the model were determinative. It is inevitable that more than a half of the factors have some degree of dependency upon each other and it was believed that these interrelationships are needed to be considered in order to provide a more realistic assessment of project success. Therefore, rather than a hierarchy, a network structure was preferred in the formation of the success model. Accordingly, the ANP was identified as the most suitable method, which is a multi-criteria decision-making method that can accommodate interactions between the criteria and offers an effective and realistic solution for complex decision-making problems. Another advantageous feature of the specified method is its suitability for the use of qualitative parameters in the analysis, as well as the quantitative ones. Due to the confidentiality issues, it was impossible to gather a significant amount of tangible data on the PPP healthcare projects being executed in Turkey. On the other hand, the ANP enabled to make use of the knowledge and experiences of the experts on these projects and include qualitative factors in the analysis.

Although not as high as the number of studies that employed the AHP, there is a number of ANP applications in the literature of construction management carried out in the last 15 years. These studies included the use of the model for contractor selection (Cheng and Li, 2004), project selection (Cheng and Li, 2005), assessment of the environmental impact of various project alternatives (Chen *et al.*, 2005), selection of project location (Cheng *et al.*, 2005), the appraisal and selection of large-scale construction projects (Dikmen *et al.*, 2007), predicting the performance of international construction joint ventures (Ozorhon *et al.*, 2007), the risk assessment of international construction projects (Bu-Qammaz *et al.*, 2009), marketing activity selection for construction companies (Polat and Donmez, 2010), assessing business failure risks of construction firms (Dikmen *et al.*, 2010), the contractor selection for highway projects (El-Abbasy *et al.*, 2013), the development of a risk management maturity system for large-scale construction projects (Jia *et al.*, 2013), risk prioritization in freeway PPP projects (Valipour *et al.*, 2015) and measuring the complexity of mega construction projects (He *et al.*, 2015).

3.4.2 The Analytic Network Process (ANP)

As explained by Saaty and Vargas (2013), a holistic approach to analyzing causal influences and their effects is to lay out all the factors and criteria involved in advance as a hierarchy or as a network system that allows for dependencies. These structures combine all possible outcomes, and utilize judgment and logic to estimate the relative influence from which the overall answer is derived; and therefore, necessitate knowledge and experience with the subject. Generally, a sound overall outcome about the real world is obtained using this approach.

The ANP is a multi-criteria decision making/forecasting method that derives the priority or weight for each of the included criteria or components, in which, the weights are identified with respect to the judgment of the factors' relative importance to the overall goal by the forecaster or a consensus of forecaster opinion (Saaty and Vargas, 2013). To apprehend the principles of the ANP, it was regarded as necessary to explore it in conjunction with the AHP. These two methodologies have some basic principles in common, and hence, the AHP gives many clues about the ANP and why it was favored as the methodology to be used for model development in this study.

Saaty (2000) defined the AHP as "a general theory of measurement". In multilevel hierarchic structures, the AHP determines the relative priorities on absolute scales from both discrete and continuous paired comparisons, which may be obtained by actual measurements or from a fundamental scale that reflects the relative strength of preferences (Saaty and Vargas, 2013). The principles of the AHP are decomposition, comparative judgments and synthesis (Saaty, 2001). A hierarchy is constructed with a goal of the problem at the top and the criteria, sub-criteria and alternatives at descending order of the hierarchy (Saaty and Vargas, 2013).

The ANP is the generalization of the AHP to feedback networks and uses a network structure to model a problem, instead of a hierarchy (Saaty and Vargas, 2013). While both methodologies share a similar basic concept, the main difference is that in the ANP, there are no prior assumptions about the independence of the higher-level elements from the lower-level ones and about the independence of the elements within a level, enabling the formation of a network (Saaty, 2005). Thus, it is necessary to look into the difference between a hierarchy and a network.

As explained by Saaty (2005), a hierarchy is a linear top-down structure with no feedback from lower to higher levels, in which, the elements are considered to be independent of each other. On the other hand, a network structure spreads out in all directions and involves cycles connecting its components of elements and loops that connect a component to itself. In other words, it allows for inner and outer dependence among the elements of its components. With respect to a common property, outer dependence indicates that the elements in a component have dependence on the elements of another component; whereas inner dependence indicates that the elements of a component have dependence upon each other. A hierarchy can be transformed to a network by creating connections between its pairs of components and among the elements of a component itself. The comparison of a hierarchy and a network is shown in Figure 3.2.

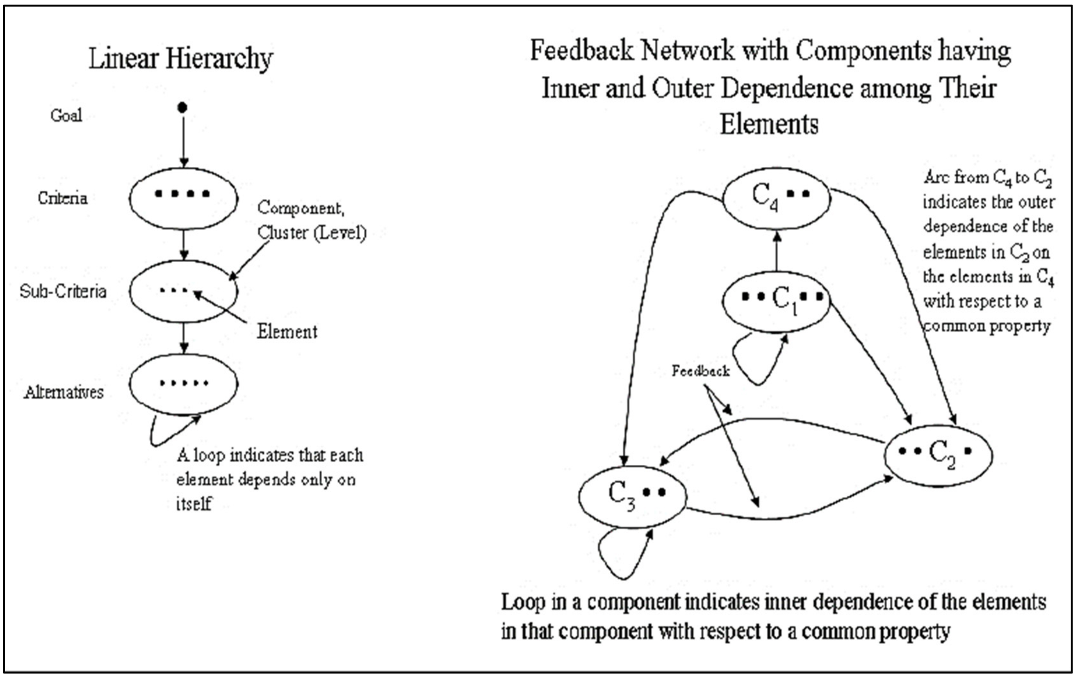


Figure 3.2. Comparison of a hierarchy to a network (Saaty, 2005)

As it was made clear by Saaty and Vargas (2013), in a hierarchy, the levels of the structure are organized in a descending order of importance and the elements in each level are compared considering the dominance or influence with respect to the elements in the level above. Dissimilarly, the components of a network do not follow a particular order but are connected as appropriate in pairs with directed lines instead. Evaluation of the influence can be carried out with respect to importance, preference or likelihood.

According to Saaty and Vargas (2013), since the hierarchic decisions have an imposed structure, it can be inferred that these decisions are likely to be more subjective. On the other hand, the ANP offers a more objective approach by including dependence and feedback, and by cycling their influence with the supermatrix. Therefore, the ANP is regarded as more satisfactory in terms of capturing the real-world circumstances. As the ANP allows the structure to develop more naturally, it can be said that it is a better way to represent the real world and is a strongly more effective decision-making tool in practice, when compared to the AHP. As mentioned by the authors, the most advantageous feature of the ANP is that it enables dealing with "data limitations and intangibles (or qualitative variables) based on individual or collective judgment of the situation".

3.4.2.1 Components, Elements and the Pairwise Comparisons

According to Saaty (2005), a network is made up of components, which consist of elements. Elements in each component interact with or have an influence on some or all of the elements of another component with respect to the criterion governing the interactions of the entire system. In representing different problems, these may be referred to as subsystems, with each subsystem consisting of components with elements, and the subsystems constitute the entire system.

The components in a network may be of three types: source components, which have influence on another component/other components; sink components, which do not have any influence on another component but are influenced by another component/other components; and transient components, which have both of the features (Saaty and Vargas, 2013).

Just like the AHP, the ANP is based on comparison judgments, which are applied to pairs of homogeneous elements, to establish relations within the structure (Saaty and Vargas, 2013). Pairwise comparisons are carried out to evaluate the relative influence of one of two elements over the other on a third element in the system, with reference to the underlying control criterion (Saaty, 2005). The question to be answered for the judgments to be made using the fundamental scale of the AHP/ANP methodology can be asked in two ways: "Given a criterion, which of two elements has greater influence on that criterion?" or "Given a criterion, which of two elements is influenced more by the given criterion?" (Saaty, 2003). The direction of the question should be maintained through the entire analysis, whether it be "having influence" or "being influenced" (Saaty and Vargas, 2013). In each set of the comparison matrices, judgments are made with respect to a common criterion, which is referred to as the control criterion (Saaty, 2005).

As mentioned by Saaty (2005), a 1-9 point scale is used in the ANP for the pairwise comparisons, in which, a score of 1 indicates equal importance of the two compared elements/clusters, and a score of 9 indicates overwhelming dominance of one element/cluster over the other. The fundamental scale used for the pairwise comparisons in the ANP is shown in Table 3.4.

Table 3.4. The fundamental scale for making judgments in the ANP (Saaty, 2005)

Intensity of Importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
2	Weak or slight	
3	Moderate importance	Experience and judgment slightly favor one activity over another
4	Moderate plus	
5	Strong importance	Experience and judgment strongly favor one activity over another
6	Strong plus	
7	Very strong or demonstrated importance	An activity is favored very strongly over another; its dominance demonstrated in practice
8	Very, very strong	
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order of affirmation

As explained by Saaty and Vargas (2013), the reciprocal property is an important feature of the pairwise comparisons. Accordingly, if one element is determined to be x times more dominant compared to another with respect to a given criterion, the lesser one is taken as the unit and the dominant one is assessed to be some multiple of that unit. Therefore, in the inverse comparison, the reciprocal value 1/x is assigned to the lesser element.

In performing the pairwise comparisons, one critical issue is to ensure the consistency of the judgments in each set of compared elements or components. The consistency ratio was introduced by Saaty for the AHP and is used for the inconsistency test in the ANP. It provides a numerical assessment of the consistency in the pairwise comparisons. As claimed by Saaty (2003), if the calculated inconsistency ratio is less than 0.10, it is considered to be satisfactory, proving that all judgments made are logically consistent.

3.4.2.2 Formation of the Supermatrix

As made clear by Saaty (2001), mathematically, the ANP follows a three-step supermatrix calculation. The first step comprises the construction of the unweighted supermatrix directly from the local priorities derived from the pairwise comparisons among the elements that have an influence on each other. In the second step, the weighted supermatrix is formed by multiplying the values of the unweighted supermatrix with their corresponding cluster weights. In the final step, a limit supermatrix is formed by raising the weighted supermatrix to powers until the columns stabilize, which is achieved when the entries of the supermatrix become identical across each row. The final priority weights are derived from the limit supermatrix.

Saaty (2005) elaborated the formation of the initial supermatrix with the following explanation. From the pairwise comparisons, a priority vector is derived, which represents the influences of a given set of elements in a component on any element in the system. These derived vectors are grouped and arranged so that the resulting matrix is obtained. In this built matrix, the flow of influence from a component of elements to itself (*i.e.* inner dependence) or from a component to another component (*i.e.* outer dependence) is represented. This matrix is called the supermatrix, in which, a typical W_{ij} is called a block of the supermatrix (Figure 3.3).

$$W_{ij} = \begin{bmatrix} W_{i1}^{(j1)} & W_{i1}^{(j2)} & \cdots & W_{i1}^{(jn_j)} \\ W_{i2}^{(j1)} & W_{i2}^{(j2)} & \cdots & W_{i2}^{(jn_j)} \\ \vdots & \vdots & \cdots & \vdots \\ W_{in_i}^{(j1)} & W_{in_i}^{(j2)} & & W_{in_i}^{(jn_j)} \end{bmatrix}$$

Figure 3.3. A block of the supermatrix (Saaty, 2005)

As denoted by Saaty (2005), each column of W_{ij} is a "principle eigenvector of the influence (importance) of the elements in the i^{th} component of the network on an element in the j^{th} component". Due to the elements with no influence, some entries of the supermatrix may be zero. Only the elements with a non-zero influence are used in paired comparisons to derive the eigenvector. The supermatrix of a network is shown in Figure 3.4.

$$W = \begin{array}{cc} & \begin{array}{cccc} C_1 & C_2 & \cdots & C_N \\ e_{11}e_{12}\cdots e_{1n_1} & e_{21}e_{22}\cdots e_{2n_2} & & e_{N1}e_{N2}\cdots e_{Nn_N} \end{array} \\ \begin{array}{cc} C_1 & \begin{array}{c} e_{11} \\ e_{12} \\ \vdots \\ e_{1n_1} \end{array} \\ C_2 & \begin{array}{c} e_{21} \\ e_{22} \\ \vdots \\ e_{2n_2} \end{array} \\ \vdots & \\ C_N & \begin{array}{c} e_{N1} \\ e_{N2} \\ \vdots \\ e_{Nn_N} \end{array} \end{array} & \begin{bmatrix} W_{11} & W_{12} & \cdots & W_{1N} \\ W_{21} & W_{22} & \cdots & W_{2N} \\ \vdots & \vdots & \cdots & \vdots \\ W_{N1} & W_{N2} & \cdots & W_{NN} \end{bmatrix} \end{array}$$

Figure 3.4. The supermatrix of a network (Saaty, 2005)

As pointed out by Saaty and Vargas (2013), unlike the unweighted supermatrix, the weighted supermatrix is a stochastic matrix, which means that all columns of the matrix sum to unity. To derive the desired priorities, this stochastic matrix should be transformed into a limit matrix, which yields the limit priority of influence of each element on every other element.

3.4.2.3 The Control Hierarchy

According to Saaty (2005), a combination of several different criteria (*i.e.* control criteria) can be integrated in the ANP model by measuring the interaction in the ANP supermatrix in accordance with the respective criteria. Individual supermatrices are built for different criteria, in which, the influence represented in eigenvectors of a supermatrix is measured with respect to a single criterion. To obtain a measure of the overall influence, the influences obtained from the limits of the several supermatrices are needed to be combined. The importance levels of the criteria are compared with respect to higher level criteria or with respect to a goal to identify their priorities. In order to display and relate the criteria, a separate control hierarchy is built, which consists of the criteria and their weights.

As mentioned by Saaty and Vargas (2013), if the analysis includes alternatives to be compared, then the derived priorities should be appropriately summed to obtain the overall priority of each alternative. Sensitivity analysis can be used to assess the effects of judgment variations on the stability of the final outcome.

3.4.3 Factors and Clusters Involved in Model Development

By virtue of the assessment of the data gathered through the conducted semi-structured interviews and in keeping with the nature of the selected model, the conceptual framework was re-formed with 33 factors organized in six groups, which are: 1) External Environment (EE), 2) Financial Characteristics (FC), 3) Project

Stakeholders (PS), 4) Planning, Tender and Contracting Processes (P), (5) Project Management (PM), and (6) Design, Construction and Operation Processes (DCO). As shown in Figure 3.5, the factor groups (*i.e.* clusters) are decomposed into the CSFs (*i.e.* nodes). The factors were elaborated with definitive sub-items as to the content extracted through the literature review and experts' remarks obtained from the semi-structured interviews, to provide insight. A list of the CSFs involving detailed factor descriptions is presented in Appendix C. In conjunction with the specific success factors, which were regarded as manageable factors, project performance improvement strategies were compiled from the explored sources of literature and synthesized, which are presented in Appendix D.

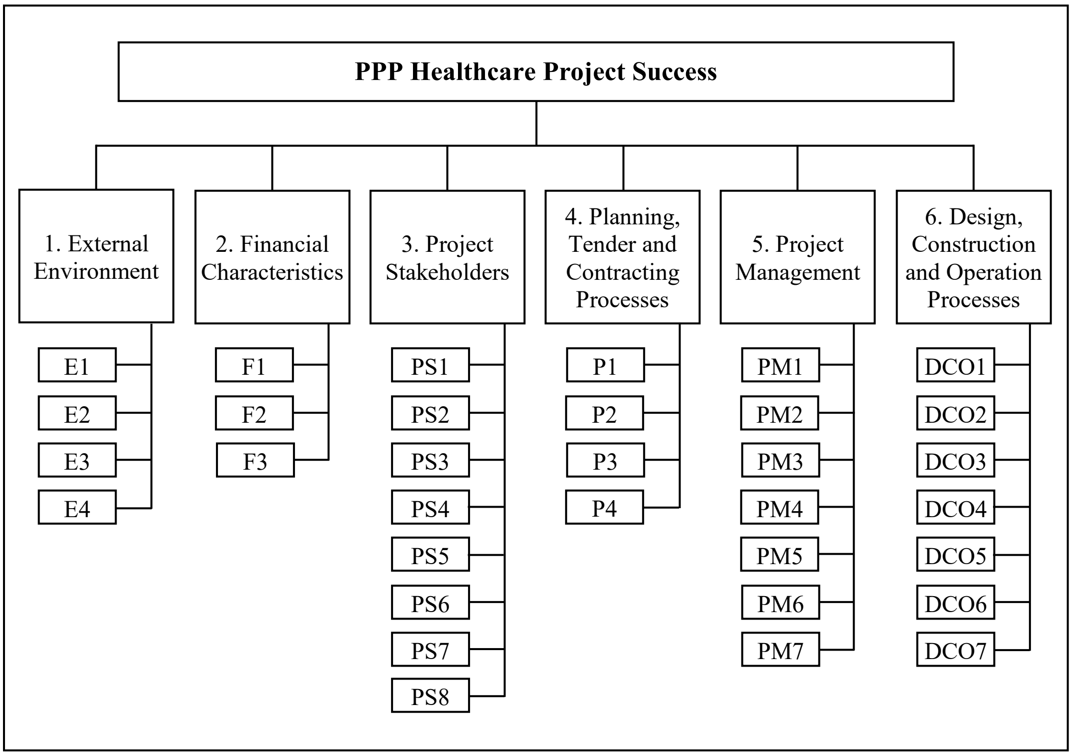


Figure 3.5. The framework used in model development

3.4.3.1 External Environment

The *External Environment* cluster is comprised of factors shaped by the prevalent political and economic environment for the project, the relevant legislation and regulations and the regional factors, which are not controllable by the project teams or which are mostly shaped by the decisions taken at the utmost level. The initial factor in this cluster refers to a stable political environment and strong government support for the project, which addresses the strength and stability of the government, the significance of the project in terms of the strategic objectives and policies of the government, a positive governmental attitude towards private sector cooperation in the project and a favorable global political environment. Favorable global economic conditions and exchange rates, and a strong and stable economic environment in the host country constitute another factor in this cluster, referring to a robust macroeconomic policy in the domestic environment, a predictable level of exchange risk and high credit rating of the host country, together with a favorable global economic market. A transparent and mature legal and regulatory framework is also included in this cluster, as comprehensive, transparent and well-prepared legislation and regulations for PPP healthcare projects was evaluated to be a critical variable for project success. The last factor in this cluster covers convenient location, and favorable weather and site conditions, which may render the project as advantageous in terms of construction field work, appointment of subcontractors and suppliers for the project and the operation of the facility.

3.4.3.2 Financial Characteristics

The *Financial Characteristics* cluster is composed of three factors, the first of which is concerned with favorable financing interest rates and financing costs, and the strength and profitability of the project. This factor covers fixed and low interest rate financing and low financial charges; the strength, financial feasibility and sustainability of the project; and sufficient profitability of the project to attract domestic and foreign investors. The second factor in this cluster addresses the provision of adequate government guarantees, which has several forms such as a debt guarantee, minimum demand guarantee, special tax allowances and the use of an appropriate method for the adjustment of payments (*e.g.* escalation with respect to changes in foreign exchange rates). The last factor in this cluster is concerned with the inclusion of investors and sponsors with sufficient financial strength in the project, which can be designated by high credit rating of the investors and reliability and financial capability of the project sponsors.

3.4.3.3 Project Stakeholders

Eight major stakeholders were identified for PPP healthcare projects and included in the *Project Stakeholders* cluster, and their essential characteristics were defined for the planning and delivery of a successful PPP project. Public agency is one of the leading stakeholders for a PPP project and its well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model was identified as a success factor. Adequate number of competent staff which have a comprehensive knowledge of PPP legislation and regulations, sufficient knowledge and experience in healthcare projects and the BLT model; sufficient budgetary resources; and a strong organizational structure are listed as the required attributes for the public agency for the execution of a successful PPP project. Furthermore, establishment of a dedicated department for PPP healthcare projects within the Ministry, with specialized units focusing on different project phases/tasks (*e.g.* preparation of the contract, preliminary project and project budget; management of the tender phase and administration of the contract; continuous supervision), clear distribution of responsibilities among the authorized public institutions in the project and cooperation in project planning, and effective communication/coordination between the institutions are necessary to provide the proper management of the PPP projects.

Another stakeholder involved in this cluster is the public agency consultant, responsible to provide the necessary support to the public agency through the execution of the PPP project. Sufficient experience, competencies and staff adequacy, sufficient knowledge and experience in healthcare projects and the BLT model, and comprehensive knowledge of PPP legislation and regulations enable the public agency consultant to act as a mediator between the public agency and the private sector stakeholders. In overcoming the problems and risks that may arise from the organizational and cultural differences between the public and private sectors, the appointment of the public agency consultant becomes critical.

The third factor in this cluster is concerned with the main contractor, which is generally the leading stakeholder in the private sector side of a PPP project. The contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model was identified as a major success factor for a PPP project. The term resource adequacy can be elaborated by the adequacy of financial, labor and equipment resources of the contractor. A strong organizational structure is necessary to tackle with construction projects of this size, supported by a mature organizational culture.

Referred to as multidimensional and complex projects, PPP healthcare projects necessitate the charging of various consultants on a wide range of specializations with regards to the issues such as traffic, Environmental and Social Impact Assessment (ESIA), fire, risk and green building. Therefore, the contractor's consultants' experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model was included in the model framework as a success factor.

Since these projects are contracted to cover the operation period within the project life cycle, it is ultimately critical for the consortium to collaborate with a reliable operator. Besides the provision of the proper operation of the facilities, in the ideal project scenario, the operator contributes to and enhances the scope of the contract and the design and construction processes of the project. Therefore, the factor covering the operator's experience, competencies, staff adequacy and financial capability, sufficient knowledge and experience in healthcare projects and the BLT model was also involved in the conceptual framework.

Another principal stakeholder that should be mentioned is the design firm, with its capacity to direct and influence the whole design, construction and operation processes. Design firm's sufficient experience, competencies, staff adequacy, financial capability, sufficient knowledge and experience in healthcare projects and the BLT model is among the success factors to which project creditors also attach a specific importance.

The subcontractors and suppliers were also included within the *Project Stakeholders* cluster. The success factor concerned with the subcontractors were elaborated with the subcontractors' (*e.g.* electrical, mechanical) experience, competence, adequacy of financial, labor and equipment resources, sufficient knowledge and experience in healthcare projects and the BLT model, while the last factor in this cluster refers to the suppliers' experience, competence, commercial strength and long-term accessibility. The coordination skills, reliability and the market dominance of the suppliers were also mentioned in the definitive sub-items of the factor.

3.4.3.4 Planning, Tender and Contracting Processes

Four factors are involved in the *Planning, Tender and Contracting Processes* cluster, one of which is associated with the project scope definition and specification of project requirements. It is one of the major responsibilities of the public agency, which should be carried out with the contribution of the relevant parties. Accordingly, the factor covers the detailed and clear definition of project scope and public authority's requirements prior to the tender process, and proper integration of end users' needs, inputs of operational staff, healthcare experts, relevant institutions, non-governmental organizations and all other interest groups early on in this process. Provision of a well-defined purpose and objectives for the project is another dimension of the factor.

Preparation of a comprehensive and realistic feasibility study prior to tender is another CSF included in this cluster, which is also under the responsibility of the public agency. Employing a specialized consultant for this process is considered to be an option to ensure the elaboration of the feasibility study, which should encompass technical, financial, economic, legal, social and environmental issues and demand projections for the project.

The third factor in this cluster addresses the characteristics of the tender process. A well-designed, competitive and transparent tender process, in which, clear and adequate tender documents are utilized, was covered in this respective factor. In order to provide a well-designed process, tender procedures must be clearly defined in advance, together with the development of appropriate and explicit tender evaluation criteria and their weighting, based on a combination of bid price and qualifications (*e.g.* technical, financial and managerial competence, experience, past performance). Competition is essential for the selection of the most appropriate bidder; and to maintain competition in the process, application of competitive tender procedures and ensuring a sufficient number of qualified bidders are necessary. To provide transparency, it should be provided that the rules are made available to all participants and the process is made open and public. Adequacy and reliability of the tender documents is another important dimension of this process, which also covers the provision of comprehensive and well-defined tender specifications by the public agency.

The last factor included in this cluster is concerned with the preparation of comprehensive and clear final contract documentation by the public agency and the contractor. This factor covers the inclusion of the well-defined roles and responsibilities of the stakeholders, explicit project objectives and scope, and adequacy and clarity of plans and specifications in the contract. Also, specification of risks in the contract with fair and reasonable risk allocation among project stakeholders is indispensable, which directs the whole project life cycle.

3.4.3.5 Project Management

The *Project Management* cluster is comprised of seven factors. The first factor in this cluster addresses effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases. Detailed and well-prepared budget and schedule, in line with whole life cost assessment and effective strategic planning for the project are the main concerns of this factor.

Due to its structure, a PPP healthcare project necessitates the integration of various project phases, processes and parties involved; and the provision of effective communication and coordination throughout the project life cycle becomes a challenging task. Therefore, ensuring the active involvement of project stakeholders throughout all project management processes, and adequate and effective communication and coordination between project stakeholders was also included as another success factor in this cluster. Providing the contribution of all the relevant stakeholders such as the public agency, public agency consultant, contractor, contractor's consultants, operator, designer, subcontractors and suppliers in all project phases and establishing proper communication channels between the project participants were mentioned as the enablers of this factor in the semi-structured interviews.

For the work to be conducted with minimum errors and revisions, it is of critical importance that the public agency provides regular monitoring and feedback throughout all project phases by competent staff, establishes an effective approval mechanism and applies proper and timely interventions on the project. Accordingly, effective control and supervision by the public agency through the life cycle of the project and an efficient governmental approval process was another success factor involved in the framework, which addresses the proper functioning of the project mechanism.

Besides the public agency, the maturity of the contractor's own monitoring and control mechanism is also critical. Therefore, efficient monitoring, evaluation, reporting and control of project performance by the private sector stakeholders is also included in the framework, which covers regular control meetings, project schedule and budget updates throughout the project life cycle and identification of deviations from plan, evaluating possible alternative course of actions and taking appropriate corrective actions.

In projects of this scale, project changes are considered to be unavoidable and providing the appropriate resolution for the disputes among various stakeholders is rather difficult to be accomplished. Addressing this issue, establishment of an efficient system for controlling project changes and resolving disputes is covered in this cluster. It necessitates taking effective change management and dispute resolution measures to properly manage deviations from the project plan and providing adaptability to changes in project plan/scope. To provide efficiency gains, an appropriate system must be established at the beginning of the project.

Having an extensive lifespan covering the planning, design, construction and operation phases and a great number of stakeholders involved, PPP projects embody a vast number and variety of uncertainties and risks. Moreover, healthcare project type is among the most complex ones to manage. Therefore, effective implementation of risk management processes across all project phases is another success factor that was involved in the framework. The proper fulfillment of this factor necessitates the establishment of an effective risk management system for the project, which encompasses risk identification, assessment, response development, monitoring and control, and documentation processes.

Effective documentation and organizational learning are the complementary dimensions of the project management process, in order to obtain continuous improvement. Accordingly, the factor concerning the establishment of a proper documentation system for the project and storage of lessons learned through an accessible PPP projects database is incorporated as the last dimension of this cluster. The project parties need to ensure that the documentation process is defined and formalized for all project phases in order to thoroughly benefit from its potential for the organization. A properly functioning PPP projects database paves the way for future projects of this type and also for other large-scale projects, preventing the information and experiences from being lost through the change of staff.

3.4.3.6 Design, Construction and Operation Processes

As the feasibility study provided by the public agency in the tender stage may have deficiencies in terms of scope and content, the need for its further development by the private sector stakeholders subsequent to the award of the tender was pointed out by the experts participated in the study. To obtain a complete analysis, the mentioned further works should be carried out in conjunction with design development and project preparation stages, which should include the conduct of a technical and financial analysis in the early stages of the project and the development of workable financial plans. Therefore, the first factor in the *Design, Construction and Operation Processes* cluster addresses the further development of the pre-tender feasibility study and preparation of a detailed technical and financial analysis early on in the design-construction phase with the contribution of the private sector stakeholders.

Since the specifications provided by the public agency in the tender phase are rather broad, the elaboration of the project specifications during the project execution stages is a critical task, which should be carried out with the participation of various stakeholders. Accordingly, the second factor involved in this cluster covers the further development of the project specifications prepared by the public agency, with the contribution of the stakeholders early on in the design-construction phase. This factor targets the definition of explicit, specific and assessable project specifications considering the entire project life cycle.

As mentioned in various studies in the literature, the provision of integrated project delivery is the key to handling issues that originate from the discrete nature of different construction project processes and phases. Thus, providing the integration of design with the construction and operation phases, and ensuring the flexibility and optimization of design is another factor involved in this cluster. This factor is concerned with the active participation of the contractor and the operator in the design process, incorporating construction and operation knowledge and experience into the early stages of planning and design. As the other dimensions, providing the flexibility of design with adaptable design solutions for the contingent future needs and changes, and undertaking a design optimization process are covered by this factor.

Factors focusing on effective site management and quality, health, safety and environment management are also defined under this cluster. Effective site management comprises a proper site layout and effective planning and management of site operations. Establishment of an efficient quality, health, safety and environment management system for the construction and operation phases targets the provision of extensive supervision and control in the construction and operation processes.

In the literature, the provision of operational and maintenance services by the private sector has been mentioned as one of the primary advantages of PPPs, in order to boost project performance. Therefore, taking the necessary measures to provide and maintain maximum performance throughout the operation phase was identified as another CSF within the framework. This factor involves the optimization of the processes pertaining to the operation and establishment of an efficient performance management system with a systematic performance measurement and reporting mechanism for the project’s operation phase.

The last factor in this cluster is objected at ensuring the proper transfer of the facility to the public authority at the end of the contract phase. This requires including the necessary measures in the contract for the development of effective hand over procedures, to make sure that the performance is maintained. Determining the obligations of the public and private sector stakeholders and defining the process to be followed, which should involve the principles of the inspections and monitoring to be undertaken in this period, are covered by this factor.

3.4.4 Implementation of the ANP

Subsequent to the formation of the revised project success framework, the objective was to analyze the interrelationships between the factors included, find out the relative importance weights of the factors and develop a project success model to assess the performance of a PPP healthcare project. For the implementation of the ANP, the links among the success factors and thus among the factor clusters were explored. The aim was to define each variable together with its relationship with other elements in the system. Proceeding cluster by cluster, each factor within a cluster was judged against the other 32 factors of the framework in terms of the presence/absence of influence. Possible insignificant influences were omitted in order to create a robust structure. The assumptions were derived from an extensive literature review as well as the subjective judgment of the experts who participated in the study.

Accordingly, the main structure of the model was constructed as shown in Figure 3.6. The direction of the arrows designates the direction of influence between two clusters, which means that there are factors in the source cluster that have an influence on at least one factor within the cluster pointed by the arrow. The loop indicates that there are factors in the cluster that have an influence on another factor/other factors within the same cluster. These constructed interrelationships between the clusters were all derived owing to the established links between the factors. It is a feature of the ANP that links established in between the factors directly induce links in between the relevant clusters.

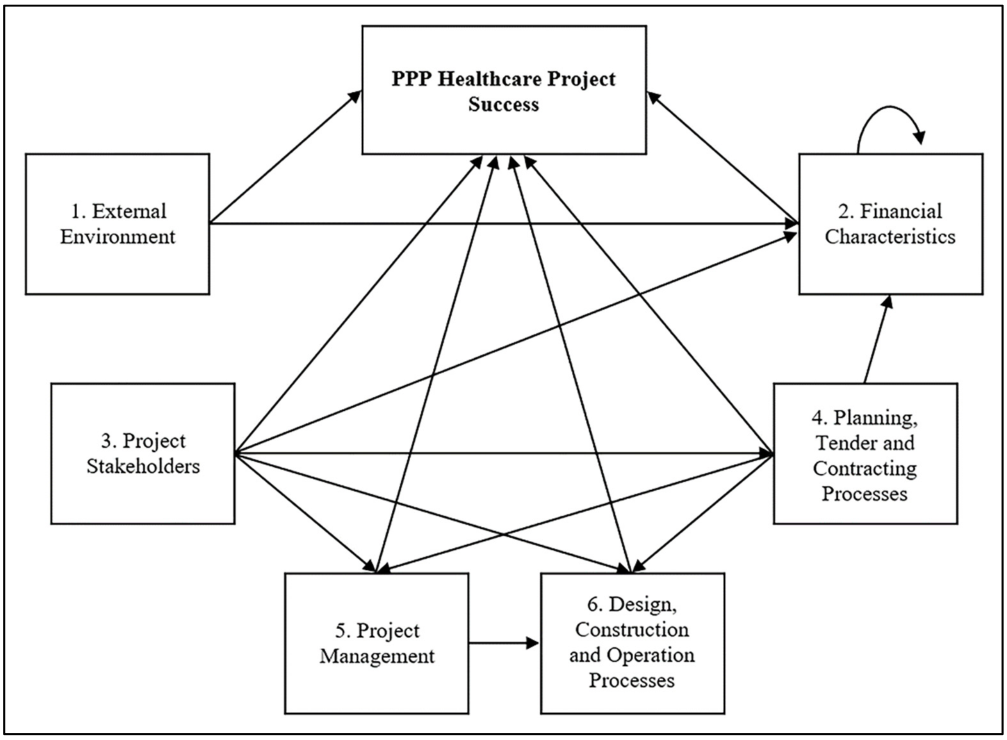


Figure 3.6. The main structure of the proposed ANP model

In the developed model, the *External Environment* and *Project Stakeholders* clusters are considered to be source components, which have an influence on another component/other components, but are not influenced by any other component. The *Design, Construction and Operation Processes* cluster is a sink component, which does not have any influence on another component but is influenced by three other components. The *Financial Characteristics* cluster is also a sink component, which is influenced by three other components, in addition to its inner dependence. The *Planning, Tender and Contracting Processes* and *Project Management* clusters are transient components; which influence another component/other components and are influenced by another component/other components at the same time.

In compliance with the context of this study, a single control criterion was used in the construction of the ANP model, *i.e.*, *PPP healthcare project success*. The questions for the pairwise comparisons were all posed with respect to this single criterion. Moreover, no alternatives were included in the model, since the aim was to derive the relative importance weights of the factors to provide a general model for project performance assessment rather than comparing specific alternatives. Hence, there is only one supermatrix, formed with respect to that criterion.

For the implementation of the ANP, once again the knowledge and experience of the private sector experts were intended to be utilized through a group discussion session. Based on the assumptions of the interrelations among the factors and among the factor groups, pairwise comparison matrices were prepared in the form of a questionnaire as a groundwork for the session, in order to facilitate easy understanding and evaluation of the experts. The questionnaire used is presented in Appendix E.

The session was conducted with the participation of five experts from the company referred to as Company C in reporting the preliminary interviews in Section 3.1. The mentioned company was also involved in the semi-structured interviews, which were explained in Section 3.3. In a similar vein with the preliminary and the in-depth interviews conducted, the experts participated in the model development session were selected among the professionals involved in PPP healthcare projects, who have experience and knowledge in the relevant area. The information about the experts is given in Table 3.5. The session was held in December 2017 and lasted for approximately three hours.

Table 3.5. Information about the experts participated in the ANP model development session

Expert	Position and Expertise	Years of Experience in	
		Construction Sector	**Healthcare PPP Projects**
A	Director of Project Management Office, Civil Engineer (PhD)	22	8
B	Director, Civil Engineer (MSc)	17	4
C	Coordinator of Project Management Office, Civil Engineer (MSc)	15	3
D	Design Manager, Architect (MSc)	14	2.5
E	Project Executive, Architect	12	3.5

At the beginning of the session, the previous phases and the objectives of the research, the structure of the conceptual framework and the principles of the ANP were explained to the experts, together with the tasks asked to be performed by them. The expert team had 3 tasks:

1. Revision of the conceptual model,
2. Assessment of the relative importance weights by using the questionnaire forms prepared in advance,
3. Testing the performance of the constructed model via examples of real projects from their own experiences.

Regarding the first task, which includes the revision of the conceptual model, all factors and their definitive sub-items were discussed, together with the cluster and node interrelations established in the model. It was attempted to ensure that all experts clearly understand each factor. As a result of the discussions, some of the proposed interrelations between the factors were cancelled. The questionnaire was also revised accordingly.

For the conduct of the second task, the questionnaire which was formed of the comparison matrices was presented to the experts. The evaluations required for the implementation of the ANP were made through consensus decision making among the experts. For each evaluation, discussions continued until all the decision makers agreed on a numerical pairwise estimate. For the construction of the ANP model, the Super Decisions Software was utilized. The pairwise comparison evaluations made by the expert team were fed into the software simultaneously during the group discussion session. This enabled the determination of the inconsistencies within the judgments of the experts and finalization of the model with the necessary revisions. The inconsistency ratio was provided via the software and monitored in all steps of the evaluation process. The participants were informed if it was greater than 0.10, so that they could review their assessment. If the calculated ratio was less than 0.10, the consistency was considered to be satisfactory.

The total number of the comparison matrices evaluated by the experts was 29. Pairwise comparisons were conducted among:

1. the nodes (*i.e.* the CSFs), in terms of their relative importance;
2. the nodes, in terms of the magnitude of their interdependencies;
3. the clusters (*i.e.* the factor groups), in terms of their relative importance;
4. the clusters, in terms of the magnitude of their interdependencies,

all with respect to the control criterion. A brief explanation was given to the experts about how the questions were posed to elicit the judgments for each set of pairwise comparison. The fundamental scale of the ANP was used in pairwise comparisons. A screenshot of the ANP model, which was constructed by using the Super Decisions Software, is presented in Figure 3.7.

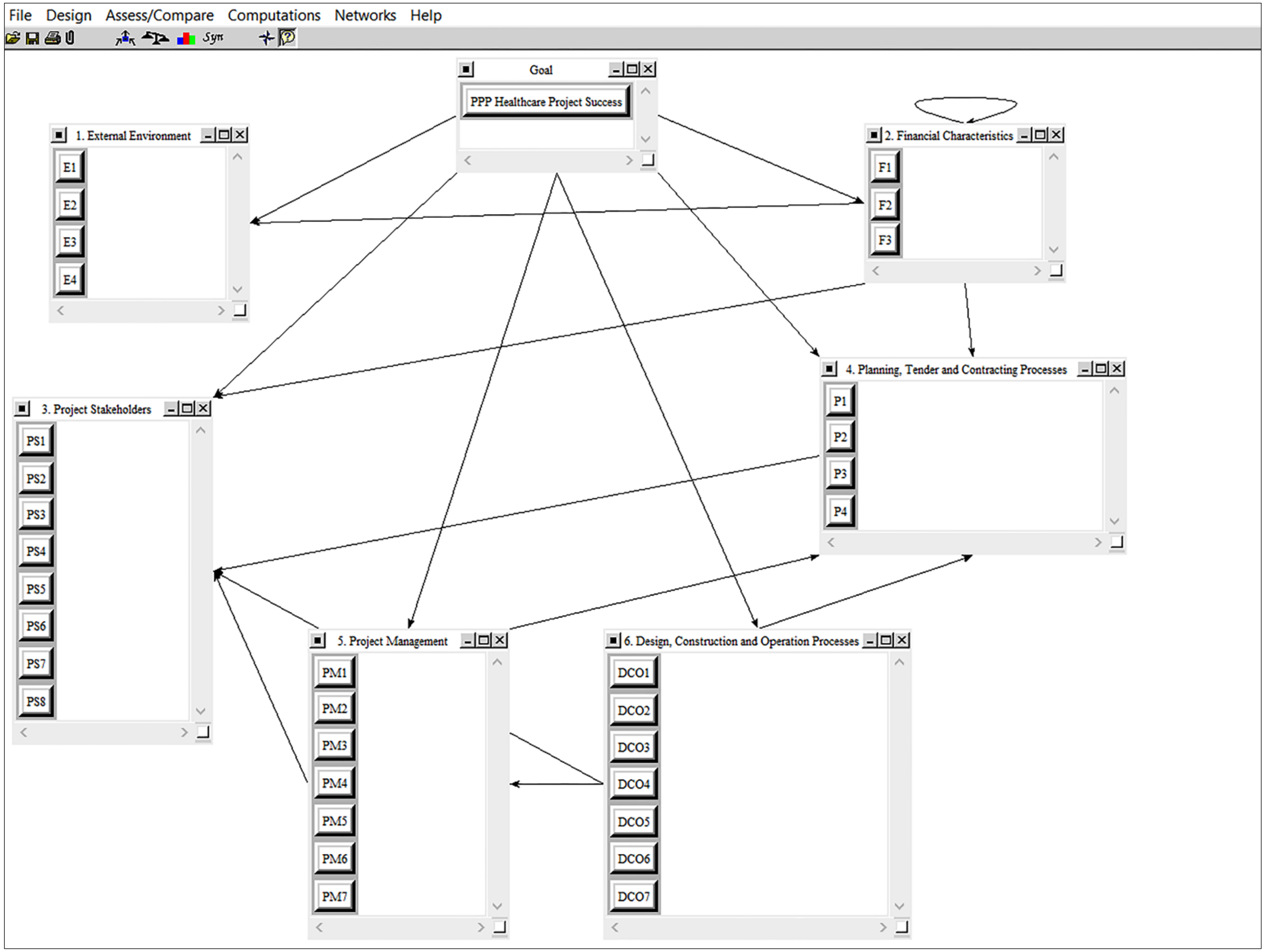


Figure 3.7. Screenshot of the ANP model developed using the Super Decisions Software

3.4.4.1 Pairwise Comparisons for the Relative Importance of the Factors

The first step was to pairwise-compare the relative importance of the CSFs, with respect to PPP healthcare project success. The question posed was: "Which factor is more important for PPP healthcare project success and how much more important?".

Of the *External Environment* factors, E1 (A stable political environment and strong government support) was judged to be the most important factor for project success, followed by E2 (Favorable global economic conditions and exchange rates, a strong and stable economic environment in the host country) and E3 (A transparent and mature legal and regulatory framework). E4 (Convenient location, favorable weather and site conditions) was evaluated to be the least important factor within this group. The strength and stability of the political environment and strong government support were referred to as the enablers of these projects. The economic environment was deemed to be critical as well but considered more manageable in terms of its impacts on the project, compared to the political environment. Following these two comes the maturity of legislation and regulations; whereas the factor concerning the location, and weather and site conditions was rather considered to be manageable by the project team by means of taking the necessary actions. Experts' judgment for the importance of the factors in the *External Environment* cluster is given in Table 3.6.

Table 3.6. Judgment for the importance of the factors in the *External Environment* cluster

Project Success	E1	E2	E3	E4	Weight
E1	1	3	5	7	0.55364
E2	1/3	1	4	6	0.28895
E3	1/5	1/4	1	3	0.10615
E4	1/7	1/6	1/3	1	0.05126
Inconsistency ratio = 0.06462					

In the *Financial Characteristics* cluster, F3 (Inclusion of investors and sponsors with sufficient financial strength in the project) was revealed as the most important factor with a significant difference, followed by F2 (Provision of adequate government guarantees) and F1 (Favorable financing interest rates and financing costs, the strength and profitability of the project) (Table 3.7). Although all of the three factors included were mentioned to be crucial, F3 stood out in this group, through the consensus of the experts. F3 is also dependent on other factors and addressed in detail in the following sub-section.

Table 3.7. Judgment for the importance of the factors in the *Financial Characteristics* cluster

Project Success	F1	F2	F3	Weight
F1	1	1	1/5	0.15618
F2	1	1	1/3	0.18517
F3	5	3	1	0.65864

Inconsistency ratio = 0.02795

In the *Project Stakeholders* cluster, PS3 (Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) was evaluated to be the most important factor, followed by PS1 (Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) (Table 3.8). PS5 (Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) and PS6 (Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) were evaluated to have almost equal importance, following PS1 and PS3. It can be inferred that PS2 (Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model) and PS4 (Contractor's consultants' experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model) were judged to be in the third circle of importance, having almost equal weights. On the other hand, it can be said that PS7 (Subcontractors' experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) and PS8 (Suppliers' experience, competence, commercial strength and long-term accessibility) were obtained with considerably lower importance weights when compared to especially the first four mentioned.

Table 3.8. Judgment for the importance of the factors in the *Project Stakeholders* cluster

Project Success	PS1	PS2	PS3	PS4	PS5	PS6	PS7	PS8	Weight
PS1	1	4	1/3	4	3	3	4	5	0.22864
PS2	1/4	1	1/5	2	1/4	1/4	3	4	0.06910
PS3	3	5	1	5	2	2	5	6	0.29416
PS4	1/4	1/2	1/5	1	1/3	1/2	3	4	0.06316
PS5	1/3	4	1/2	3	1	1	4	5	0.14441
PS6	1/3	4	1/2	2	1	1	4	5	0.13711
PS7	1/4	1/3	1/5	1/3	1/4	1/4	1	2	0.03698
PS8	1/5	1/4	1/6	1/4	1/5	1/5	1/2	1	0.02644
Inconsistency ratio = 0.06754									

Of the *Planning, Tender and Contracting Processes* factors, P4 (Comprehensive and clear final contract documentation prepared by the public agency and the contractor) was evaluated to be the most important one, as it directs the whole project life cycle through the defined roles and responsibilities of the stakeholders, project scope and risk allocation among the project stakeholders, and through the included plans and specifications (Table 3.9). As to the results, the importance of P4 was followed by P1 (Clear definition of project scope and public authority's requirements prior to the tender process, proper integration of end users' needs, inputs of operational staff, healthcare experts and all other interest groups in this process). Although not devoted enough time and effort in the current state, scope definition prior to the tender process was mentioned to have a critical importance, which should be conducted with the proper integration of end users' needs, inputs of operational staff, healthcare experts, relevant institutions, non-governmental organizations and all other interest groups early on in the process. Relatively low weights were yielded for factors P3 (A well-designed, competitive and transparent tender process, clarity and adequacy of tender documents) and P2 (Preparation of a comprehensive and realistic feasibility study prior to tender).

Table 3.9. Judgment for the importance of the factors in the *Planning, Tender and Contracting Processes* cluster

Project Success	P1	P2	P3	P4	Weight
P1	1	6	2	1/2	0.32009
P2	1/6	1	1/2	1/4	0.07780
P3	1/2	2	1	1/3	0.15026
P4	2	4	3	1	0.45185
Inconsistency ratio = 0.03863					

Of the *Project Management* factors, PM5 (Establishment of an efficient system for controlling project changes and resolving disputes) was revealed as the leading factor (Table 3.10). Following PM5, PM2 (Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders) and PM1 (Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases) became prominent, followed by PM4 (Efficient monitoring, evaluation, reporting and control of project performance). In the fourth circle of importance, PM3 (Effective control and supervision by the public agency through the life cycle of the project and an efficient governmental approval process) and PM6 (Effective implementation of risk management processes across all project phases) can be listed, with almost equal weights. On the other hand, PM7 (Establishment of a proper documentation system for the project and storage of lessons learned through an accessible PPP projects database) was attached a significantly lower importance weight compared to the other factors within this cluster.

Table 3.10. Judgment for the importance of the factors in the *Project Management* cluster

Project Success	**PM1**	**PM2**	**PM3**	**PM4**	**PM5**	**PM6**	**PM7**	**Weight**
PM1	1	1	2	2	1	2	5	0.20057
PM2	1	1	2	2	1	2	5	0.20057
PM3	1/2	1/2	1	1/3	1/3	1	4	0.08937
PM4	1/2	1/2	3	1	1/3	2	4	0.13829
PM5	1	1	3	3	1	4	4	0.25018
PM6	1/2	1/2	1	1/2	1/4	1	3	0.08467
PM7	1/5	1/5	1/4	1/4	1/4	1/3	1	0.03636
Inconsistency ratio = 0.03311								

In the *Design, Construction and Operation Processes* cluster, DCO1 (Further development of the pre-tender feasibility study and preparation of a detailed technical and financial analysis early on in the design-construction phase with the contribution of the private sector stakeholders) was the top-ranked factor, followed by DCO2 (With the contribution of the stakeholders early on in the design-construction phase, further development of the project specifications prepared by the public agency) and DCO3 (Providing the integration of design with the construction and operation phases, ensuring its flexibility and optimization) with equal weights (Table 3.11). Subsequent to the signing of the contract, the contractor's preparation with the conduct of technical and financial analysis and further work on the feasibility study was evaluated to be necessary by the experts. Further development of the project specifications by the contractor, with the participation of the public agency, public agency consultant, operator, design firm and contractors' consultants, was also regarded as essential. Providing the integration of design, construction and operation processes and ensuring maximum design performance were deemed to be the backbone of a successful PPP project. The factors DCO4 (Effective site management) and DCO6 (Taking the necessary measures to provide and maintain maximum performance throughout the operation phase) were listed after the first three, with almost equal weights. DCO5 (Establishment of an efficient quality, health, safety and environment management system for the construction and operation phases) was attached a relatively low importance weight compared to the mentioned ones, and DCO7 (Ensuring the proper transfer of the facility to the public authority at the end of the contract phase) was revealed as the factor with the lowest importance weight in this cluster.

Table 3.11. Judgment for the importance of the factors in the *Design, Construction and Operation Processes* cluster

Project Success	DCO1	DCO2	DCO3	DCO4	DCO5	DCO6	DCO7	Weight
DCO1	1	1	1	2	3	3	6	0.23333
DCO2	1	1	1	2	2	2	5	0.20211
DCO3	1	1	1	2	2	2	5	0.20211
DCO4	1/2	1/2	1/2	1	4	1	4	0.13398
DCO5	1/3	1/2	1/2	1/4	1	1/4	1	0.06085
DCO6	1/3	1/2	1/2	1	4	1	4	0.12867
DCO7	1/6	1/5	1/5	1/4	1	1/4	1	0.03896
Inconsistency ratio = 0.03945								

3.4.4.2 Pairwise Comparisons for the Interdependencies Between the Factors

The second step was to analyze the interdependencies between the factors. The question posed was: “Considering PPP healthcare project success, given a factor, which of the two factors influences it more, and how much more?”. The answers obtained are presented herein.

Within the *Financial Characteristics* cluster, factors F1 and F3 were identified as the factors with interdependencies. In the first step, the magnitude of influence of the factors E1, E2 and E3 from *External Environment* cluster on F1 (Favorable financing interest rates and financing costs, the strength and profitability of the project) were explored (Table 3.12). As to the obtained results, influence of the factors E1 (A stable political environment and strong government support) and E2 (Favorable global economic conditions and exchange rates, a strong and stable economic environment in the host country) on F1 were revealed to be equal to each other, whereas E3 (A transparent and mature legal and regulatory framework) had a relatively low influence on F1.

Table 3.12. *External Environment* influences on F1

F1	E1	E2	E3	Weight
E1	1	1	3	0.42857
E2	1	1	3	0.42857
E3	1/3	1/3	1	0.14286
Inconsistency ratio = 0.00000				

The various influences on factor F3 (Inclusion of investors and sponsors with sufficient financial strength in the project) were also examined. Factors from the *External Environment* cluster, *Financial Characteristics* cluster, *Project Stakeholders* cluster and *Planning, Tender and Contracting Processes* cluster were pairwise compared within their clusters according to their magnitude of influence on F3. The obtained results are presented in Tables 3.13-3.16. Accordingly, for the first cluster, it was revealed that F3 is greatly affected from E3 (A transparent and mature legal and regulatory framework) and E2 (Favorable global economic conditions and exchange rates, a strong and stable economic environment in the host country). It was pointed out by the experts that the legal and regulatory framework has critical importance for the creditors, in addition to the global economic conditions and economic environment in the host country. Within the *Financial Characteristics* cluster, the influence of F2 (Provision of adequate government guarantees) attained a high weight. Within the *Project Stakeholders* cluster, the influence of PS4 (Contractor's consultants' experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model) was rated as the highest, as the project sponsors attach critical importance to the mentioned issues. This factor was followed by PS3 (Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) and PS5 (Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model). It was mentioned by the experts that PS6 (Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) is also critical for the sponsors, although the first three factors were rated at the top. Among the *Planning, Tender and Contracting Processes* factors, P2 (Preparation of a comprehensive and realistic feasibility study prior to tender) was evaluated as significantly more influential on F3 when compared to the other two, as the feasibility study is one of the leading issues that the project creditors attach importance to.

Table 3.13. *External Environment* influences on F3

F3	E1	E2	E3	Weight
E1	1	1/3	1/4	0.12601
E2	3	1	1	0.41606
E3	4	1	1	0.45793
Inconsistency ratio = 0.00885				

Table 3.14. *Financial Characteristics* influences on F3

F3	F1	F2	Weight
F1	1	1/4	0.20000
F2	4	1	0.80000
Inconsistency ratio = 0.00000			

Table 3.15. *Project Stakeholders* influences on F3

F3	PS1	PS2	PS3	PS4	PS5	PS6	Weight
PS1	1	1	1/6	1/7	1/6	1/5	0.03503
PS2	1	1	1/6	1/7	1/6	1/5	0.03503
PS3	6	6	1	1	1	4	0.26299
PS4	7	7	1	1	2	5	0.32793
PS5	6	6	1	1/2	1	4	0.23695
PS6	5	5	1/4	1/5	1/4	1	0.10207
Inconsistency ratio = 0.04782							

Table 3.16. *Planning, Tender and Contracting Processes* influences on F3

F3	P2	P3	P4	Weight
P2	1	4	4	0.66667
P3	1/4	1	1	0.16667
P4	1/4	1	1	0.16667
Inconsistency ratio = 0.00000				

Within the *Planning, Tender and Contracting Processes* cluster, factors P2 and P4 were identified as the factors that have interdependencies with the *Project Stakeholders* factors (Tables 3.17-3.18). Comparing the influence of PS1 (Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) and PS2 (Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model) on P2 (Preparation of a comprehensive and realistic feasibility study prior to tender), PS2 was attached a greater weight with respect to its influence. On the other hand, on P4 (Comprehensive and clear final contract documentation prepared by the public agency and the contractor), the influence of PS1 (Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) and PS3 (Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) were assigned equal weights.

Table 3.17. *Project Stakeholders* influences on P2

P2	PS1	PS2	Weight
PS1	1	1/3	0.25000
PS2	3	1	0.75000
Inconsistency ratio = 0.00000			

Table 3.18. *Project Stakeholders* influences on P4

P4	PS1	PS3	Weight
PS1	1	1	0.50000
PS3	1	1	0.50000
Inconsistency ratio = 0.00000			

When the influences on the factor PM1 (Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases) were assessed, it was revealed that it is significantly influenced by PS3 (Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) and P4 (Comprehensive and clear final contract documentation prepared by the public agency and the contractor), in accordance with the judgment of the experts (Tables 3.19-3.20).

Table 3.19. *Project Stakeholders* influences on PM1

PM1	PS3	PS4	PS5	Weight
PS3	1	7	7	0.77317
PS4	1/7	1	1/2	0.08767
PS5	1/7	2	1	0.13916
Inconsistency ratio = 0.05156				

Table 3.20. *Planning, Tender and Contracting Processes* influences on PM1

PM1	P1	P2	P4	Weight
P1	1	1	1/3	0.20000
P2	1	1	1/3	0.20000
P4	3	3	1	0.60000
Inconsistency ratio = 0.00000				

The factor PM2 is influenced by four factors from the *Project Stakeholders* cluster (Table 3.21), of which, PS3 (Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) was assessed as the leading one, followed by PS1 (Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model).

Table 3.21. *Project Stakeholders* influences on PM2

PM2	**PS1**	**PS2**	**PS3**	**PS5**	**Weight**
PS1	1	2	1/2	3	0.28795
PS2	1/2	1	1/3	1	0.13767
PS3	2	3	1	3	0.44858
PS5	1/3	1	1/3	1	0.12580
Inconsistency ratio = 0.01716					

The factor PM3 (Effective control and supervision by the public agency through the life cycle of the project and an efficient governmental approval process) is under the influence of PS1 (Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) and PS2 (Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model) from the *Project Stakeholders* cluster (Table 3.22). The influence of PS1 was evaluated to be significantly more dominant when compared to PS2, on PM3.

Table 3.22. *Project Stakeholders* influences on PM3

PM3	**PS1**	**PS2**	**Weight**
PS1	1	8	0.88889
PS2	1/8	1	0.11111
Inconsistency ratio = 0.00000			

According to the experts' judgment, PM4 (Efficient monitoring, evaluation, reporting and control of project performance) is highly influenced by PS3

(Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model), followed by PS5 (Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model). Although the contractor is the principle stakeholder in project performance monitoring and control, the operator is also responsible for the process in the operation phase (Table 3.23).

Table 3.23. *Project Stakeholders* influences on PM4

PM4	PS3	PS4	PS5	Weight
PS3	1	5	3	0.63699
PS4	1/5	1	1/3	0.10473
PS5	1/3	3	1	0.25829
Inconsistency ratio = 0.03703				

On the factor PM5 (Establishment of an efficient system for controlling project changes and resolving disputes), which was the highest ranked factor in this cluster with respect to its importance, it was revealed that PS1 (Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) is the most influential factor, followed by PS2 (Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model). It was pointed out by the experts that the greatest responsibility for establishing such a system belongs to the public sector stakeholders. Following PS1 and PS2, the importance of the factors PS3 (Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) and PS5 (Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) were obtained with equal weights (Table 3.24).

Table 3.24. *Project Stakeholders* influences on PM5

PM5	PS1	PS2	PS3	PS4	PS5	PS6	Weight
PS1	1	3	2	6	2	9	0.38201
PS2	1/3	1	2	3	2	4	0.21032
PS3	1/2	1/2	1	3	1	4	0.15359
PS4	1/6	1/3	1/3	1	1/3	2	0.06116
PS5	1/2	1/2	1	3	1	4	0.15359
PS6	1/9	1/4	1/4	1/2	1/4	1	0.03932
Inconsistency ratio = 0.02353							

PM6 (Effective implementation of risk management processes across all project phases) was evaluated to be greatly influenced by PS3 (Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model). Accordingly, the contractor was mentioned as the primary party to establish an effective risk management system for the project. PS3 is followed by PS4 (Contractor's consultants' experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model) and PS5 (Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model), as to the experts' judgment (Table 3.25).

Table 3.25. *Project Stakeholders* influences on PM6

PM6	PS1	PS2	PS3	PS4	PS5	Weight
PS1	1	1	1/5	1/4	1/4	0.06268
PS2	1	1	1/5	1/4	1/4	0.06268
PS3	5	5	1	3	3	0.45628
PS4	4	4	1/3	1	1	0.20918
PS5	4	4	1/3	1	1	0.20918
Inconsistency ratio = 0.02777						

When the influences on PM7 (Establishment of a proper documentation system for the project and storage of lessons learned through an accessible PPP projects database) were assessed, it was revealed that PS2 (Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model) is the most influential one, followed by PS1 (Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) and PS3 (Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) with equal weights, and PS5 (Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) with a slightly lower weight (Table 3.26).

Table 3.26. *Project Stakeholders* influences on PM7

PM7	PS1	PS2	PS3	PS5	Weight
PS1	1	1	1	1	0.24627
PS2	1	1	1	2	0.29788
PS3	1	1	1	1	0.24627
PS5	1	1/2	1	1	0.20959
Inconsistency ratio = 0.02271					

DCO1 (Further development of the pre-tender feasibility study and preparation of a detailed technical and financial analysis early on in the design-construction phase with the contribution of the private sector stakeholders), which was the highest ranked factor in the *Design, Construction and Operation Processes* cluster with respect to its importance, was revealed to be greatly influenced by PS3 (Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model), followed by PS5 (Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) (Table 3.27). It is also strongly influenced by P2 (Preparation of a comprehensive and realistic feasibility study prior to tender) from the *Planning, Tender and Contracting Processes* cluster, according to the judgment of the experts (Table 3.28).

Table 3.27. *Project Stakeholders* influences on DCO1

DCO1	PS3	PS4	PS5	Weight
PS3	1	5	3	0.63699
PS4	1/5	1	1/3	0.10473
PS5	1/3	3	1	0.25829
Inconsistency ratio = 0.03703				

Table 3.28. *Planning, Tender and Contracting Processes* influences on DCO1

DCO1	P1	P2	Weight
P1	1	1/3	0.25000
P2	3	1	0.75000
Inconsistency ratio = 0.00000			

Among the factors with influences on DCO2 (With the contribution of the stakeholders early on in the design-construction phase, further development of the project specifications prepared by the public agency), PS3 (Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) obtained the highest weight of influence, followed by PS1 (Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) and PS2 (Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model) with equal weights (Table 3.29). PS4 (Contractor's consultants' experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model), PS5 (Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) and PS6 (Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) attained equal weights with respect to their influence on DCO2. In the *Planning, Tender and Contracting Processes* cluster, factors P3 (A well-designed, competitive and transparent tender process, clarity and adequacy of tender documents) and P4 (Comprehensive and clear final contract documentation prepared by the public agency and the contractor) were revealed to be equally influential on DCO2 (Table 3.30).

Table 3.29. *Project Stakeholders* influences on DCO2

DCO2	PS1	PS2	PS3	PS4	PS5	PS6	Weight
PS1	1	1	1/3	3	3	3	0.18609
PS2	1	1	1/3	3	3	3	0.18609
PS3	3	3	1	5	5	5	0.42310
PS4	1/3	1/3	1/5	1	1	1	0.06824
PS5	1/3	1/3	1/5	1	1	1	0.06824
PS6	1/3	1/3	1/5	1	1	1	0.06824
Inconsistency ratio = 0.00930							

Table 3.30. *Planning, Tender and Contracting Processes* influences on DCO2

DCO2	P3	P4	Weight
P3	1	1	0.50000
P4	1	1	0.50000
Inconsistency ratio = 0.00000			

As to the experts' judgment, the factor DCO3 (Providing the integration of design with the construction and operation phases, ensuring its flexibility and optimization) is highly influenced by PS3 (Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model), PS5 (Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) and PS6 (Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model), with equal weights (Table 3.31). They were followed by PS4 (Contractor's consultants' experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model) and PS7 (Subcontractors' experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model). The factor is also dependent to P1 (Clear definition of project scope and public authority's requirements prior to the tender process, proper integration of end users' needs, inputs of operational staff, healthcare experts and all other interest groups in this process) and P4 (Comprehensive and clear final contract documentation prepared by the public agency and the contractor), among which, P4 was evaluated to be more influential (Table 3.32). Within the *Project Management* cluster, the factors PM2 (Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders) and PM3 (Effective control and supervision by the public agency through the life cycle of the project and an efficient governmental approval process) attained equal weights with respect to their influence on DOC3 (Table 3.33).

Table 3.31. *Project Stakeholders* influences on DCO3

DCO3	PS3	PS4	PS5	PS6	PS7	Weight
PS3	1	2	1	1	4	0.26667
PS4	1/2	1	1/2	1/2	2	0.13333
PS5	1	2	1	1	4	0.26667
PS6	1	2	1	1	4	0.26667
PS7	1/4	1/2	1/4	1/4	1	0.06667
Inconsistency ratio = 0.00000						

Table 3.32. *Planning, Tender and Contracting Processes* influences on DCO3

DCO3	P1	P4	Weight
P1	1	1/2	0.33333
P4	2	1	0.66667
Inconsistency ratio = 0.00000			

Table 3.33. *Project Management* influences on DCO3

DCO3	PM2	PM3	Weight
PM2	1	1	0.50000
PM3	1	1	0.50000
Inconsistency ratio = 0.00000			

According to the judgment of the experts, DCO4 (Effective site management) is strongly influenced by PS3 (Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) (Table 3.34). The factor also has dependencies to the factors in the *Project Management* cluster, the strongest one being PM4 (Efficient monitoring, evaluation, reporting and control of project performance), followed by PM1 (Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases), PM5 (Establishment of an efficient system for controlling project changes and resolving disputes), PM6 (Effective implementation of risk management processes across all project phases) and PM2 (Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders), as to the descending order of influence (Table 3.35).

Table 3.34. *Project Stakeholders* influences on DCO4

DCO4	PS3	PS4	Weight
PS3	1	5	0.83333
PS4	1/5	1	0.16667
Inconsistency ratio = 0.00000			

Table 3.35. *Project Management* influences on DCO4

DCO4	PM1	PM2	PM4	PM5	PM6	Weight
PM1	1	2	1/2	1	2	0.21660
PM2	1/2	1	1/2	1/2	1/2	0.10830
PM4	2	2	1	2	2	0.32697
PM5	1	2	1/2	1	1	0.18465
PM6	1/2	2	1/2	1	1	0.16348
Inconsistency ratio = 0.02607						

Through the assessment of the influences on DCO5 (Establishment of an efficient quality, health, safety and environment management system for the construction and operation phases), PS3 (Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model), PS4 (Contractor's consultants' experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model) and PS5 (Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) were obtained with equal weights (Table 3.36). Among the two *Project Management* factors, PM6 (Effective implementation of risk management processes across all project phases) was evaluated to be more influential when compared to PM1 (Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases), on DCO5 (Table 3.37).

Table 3.36. *Project Stakeholders* influences on DCO5

DCO5	PS3	PS4	PS5	Weight
PS3	1	1	1	0.33333
PS4	1	1	1	0.33333
PS5	1	1	1	0.33333
Inconsistency ratio = 0.00000				

Table 3.37. *Project Management* influences on DCO5

DCO5	PM1	PM6	Weight
PM1	1	1/2	0.33333
PM6	2	1	0.66667
Inconsistency ratio = 0.00000			

The factor DCO6 (Taking the necessary measures to provide and maintain maximum performance throughout the operation phase) had interdependencies with the factors in the *Project Stakeholders*, *Planning, Tender and Contracting Processes* and *Project Management* clusters. Within the *Project Stakeholders* cluster, the most influential factors on DCO6 are PS1 (Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) and PS5 (Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) with equal weights, as to the judgment of the experts (Table 3.38). Within the *Planning, Tender and Contracting Processes* cluster, it was revealed that the factor with the highest influence on DCO6 is P1 (Clear definition of project scope and public authority's requirements prior to the tender process, proper integration of end users' needs, inputs of operational staff, healthcare experts and all other interest groups in this process) (Table 3.39), whereas within the *Project Management* cluster, the most influential factors are PM3 (Effective control and supervision by the public agency through the life cycle of the project and an efficient governmental approval process), PM1 (Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases), PM2 (Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders) and PM5 (Establishment of an efficient system for controlling project changes and resolving disputes), as to the descending order of influence, followed by PM4 (Efficient monitoring, evaluation, reporting and control of project performance) and PM6 (Effective implementation of risk management processes across all project phases) with equal weights (Table 3.40).

Table 3.38. *Project Stakeholders* influences on DCO6

DCO6	PS1	PS2	PS4	PS5	Weight
PS1	1	4	4	1	0.40000
PS2	1/4	1	1	1/4	0.10000
PS4	1/4	1	1	1/4	0.10000
PS5	1	4	4	1	0.40000
Inconsistency ratio = 0.00000					

Table 3.39. *Planning, Tender and Contracting Processes* influences on DCO6

DCO6	P1	P2	P4	Weight
P1	1	4	3	0.63371
P2	1/4	1	1	0.17437
P4	1/3	1	1	0.19192
Inconsistency ratio = 0.00885				

Table 3.40. *Project Management* influences on DCO6

DCO6	PM1	PM2	PM3	PM4	PM5	PM6	Weight
PM1	1	3	1/2	3	3	3	0.26924
PM2	1/3	1	1/2	3	1	3	0.15838
PM3	2	2	1	3	3	3	0.31197
PM4	1/3	1/3	1/3	1	1	1	0.08117
PM5	1/3	1	1/3	1	1	1	0.09807
PM6	1/3	1/3	1/3	1	1	1	0.08117
Inconsistency ratio = 0.03930							

Considering the influences on DCO7 (Ensuring the proper transfer of the facility to the public authority at the end of the contract phase), the factors PS1 (Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) and PS5 (Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) were obtained with a high influence weight, followed by PS3 (Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) (Table 3.41). P1 (Clear definition of project scope and public authority's requirements prior to the tender process, proper integration of end users' needs, inputs of operational staff, healthcare experts and all other interest groups in this process) and P4 (Comprehensive and clear final contract documentation prepared by the public agency and the contractor) were evaluated to be equally influential on DCO7, likewise PM1 (Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases) and PM5 (Establishment of an efficient system for controlling project changes and resolving disputes) (Tables 3.42 and 3.43).

Table 3.41. *Project Stakeholders* influences on DCO7

DCO7	PS1	PS2	PS3	PS4	PS5	Weight
PS1	1	4	4	4	1	0.35722
PS2	1/4	1	1/3	1	1/4	0.07086
PS3	1/4	3	1	3	1/4	0.14384
PS4	1/4	1	1/3	1	1/4	0.07086
PS5	1	4	4	4	1	0.35722
Inconsistency ratio = 0.04407						

Table 3.42. *Planning, Tender and Contracting Processes* influences on DCO7

DCO7	P1	P4	Weight
P1	1	1	0.50000
P4	1	1	0.50000
Inconsistency ratio = 0.00000			

Table 3.43. *Project Management* influences on DCO7

DCO7	PM1	PM5	Weight
PM1	1	1	0.50000
PM5	1	1	0.50000
Inconsistency ratio = 0.00000			

3.4.4.3 Pairwise Comparisons for the Relative Importance of the Clusters

The third step was to pairwise-compare the relative importance of the clusters, with respect to PPP healthcare project success. The question posed was: "Which cluster is more important for PPP healthcare project success and how much more important?". The obtained pairwise comparison matrix is shown in Table 3.44.

As to the expert team's judgment, it was revealed that the clusters with the utmost importance for project success are *Financial Characteristics* and *Project Stakeholders* with equal weights of 0.26. Following them comes the *Planning, Tender and Contracting Processes* cluster, with a weight of 0.17. The *Project*

Management and *Design, Construction and Operation Processes* clusters were obtained with equal weights of 0.12, whereas the cluster that was attached the least importance is the *External Environment* cluster, with a weight of 0.07.

Table 3.44. Judgment for the importance of the clusters

Project Success	EE	FC	PS	P	PM	DCO	Weight
EE	1	1/3	1/3	1/2	1/2	1/2	0.07410
FC	3	1	1	2	2	2	0.25622
PS	3	1	1	2	2	2	0.25622
P	2	1/2	1/2	1	2	2	0.17355
PM	2	1/2	1/2	1/2	1	1	0.11995
DCO	2	1/2	1/2	1/2	1	1	0.11995
Inconsistency ratio = 0.01519							

3.4.4.4 Pairwise Comparisons for the Interdependencies Between the Clusters

The fourth step was to examine the interdependencies between the clusters. The question posed was: "Considering PPP healthcare project success, given a cluster, which of the two clusters influences it more, and how much more?". The answers obtained are presented herein.

As to the results, the *Financial Characteristics* cluster is highly influenced by the *External Environment* cluster and by the *Financial Characteristics* cluster itself, with an equal weight of 0.39 (Table 3.45). Then comes the *Project Stakeholders* cluster, with a 0.14 weight, followed by the *Planning, Tender and Contracting Processes* cluster with a weight of 0.09.

Table 3.45. Influences on the *Financial Characteristics* cluster

Financial Characteristics	EE	FC	PS	P	Weight
EE	1	1	3	4	0.38493
FC	1	1	3	4	0.38493
PS	1/3	1/3	1	2	0.14279
P	1/4	1/4	1/2	1	0.08735
Inconsistency ratio = 0.00772					

The *Project Management* cluster is interrelated with the *Project Stakeholders* and *Planning, Tender and Contracting Processes* clusters, amongst which, the former has an influence weight of 0.80 and the latter has an influence weight of 0.20 on the relevant cluster, according to the experts' judgment (Table 3.46).

Table 3.46. Influences on the *Project Management* cluster

Project Management	PS	P	Weight
PS	1	4	0.80000
P	1/4	1	0.20000
Inconsistency ratio = 0.00000			

The *Design, Construction and Operation Processes* cluster was judged to be influenced by the *Project Stakeholders* cluster with a weight of 0.50, whereas by the *Planning, Tender and Contracting Processes* and *Project Management* clusters with an equal weight of 0.25 (Table 3.47).

Table 3.47. Influences on the *Design, Construction and Operation Processes* Cluster

Design, Construction and Operation Processes	PS	P	PM	Weight
PS	1	2	2	0.50000
P	1/2	1	1	0.25000
PM	1/2	1	1	0.25000
Inconsistency ratio = 0.00000				

3.4.4.5 Synthesizing the Results and Obtaining the Relative Importance Weights of the Factors

Subsequent to the completion of the pairwise comparisons for the whole network, construction of a synthesized supermatrix was required for the resolution of the effects of the interdependencies that exist among the clusters and among the nodes of the ANP model. Accordingly, the unweighted supermatrix, weighted supermatrix and limit supermatrix were formed by the use of the software and the importance weight of each element was computed. The limit supermatrix, which reveals the importance weights of the model parameters, is presented in Appendix F.

Table 3.48 shows the importance weights of the factors in the model in two ways: the local importance weight and the global importance weight. The local importance weight is the weight of a factor in the cluster it belongs to. The sum of the priority values of all the factors in a cluster is 1.00. The global importance weight is the weight of the factor in the entire model. The factor importance weights in the model also sum to unity.

Table 3.48. Summary of the priorities in the model

Cluster	Factor	Local Importance Weight (Within Cluster)	Global Importance Weight (Entire Model)	Rank
External Environment	E1	0.37449	0.04478	7
	E2	0.37048	0.04430	8
	E3	0.23526	0.02813	12
	E4	0.01978	0.00237	33
Financial Characteristics	F1	0.16505	0.03300	11
	F2	0.30952	0.06189	4
	F3	0.52543	0.10506	2
Project Stakeholders	PS1	0.25611	0.09757	3
	PS2	0.09963	0.03795	10
	PS3	0.35124	0.13380	1
	PS4	0.06809	0.02594	14
	PS5	0.12649	0.04819	6
	PS6	0.07057	0.02689	13
	PS7	0.01681	0.00640	28
	PS8	0.01107	0.00422	30
Planning, Tender and Contracting Processes	P1	0.28805	0.03987	9
	P2	0.14442	0.01999	16
	P3	0.14652	0.02028	15
	P4	0.42101	0.05827	5
Project Management	PM1	0.19919	0.01722	20
	PM2	0.20370	0.01761	18
	PM3	0.10772	0.00931	26
	PM4	0.13436	0.01161	23
	PM5	0.23022	0.01990	17
	PM6	0.09340	0.00807	27
	PM7	0.03141	0.00272	32
Design, Construction and Operation Processes	DCO1	0.23332	0.01742	19
	DCO2	0.20211	0.01509	21
	DCO3	0.20211	0.01509	22
	DCO4	0.13398	0.01001	24
	DCO5	0.06085	0.00454	29
	DCO6	0.12867	0.00961	25
	DCO7	0.03897	0.00291	31

All of the factors are presented in rank order with respect to their revealed importance weights in Table 3.49. As to the obtained results, the factor with the highest importance weight in the model is PS3 (Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model), with a value of 0.134. This can be attributed to the assignment of a high factor rating within its cluster, as well as the magnitude of its interdependencies with the other factors, since PS3 strongly influences a great number of factors within the network. It was revealed that F3 (Inclusion of investors and sponsors with sufficient financial strength in the project) and PS1 (Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model) also contribute significantly to project success. It can be said that these three factors constitute the backbone of a successful project, together with F2 (Provision of adequate government guarantees) and P4 (Comprehensive and clear final contract documentation prepared by the public agency and the contractor) in the fourth and fifth ranks.

According to the results, the factors that were attached the least importance are E4 (Convenient location, favorable weather and site conditions), PM7 (Establishment of a proper documentation system for the project and storage of lessons learned through an accessible PPP projects database), DCO7 (Ensuring the proper transfer of the facility to the public authority at the end of the contract phase) and PS8 (Suppliers' experience, competence, commercial strength and long-term accessibility), in the descending order. These were the expected factors to be revealed as less influential on project success when compared to the others, in accordance with the experts' comments obtained in the session.

Subsequent to the completion of the analysis, the factors were ranked with respect to their importance weights revealed through the ANP model and presented to the experts during the session to have their comments on the results. The ranking of the factors was considered reasonable by the experts, and it was mentioned that having the *Project Stakeholders*, *Financial Characteristics*, *Planning, Tender and Contracting Processes* and *External Environment* factors in the upper ranks is sensible, since these clusters mostly involve the predominant factors for the project, influencing the other clusters.

Table 3.49. Factors ranked with respect to their global priority values

Rank	ID	Factor	Weight
1	PS3	Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	0.134
2	F3	Inclusion of investors and sponsors with sufficient financial strength in the project	0.105
3	PS1	Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	0.098
4	F2	Provision of adequate government guarantees	0.062
5	P4	Comprehensive and clear final contract documentation prepared by the public agency and the contractor	0.058
6	PS5	Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	0.048
7	E1	A stable political environment and strong government support	0.045
8	E2	Favorable global economic conditions and exchange rates, a strong and stable economic environment in the host country	0.044
9	P1	Clear definition of project scope and public authority's requirements prior to the tender process, proper integration of end users' needs, inputs of operational staff, healthcare experts and all other interest groups in this process	0.040
10	PS2	Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	0.038
11	F1	Favorable financing interest rates and financing costs, the strength and profitability of the project	0.033
12	E3	A transparent and mature legal and regulatory framework	0.028
13	PS6	Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	0.027
14	PS4	Contractor's consultants' (*e.g.* traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	0.026
15	P3	A well-designed, competitive and transparent tender process, clarity and adequacy of tender documents	0.020
16	P2	Preparation of a comprehensive and realistic feasibility study prior to tender	0.020
17	PM5	Establishment of an efficient system for controlling project changes and resolving disputes	0.020
18	PM2	Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders	0.018
19	DCO1	Further development of the pre-tender feasibility study and preparation of a detailed technical and financial analysis early on in the design-construction phase with the contribution of the private sector stakeholders	0.017
20	PM1	Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases	0.017
21	DCO2	With the contribution of the stakeholders early on in the design-construction phase, further development of the project specifications prepared by the public agency	0.015
22	DCO3	Providing the integration of design with the construction and operation phases, ensuring its flexibility and optimization	0.015
23	PM4	Efficient monitoring, evaluation, reporting and control of project performance	0.012
24	DCO4	Effective site management	0.010
25	DCO6	Taking the necessary measures to provide and maintain maximum performance throughout the operation phase	0.010
26	PM3	Effective control and supervision by the public agency through the life cycle of the project and an efficient governmental approval process	0.009
27	PM6	Effective implementation of risk management processes across all project phases	0.008
28	PS7	Subcontractors' (*e.g.* electrical, mechanical) experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	0.006
29	DCO5	Establishment of an efficient quality, health, safety and environment management system for the construction and operation phases	0.005
30	PS8	Suppliers' experience, competence, commercial strength and long-term accessibility	0.004
31	DCO7	Ensuring the proper transfer of the facility to the public authority at the end of the contract phase	0.003
32	PM7	Establishment of a proper documentation system for the project and storage of lessons learned through an accessible PPP projects database	0.003
33	E4	Convenient location, favorable weather and site conditions	0.002

3.5 Model Testing with Two Real Projects

Subsequent to the development of the ANP model, the expert team was asked to test the model on two real PPP healthcare projects that they had been involved in. In Table 3.50, general information is given about the two projects assessed by the experts. Both projects were in the operation phase, reached to construction completion in 2016 and 2017, respectively. It was asked from the experts to assign a rating to each of the 33 factors using the 1-5 point Likert scale, considering the extent to which these factors were realized in their project (1: Very low, 2: Low, 3: Medium, 4: High, 5: Very high). Once again, the rating process was carried out through consensus decision making among the experts. The expert team’s evaluations and the revealed results are presented in Table 3.51. The weighted ratings for the factors were calculated by multiplying the factor importance weights revealed through the analysis with the ratings provided by the experts and the project success rating was obtained by summing them up for each project. Accordingly, a project success rating of 3.21 was attained for Project 1 and 3.47 was attained for Project 2, both corresponding to the medium-to-high level. The outcome was regarded as expectable by the experts, since Project 1 was the very first experience of the company with PPP healthcare projects. As mentioned by the expert group, although it was a project of a smaller scale and relatively easy to manage when compared to Project 2, the company had been unfamiliar with the project structure, with the included stakeholders, with the inherent bureaucracy and so forth, during the course of Project 1. Despite the fact that Project 2 was denoted to be a more complex one with a much larger project area, the experts considered some of the inherent processes of the organization to be relatively more mature during the course of Project 2, thanks to the experience gained. But still, the expert team pointed out that they had a way to go, therefore interpreted the rating of 3.47 as reasonable.

Table 3.50. General information for the two test cases

	Project 1	Project 2
Project Size (m^2)	142,000.00	540,000.00
Current Project Phase	Operation	Operation
Project Start Date	2014	2015
Construction Finish Date	2016	2017

Table 3.51. Obtained and processed data regarding the two test cases

Factor ID	Importance Weight	Project 1		Project 2	
		Rating	Weighted Rating	Rating	Weighted Rating
E1	0.045	5	0.225	5	0.225
E2	0.044	4	0.176	4	0.176
E3	0.028	1	0.028	2	0.056
E4	0.002	2	0.004	1	0.002
F1	0.033	4	0.132	4	0.132
F2	0.062	5	0.310	5	0.310
F3	0.105	5	0.525	5	0.525
PS1	0.098	1	0.098	2	0.196
PS2	0.038	1	0.038	1	0.038
PS3	0.134	3	0.402	4	0.536
PS4	0.026	4	0.104	4	0.104
PS5	0.048	3	0.144	3	0.144
PS6	0.027	4	0.108	3	0.081
PS7	0.006	3	0.018	3	0.018
PS8	0.004	4	0.016	3	0.012
P1	0.040	1	0.040	1	0.040
P2	0.020	2	0.040	2	0.040
P3	0.020	1	0.020	1	0.020
P4	0.058	4	0.232	4	0.232
PM1	0.017	4	0.068	3	0.051
PM2	0.018	3	0.054	4	0.072
PM3	0.009	2	0.018	2	0.018
PM4	0.012	5	0.060	4	0.048
PM5	0.020	2	0.040	3	0.060
PM6	0.008	3	0.024	3	0.024
PM7	0.003	2	0.006	3	0.009
DCO1	0.017	4	0.068	4	0.068
DCO2	0.015	4	0.060	4	0.060
DCO3	0.015	3	0.045	4	0.060
DCO4	0.010	5	0.050	5	0.050
DCO5	0.005	4	0.020	3	0.015
DCO6	0.010	3	0.030	4	0.040
DCO7	0.003	3	0.009	4	0.012
Success Rating of the Project		3.21 / 5.00 (Medium-to-high)		3.47 / 5.00 (Medium-to-high)	

To provide the experts with a more detailed output of the assessment, factors were ranked with respect to their deficient weighted rating points. To calculate a factor's deficient rating point, the weighted rating of a factor was subtracted from the highest possible weighted rating for the factor, which is a product of the factor's importance weight and the highest possible rating (*i.e.* 5.00). The ranked list, which highlighted the most critical factors for the improvement of the project's performance, was presented to the experts during the session. It was observed that most of the high-ranked factors were common for the two projects; although there were minor differences between the order of the factors. Most of those critical factors pertain to the *Project Stakeholders*, *Planning, Tender and Contracting Processes* and *External Environment* clusters. On the other hand, PM2 (Effective control and supervision of the public agency through all project phases) and DCO3 (Providing the integration of design with the construction and operation phases, ensuring its flexibility and optimization) were revealed to be critical for Project 1, whereas PS6 (Sufficient knowledge of consortium members on healthcare projects and BLT model) and PM1 (An efficient system for controlling changes and resolving disputes) were distinctive for Project 2. It was stated by the experts that the model gives consistent results with their evaluations and the findings for the two projects were regarded as reasonable.

3.6 Discussion of the Results Revealed Through the Session

According to the results of the analysis, 16 factors with the highest importance weights in the model belong to the *Project Stakeholders*, *Financial Characteristics*, *Planning, Tender and Contracting Processes* and *External Environment* clusters. No factor of *Project Management* and *Design, Construction and Operation Processes* took part among the highest-ranked factors, which is also consistent with the experts' judgment for the importance of the clusters. This was an expected finding, since the factors in the *Project Management* and *Design, Construction and Operation Processes* clusters can be regarded as factors mainly under the control of a single party. Therefore, the factors within these clusters were deemed to be more manageable compared to the factors in the other four clusters by the experts. This approach explains the results revealed by the ANP, which is also consistent with the density of the interrelationships among the factors. The factors with significant influence on several other factors attained high importance weights in the model. The results also indicate the high importance attached to the project preparation phase and stakeholder assemble for project success, together with the planning efforts.

Through the testing of the model with two real PPP healthcare projects, the success ratings revealed for the cases were regarded as reasonable by the experts. Also, the determined critical factors for the improvement of the project success rating were consistent with the evaluations made by the experts. As the analysis results suggest, the experience and competencies of the major stakeholders, strong project sponsors, public agency's contribution and support throughout the project, controlling major financial risks, sophistication of project requirements and scope, and elaboration and inclusiveness of the final contract are the most important determinants of PPP healthcare project success. Nevertheless, it should be noted that the 33 factors included in the framework were filtered from an exhaustive list of success factors, in accordance with expert opinion. To attain a complete project performance outcome, all of the factors involved in the model are needed to be combined, without ignoring any of them.

CHAPTER 4

DEVELOPMENT OF THE DECISION SUPPORT SYSTEM

In this chapter, the development of the PPP Healthcare Decision Support System is elucidated, which was proposed based on the project success model presented in the previous chapter. Subsequent to the definition of the scope and capabilities of the system, its structure was explained by elaborating on its main components and functions.

4.1 Scope and Capabilities of the System

Development of a decision support system to assist the private sector construction companies in the pre-tender, tender and execution phases of the PPP healthcare projects was set as a major aim for this study, besides the other objectives identified. The system was designed with the intention to assess the performance of a PPP healthcare project, visualize project success by virtue of the previously revealed links between the success factors and provide guidance for project performance improvement. It was developed based on the PPP Healthcare Project Success Model constructed in the prior stage of the study and elaborated with the performance improvement strategies extracted through the conducted literature review. It was aimed that the project executives draw advantage from the prediction and assessment capability of the tool to provide a snapshot of their project's performance via the key determinants of project success. To exploit its full potential, the proposed tool is suggested to be used as from the preliminary stages of a project. It can also provide a basic idea for the organizations in taking the decision to/not to undertake a project, even though that was not the main driving force behind its development. Using the tool prior to the bid stage of a PPP healthcare project, a construction company may have the chance to assess the success potential of the project; gain insight about the key project components; and determine the strengths and weaknesses with respect to the project characteristics, project stakeholders, project management and implementation capabilities. By choosing among the performance improvement strategies embedded in the tool or by defining project-specific ones, the user can create alternative project scenarios and build a roadmap for the effective management of the project throughout its life cycle. Utilization of the tool through the different stages of a project may contribute to continuous monitoring and control of project performance and may also promote organizational learning and continuous improvement of the company's processes.

Capabilities of the developed decision support system can be listed as follows:

- Assessment of project performance on the basis of the pre-determined success factors,
- Designation of the importance weights for the factors, which were identified in the former stage of the research through the evaluation of a group of experts with considerable experience in PPP healthcare projects,
- Revealing a prediction for the project performance rating out of 5.00,
- Setting forth the strengths and weaknesses of the project,
- Visualizing the interrelationships between the factors through the developed dependence diagrams,
- Proposing strategies for the improvement of project performance with regards to the relevant factors and enabling the insertion of user-defined strategies,
- Facilitating the selection of strategies to be implemented and the generation of alternative scenarios for the project,
- Comparing the performance ratings of the baseline assessment and the generated project scenarios,
- Storing the data of previous project assessments and by this means, contributing to organizational learning.

4.2 Structure of the System

The PPP Healthcare Decision Support System was developed with ASP.NET, which is an open source web application framework designed by Microsoft. The web-based application uses Microsoft SQL Server for data storage. The classes of the system, their attributes, operations and the relationships among the classes are shown with a Unified Modeling Language (UML) class diagram in Figure 4.1.

The explanations given in this chapter are depicted with snapshots from the developed decision support system, using one of the project assessments provided in the testing sessions of the tool, *i.e.* Project 1, as an example. Some of the basic figures are given within the main body of the text, whereas the vast majority are presented in Appendix G, to provide integrity.

The tool comprises three tabs in the main menu, namely, **File**, **Review** and **Help**. Both English and Turkish language options are provided in the tool to facilitate easy and proper comprehension for the project executives. Information indicators are inserted in various screens of the system to provide key information and assist the user in proceeding through the application. In the home pages, general information about the objectives, contents and capabilities of the tool are provided, together with the categorization of the project performance rating values and their corresponding expressions. The initial home page of the application is presented in Figure 4.2. Steps explaining how to carry out a project assessment are also included within the home pages (Figure 4.3).

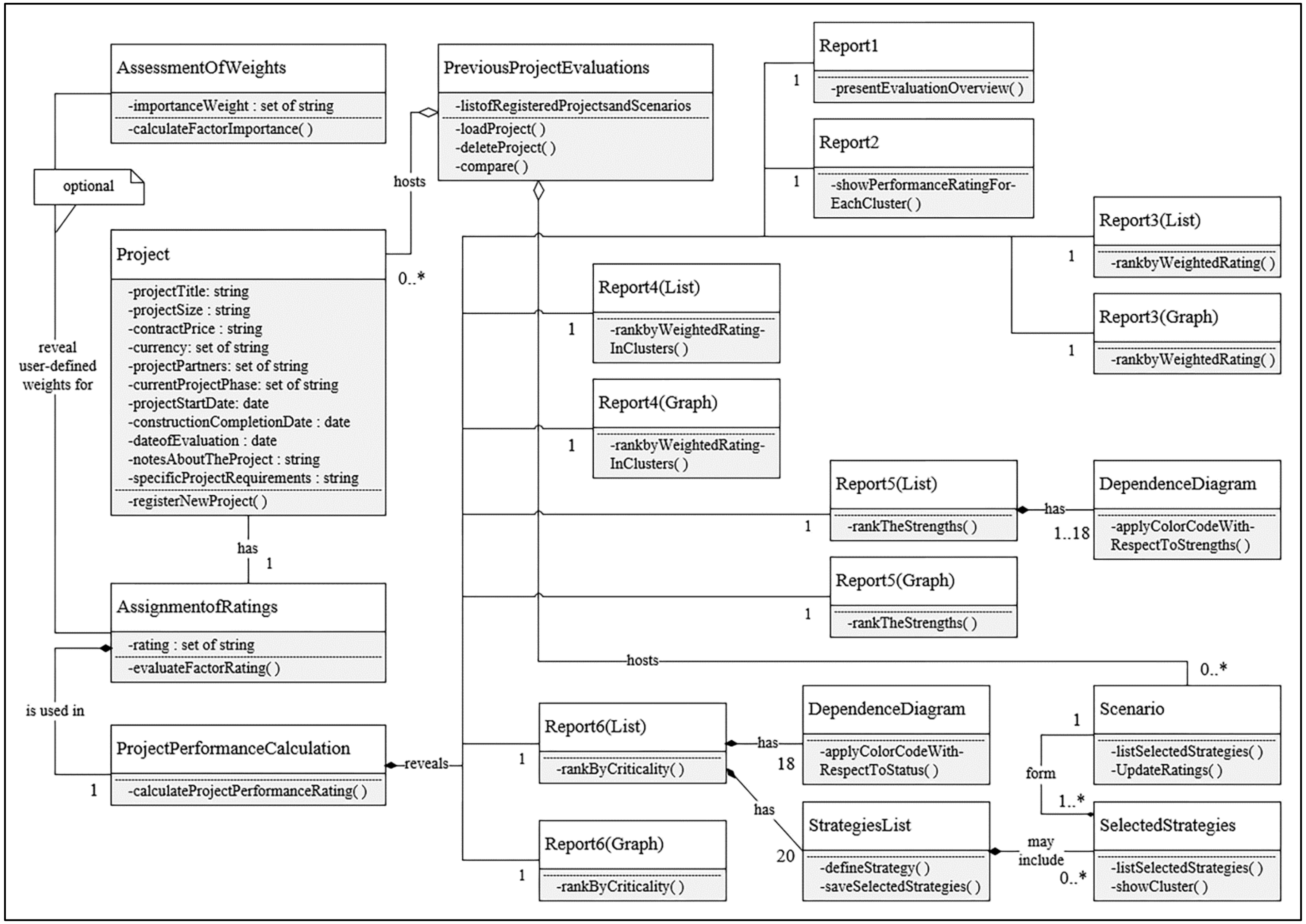


Figure 4.1. Overview of the decision support system

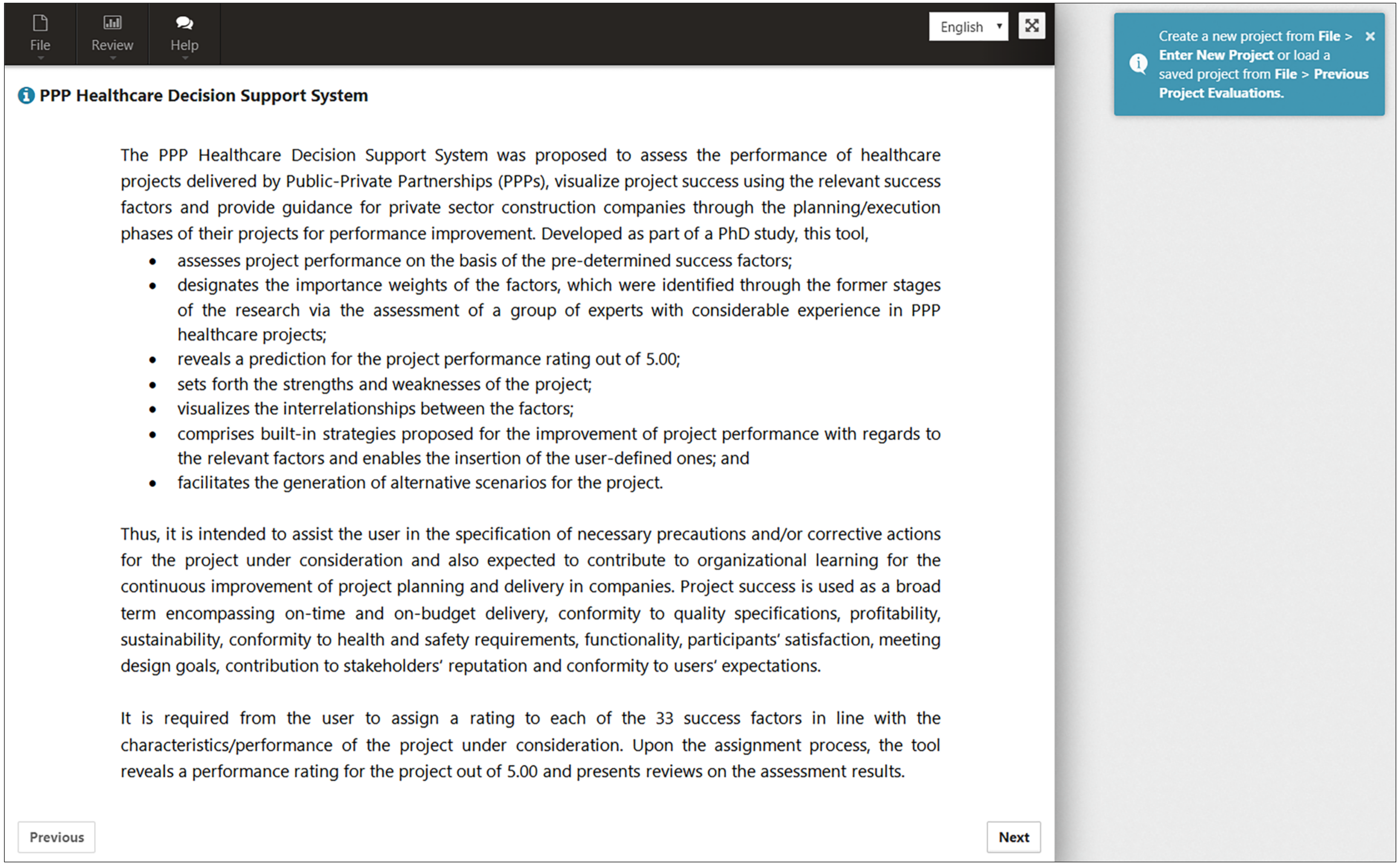


Figure 4.2. The initial home page of the application (Page 1 out of 3)

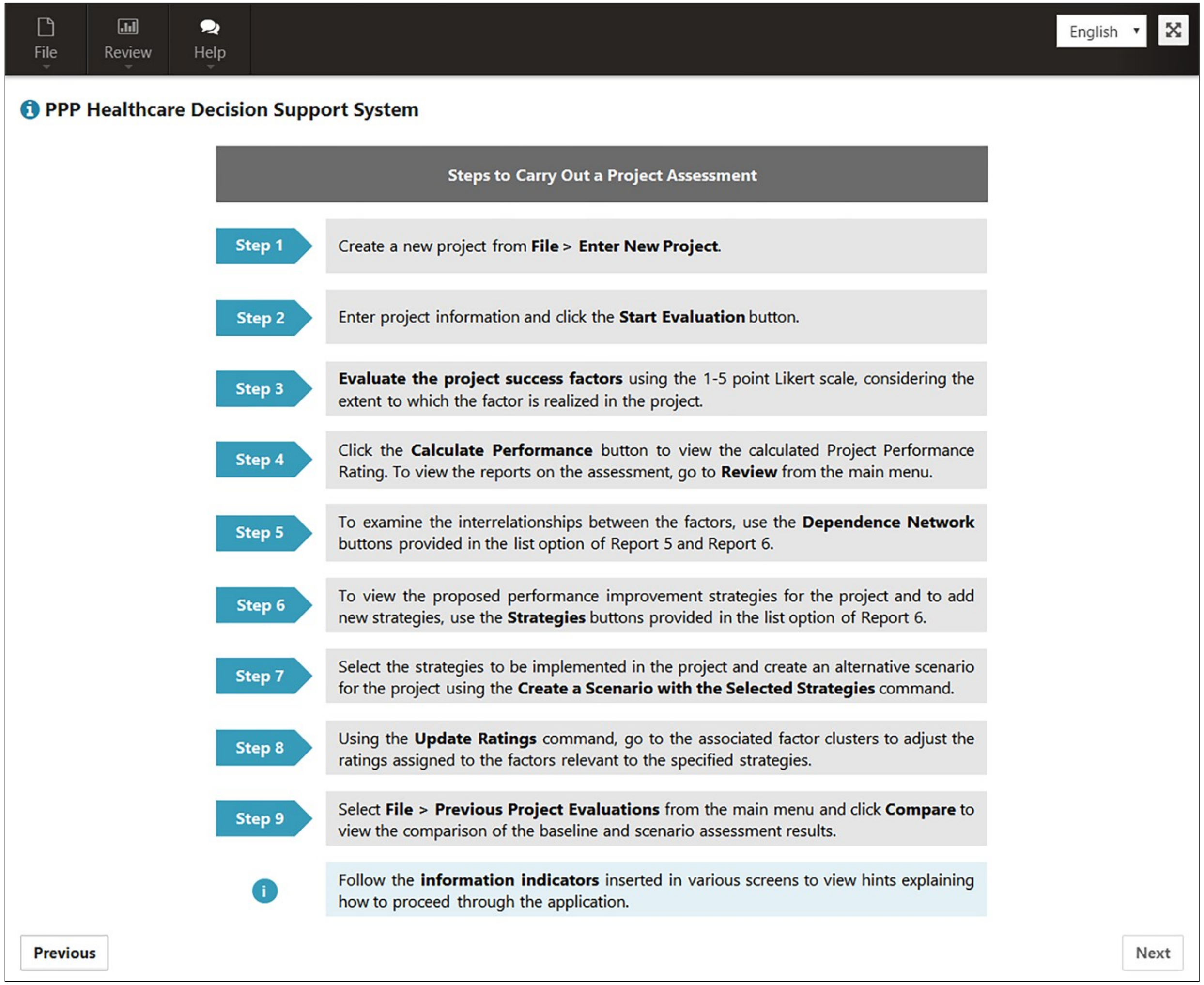


Figure 4.3. Steps of carrying out an assessment, as shown in the home page (Page 3 out of 3)

Under the **File** tab, there are three options: **Enter New Project**, **Previous Project Evaluations** and **Assessment with User-Defined Weights** (Figure 4.4). Under the **Review** tab, six different reports are presented with respect to the completed project assessment (Figure 4.5).

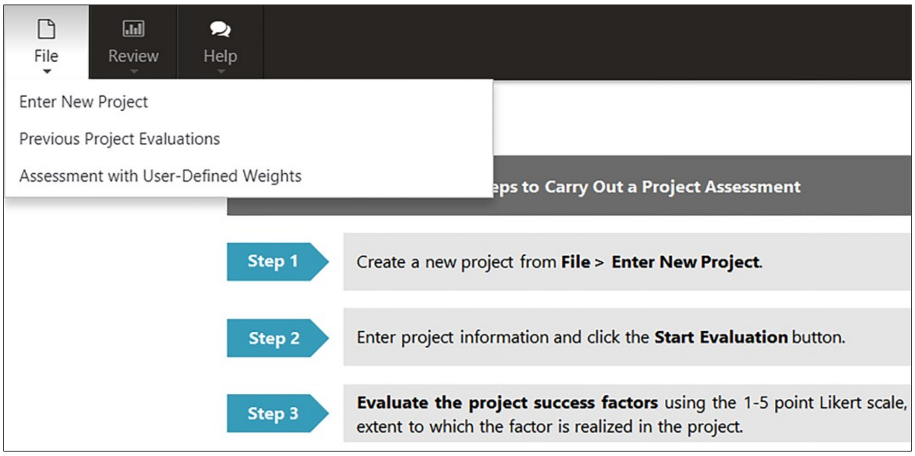


Figure 4.4. The commands under the **File** tab in the main menu

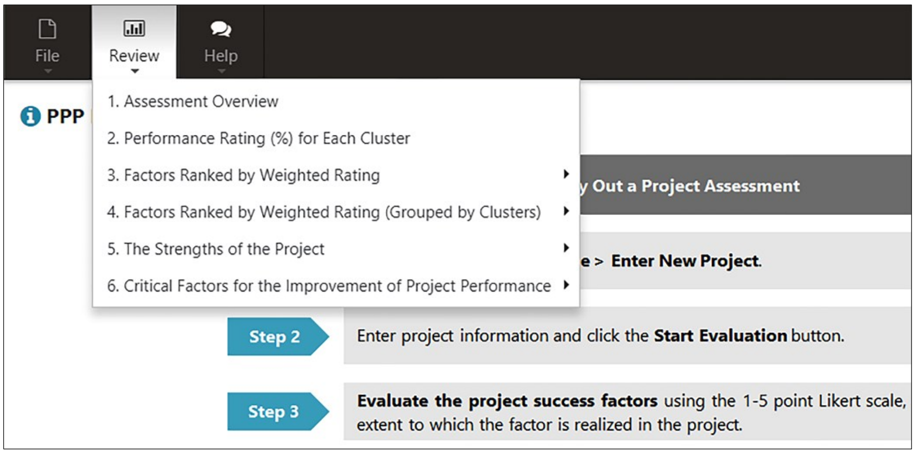


Figure 4.5. The commands under the **Review** tab in the main menu

Under the **Help** tab, three documents are provided, namely, Model Structure and Development, List of Success Factors, and Instructions to Use the Application. The structure of the model and development phases of the tool are explained in **Model Structure and Development** (Figure G.1). A list of the success factors including detailed factor descriptions is given in **List of Success Factors** (Figure G.2). Detailed guidance on how to use the tool and the related information are presented in **Instructions to Use the Application** (Figure G.3).

4.2.1 Registration of a Project

Registration of a new project is conducted via the **Enter New Project** command available under the **File** tab of the tool. Following this command, a project registration screen appears (Figure 4.6). The registration information includes the Project Title, Project Size, Contract Price, Currency (TL or USD), Project Partners, Current Project Phase (Preparation, Tender, Design, Construction, Operation), Project Start Date (Anticipated/Actual) and Construction Completion Date (Anticipated/Actual), amongst which, only the project title is compulsory to continue with the assessment. Date of evaluation is automatically assigned by the tool. **Notes about the Project** section is included to make a record of the general information about the project, such as the facilities included, number of total units provided, the number of hospital beds and other details related to the project program. **Specific Project Requirements** section is provided to capture information such as the targeted/acquired project certifications, and innovative technological equipment or implementations applicable to the project. Upon the registration of project information, the **Start Evaluation** button enables the project to be automatically saved with the project title provided, together with the **Baseline** label.

4.2.2 Carrying Out the Project Performance Assessment

In the subsequent step, the basic diagram of the PPP Healthcare Project Success Model appears on the screen to facilitate the project performance evaluation process (Figure 4.7). As the user clicks each factor cluster, a pop-up window is displayed. In

Figure 4.8, an example evaluation screen for the *Planning, Tender and Contracting Processes* cluster is shown. Following the sequential order of the clusters, the factors included in each cluster are evaluated by the user, considering the extent to which the factor is realized in the project. The evaluation is made by assigning a rating to each factor, using the 1-5 point scale (1: Very low, 2: Low, 3: Medium, 4: High, 5: Very high). The factor descriptions are displayed as a tooltip when the cursor is pointed on the information icons provided (Figure G.4). The importance weights of the factors are predefined in the system, which were obtained in the previous phase of the research. By multiplying the factor importance weight and the assigned rating by the user, the tool calculates the weighted rating for each factor. Evaluation screen for the *Project Management* cluster is given as another example in Figure G.5.

A bar showing the completed steps of the assessment is provided to facilitate the progress. When the evaluations are completed for all clusters, the **Calculate Performance** button allows the user to view the performance rating of the project out of 5.00 and its corresponding expression (Figure 4.9). The tool adds up the weighted ratings of all of the 33 factors for the calculation of the project performance rating. The performance rating values were categorized as shown in Table 4.1.

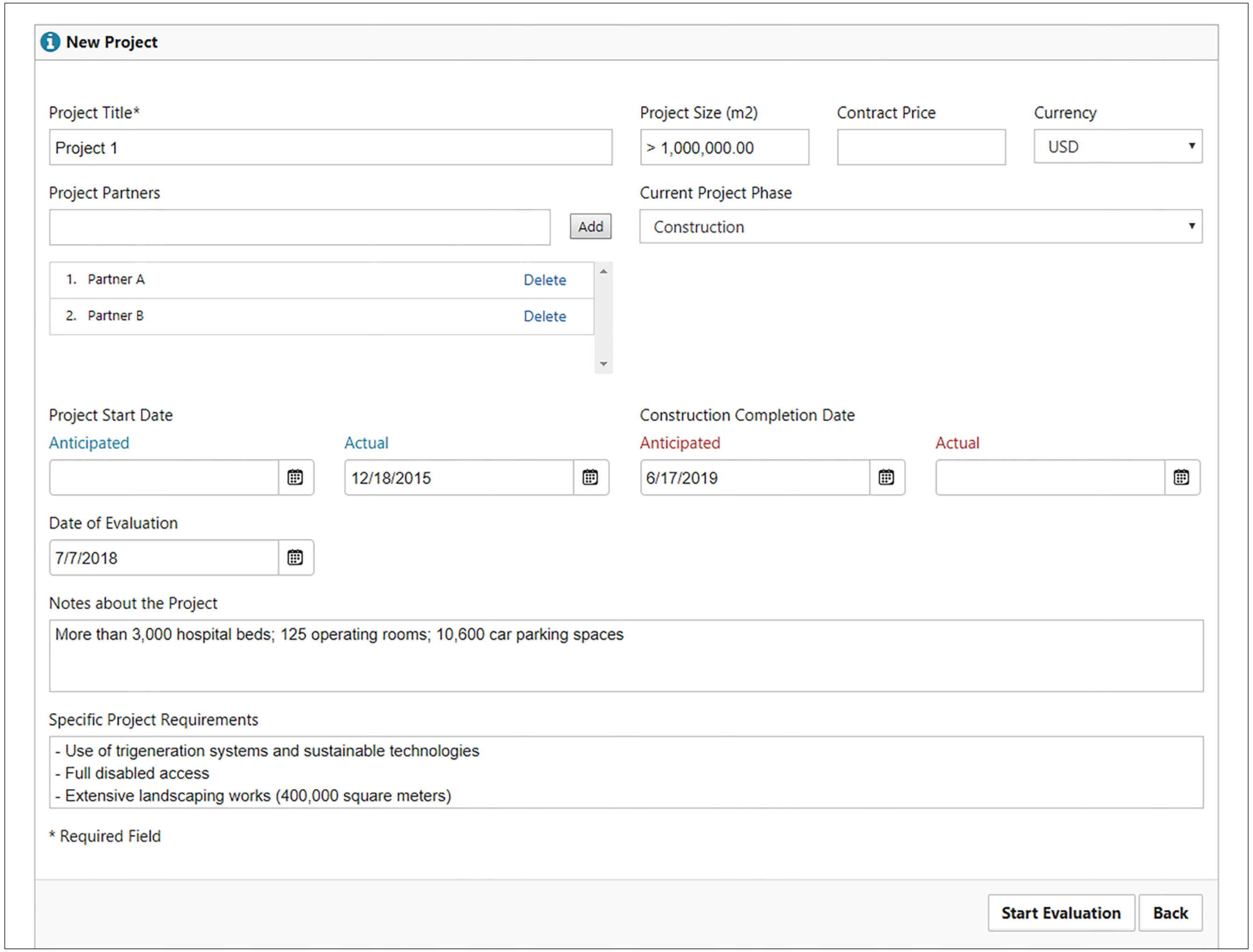


Figure 4.6. A screenshot of the project registration screen

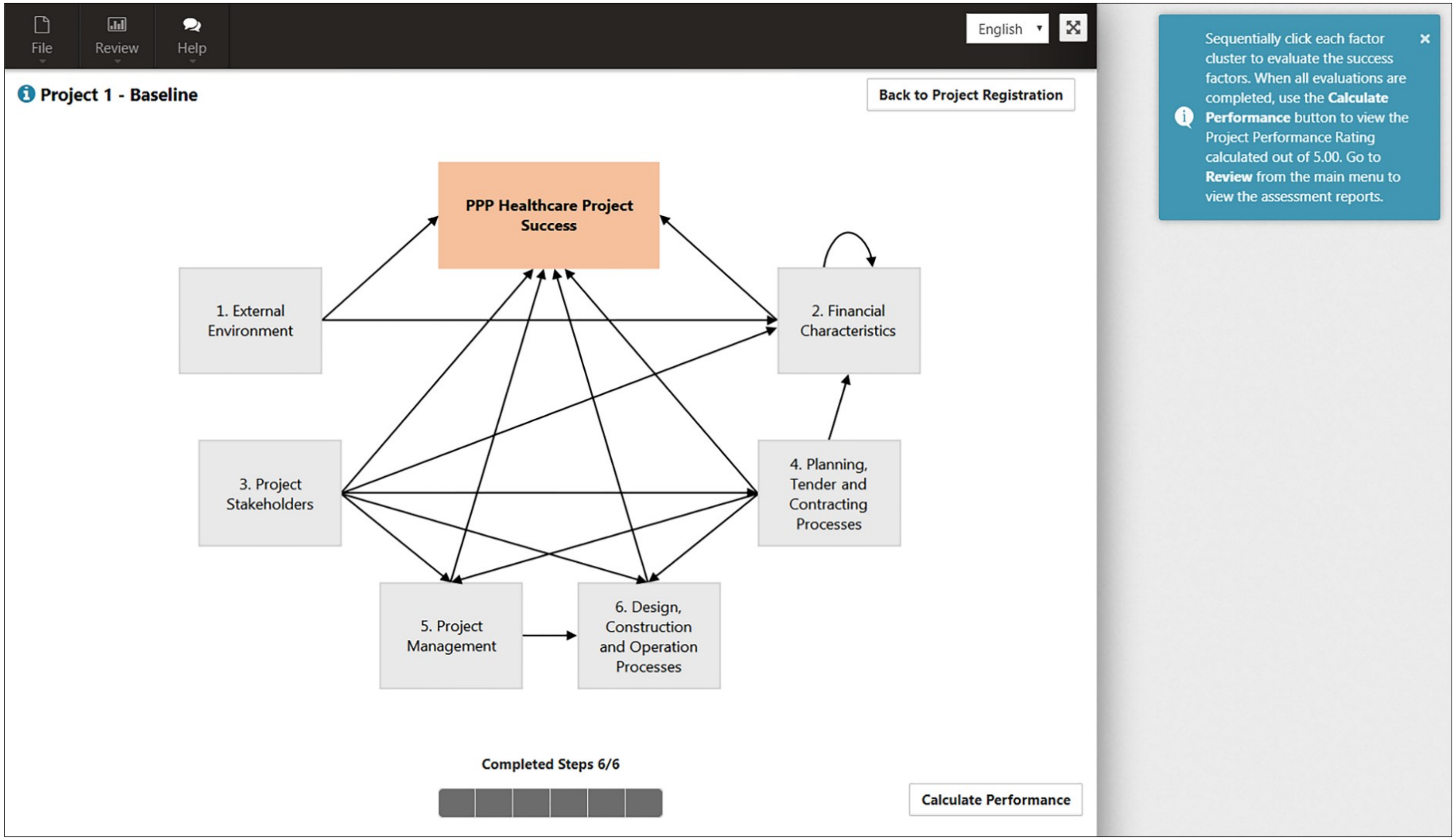


Figure 4.7. The main diagram of the performance assessment process

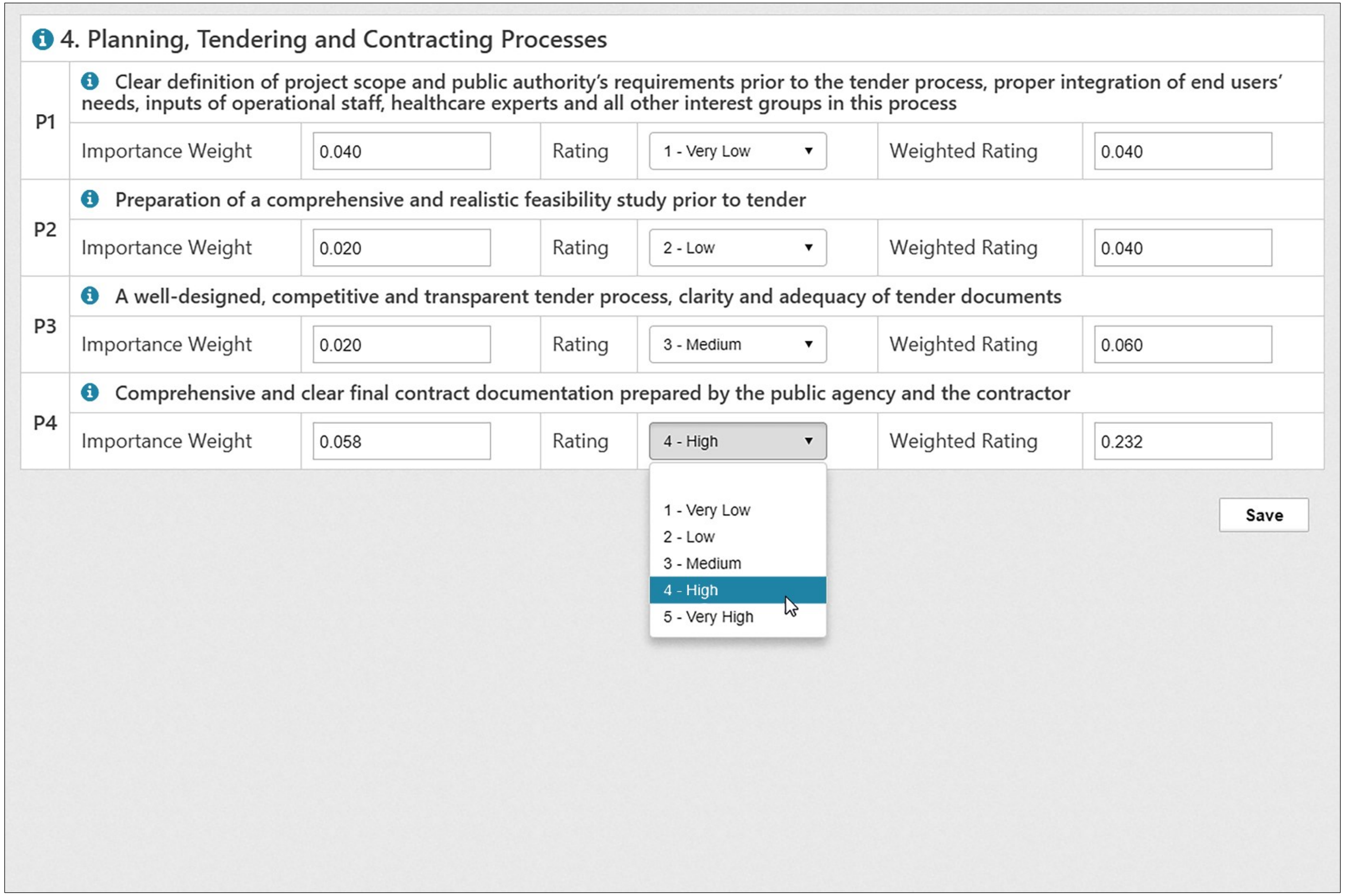


Figure 4.8. Demonstration of the rating assignment in the evaluation screen

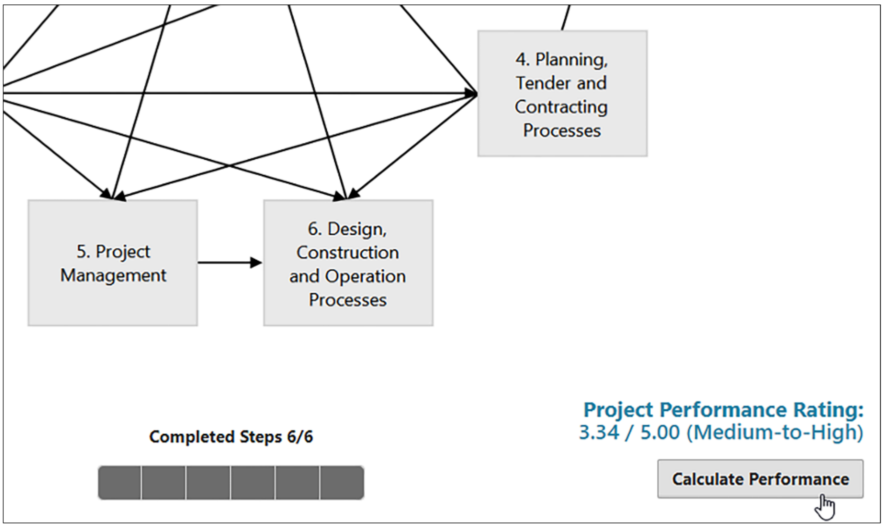


Figure 4.9. Displaying the performance rating of the project

Table 4.1. Categorization for the project performance rating values

Project Performance Rating	**Linguistic Terms for the Rating Values and Ranges**
1	Very Low
1-2	Very Low-to-Low
2	Low
2-3	Low-to-Medium
3	Medium
3-4	Medium-to-High
4	High
4-5	High-to-Very High
5	Very High

4.2.3 Reviewing the Assessment Reports

The **Review** component is comprised of six different reports, aimed for the detailed examination of the assessment results and provision of guidance for performance improvement. The contents of each report are explained in this sub-section.

4.2.3.1 Report 1: Assessment Overview

In Report 1, an overview of the assessment is presented with the utilization of a color code. In categorizing the importance weight values, a three-point scale is used (*i.e.* Low, Medium and High) and the value ranges are defined accordingly (Table 4.2). The categorization of the performance rating values is aligned with the 1-5 point scale used for the assignment of factor ratings. A demonstration of Report 1 is given in Figure G.6.

Table 4.2. Importance weight categorization used in Report 1

Value Range for the Importance Weight (w)	Definition
$w < 0.01$	Low
$0.01 \leq w \leq 0.03$	Medium
$0.03 < w$	High

4.2.3.2 Report 2: Performance Rating (%) for Each Cluster

In Report 2, the performance rating percentages for six different clusters are shown with a bar chart. It is solely based on the factor ratings assigned by the user. A demonstration of Report 2 is presented in Figure G.7.

4.2.3.3 Report 3: Factors Ranked by Weighted Rating

In Report 3, the factors are ranked with respect to their weighted rating, which is a product of their importance weight and factor rating. The weighted rating is given in percentages, to show the percent contribution of the factor to project performance. The report has two options, *i.e.* **List** and **Graph**, which can be selected from the main menu (Figure 4.10).

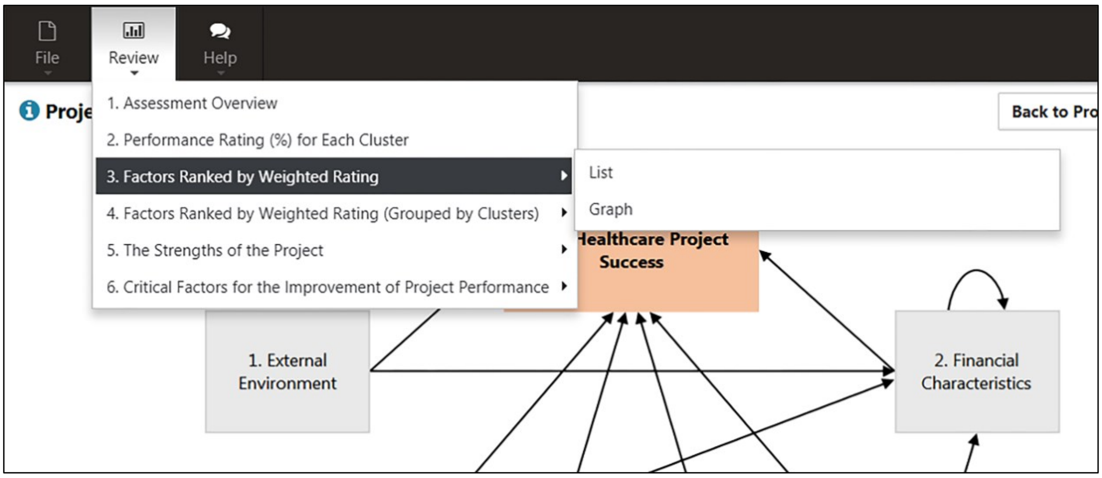


Figure 4.10. List and graph options provided in the main menu for Reports 3-6

In the list option (Figure G.8), the calculation details can be viewed by using the **Show calculations** button (Figure G.9). In the graph option, a scatter plot is used to visualize the ranking of the factors with respect to their weighted rating. Factor denotations can be viewed by pointing the cursor on the data points (Figure G.10).

4.2.3.4 Report 4: Factors Ranked by Weighted Rating (Grouped by Clusters)

In Report 4, the factors are ranked with respect to their weighted rating, which is a product of their importance weight and factor rating, and grouped according to their clusters. The weighted rating is given in percentages, to show the percent contribution of the factor to project performance. The report has two options, *i.e.* **List** and **Graph**, which can be selected from the main menu.

In the list option (Figure G.11), the calculation details can be viewed by using the **Show calculations** button. In the graph option, a scatter plot is used to visualize the ranking of the factors within clusters, with respect to their weighted rating. The points are color-coded for the representation of six different clusters. Factor denotations can be viewed by pointing the cursor on the data points (Figure G.12).

4.2.3.5 Report 5: The Strengths of the Project

In Report 5, the strengths of the project are ranked with respect to their percent contribution to project performance (Figure G.13). A factor is identified as a strength for the project if it has a weighted rating equal to/above the threshold value "and" if it has a rating above 3.00. The threshold value is set to 3.00% in the system, but it can be changed by the user. This default value was calculated by using the average factor rating (Rating = 3), and taking the average factor importance weight as 0.03, which was attained by dividing the sum of the importance weight values of the factors (1.00 in total) by 33 (the total number of factors). The calculation details can be viewed by using the **Show calculations for the 3.00% threshold value** button (Figure G.14). The report has two options: **List** and **Graph**.

In the list option, the calculation details for the **%Contribution to Project Performance** can be viewed by using the **Show calculations** button and the dependence diagram for a factor can be viewed by using the relevant **Dependence Diagram** button in the table. In the dependence diagrams of this report, a color code with two different shades is used to highlight the factors which are identified as the strengths of the project (Figure G.15). The dependence diagrams are available in both Report 5 and 6, and are explained in detail under its respective sub-section. In the graph option of Report 5, a bar chart is used to visualize the strengths of the project with respect to their percent contribution to project performance (Figure G.16). Factor denotations can be viewed by pointing the cursor on the data points.

4.2.3.6 Report 6: Critical Factors for the Improvement of Project Performance

The factors are ranked with respect to their contribution to project performance deficiency in Report 6 (Figure G.17). This ranking indicates the criticality level of the factors for the improvement of the project performance rating. The strategies/corrective actions should be developed according to the determined critical factors, while maintaining the high performance of the factors with a rating of 5.00.

A status categorization is used to point out the criticality level of the factors. The value ranges of this categorization are given in Table 4.3. The deficient points are calculated by subtracting the weighted rating of a factor from the highest possible weighted rating for the factor, which is a product of the factor's importance weight and the highest rating (*i.e.* 5.00).

Table 4.3. Factor status categorization used in Report 6

Factor Status	**Deficient Points (d)**
Most Critical	$0.06 < d$
Critical	$0.03 < d \leq 0.06$
Moderately Critical	$0.02 \leq d \leq 0.03$
Non-Critical	$0 < d < 0.02$
Rating = 5	$d = 0$

In the list option of the report, the calculation details for the deficient factor points can be viewed by using the **Show calculations** button (Figure G.18). The dependence diagram for a factor can be displayed by using the relevant **Dependence Diagram** button in the table (Figure G.19). In the dependence diagrams of this report, factors are highlighted with five different shades with respect to the categorization given in Table 4.3. The dependence diagrams for the factors F3, PM1, DCO1, DCO2, DCO3, DCO4, DCO5, DCO6 and DCO7 were selected as examples due to their more complex network schemes comprising a high number of factors and are presented in Figures G.20-G.28.

In the graph option of the report, factors which are specified as the most critical, critical and moderately critical in terms of project performance improvement are shown with respect to their percent contribution to project performance deficiency (Figure G.29). Factor denotations can be viewed by pointing the cursor on the data points.

4.2.4 Dependence Diagrams

To visualize the interrelationships between the factors, dependence diagrams are provided for the factors with dependencies on other factors. By means of the constructed diagrams, it was aimed to assist the project executives in the process of building project performance improvement strategies by facilitating a thorough examination of the factors. The network of influence for a factor highlights the interrelated factors which are needed to be improved in order to enhance the performance of the respective factor. Since some of the factors in the model do not interact with any others, the dependence diagrams are only available for 18 of the factors which have dependencies. Factors are shown with their ID in the dependence diagrams, together with their importance weights. Different color codes are applied for the dependence diagrams of Report 5 and Report 6, to facilitate the designation of different measures and categorizations. In the dependence diagram of a factor, its definitive sub-items are provided, together with the designations of the factors which appear in the network.

The arrows between the factors show the direction of impact, whereas the values on the arrows show the degree of impact between the factors. These impact values, which indicate the degree of impact that the factors of a cluster have on a dependent factor, were extracted from the ANP model developed in the previous stage of the study. It should be noted that the values are only meaningful when the impact of factors belonging to the same cluster are compared to each other. When the impact values on a dependent factor are examined, it can be noticed that the sum of the impact values of the factors belonging to the same cluster equals to 1.0. In a dependence diagram window, the impact values can be hidden by checking the **Hide impact values** option. In Figure G.30, the dependence diagram for the factor F3 is shown, with the **Hide impact values** option checked.

4.2.5 Proposal of Performance Improvement Strategies

Proposal of strategies for performance improvement is one of the primary functions of the developed decision support system. In the list option of Report 6, proposed performance improvement strategies for a factor can be viewed by using the relevant **Strategies** button in the table. In order to improve the performance level of the most critical, critical and moderately critical factors determined by the system, which have a very high/high/moderate impact on the improvement of project performance, the proposed strategies can be examined. An example of a **Strategies** pop-up window is presented in Figure G.31. Strategies are provided for 20 of the factors in total, which were considered to be the factors manageable by the project teams. The tool enables the user to add more strategies to the pre-defined strategies lists considering the specific features of the project, by using the **Add New Strategies** section in the **Strategies** pop-up window. Once a new strategy is defined and saved, it appears in the strategies list of the relevant factor (Figure G.32).

4.2.6 Scenario Generation

Alternative scenarios to the baseline project assessment can be generated through the selection of the applicable strategies in the project and adjusting the assigned ratings of the associated factors accordingly. By that means, an updated project performance rating is obtained, which can be compared to the baseline assessment rating and the outcome of the selected performance improvement strategies can be examined. To create an alternative scenario for the project, the appropriate strategies to be implemented in the project are selected by checking the relevant boxes in the **Strategies** pop-up window, and then, the selected strategies are saved by using the **Save Selected Strategies** button (Figure G.33). The process is repeated for all of the factors considered for performance improvement and when completed, the user creates the scenario via the **Create a Scenario with the Selected Strategies** button in the list option of Report 6 (Figure G.34). A list of the selected strategies for the respective scenario is displayed in a pop-up window (Figure G.35). Using the

Update Ratings button provided, necessary adjustments can be made on the relevant ratings. The factor clusters that the selected strategies are associated with are then displayed as a notification, and accordingly, the user should proceed to the relevant clusters and update the relevant factor ratings. The selected strategies are demonstrated in the respective evaluation pop-up windows (Figure G.36). When the rating adjustments are completed for all of the relevant factors, the performance rating of the scenario is calculated out of 5.0, with the use of the **Calculate Performance** button.

When the user creates a new scenario through the given instructions, it is denominated as **Scenario 1**, **Scenario 2**, and so forth automatically, and saved under the relevant **Baseline** assessment. The list of the saved project assessments and scenarios can be accessed using the **Previous Project Evaluations** command under the **File** tab. By means of the relevant screen, a saved project can be loaded or deleted (Figure 4.11). The comparison of the project performance ratings revealed for the baseline and scenario assessments can be viewed from the same list, via the **Compare** option. Not only the performance ratings, but also the selected strategies for the generated scenarios are designated in the table of comparison (Figure 4.12).

4.2.7 Assessment with User-Defined Weights

As mentioned previously in this chapter, the default importance weights of the factors were obtained through the assessment of a group of experts with considerable experience in PPP healthcare projects. On the other hand, instead of using the default importance weights for the factors, the tool enables the user to redefine the weights and carry out a more customized assessment. For this option, **Assessment with User-Defined Weights** command is included under the **File** tab of the main menu. The project registration screen is identical to the one that appears in the assessment using the default weights. After entering the project information, the user proceeds to the evaluation of the factor importance weights. On the displayed screen (Figure G.37), the user assigns a weight between the values 1-5 to each factor, considering the importance of the factor for project performance (1: Very low, 2: Low, 3: Medium, 4: High, 5: Very high). Once the evaluations are completed for all of the 33 factors, the **Save** button is used to calculate the factor importance weights. The tool normalizes each value so that the sum of the importance weights of the factors equals to 1.00. The calculated importance weights are displayed in the evaluation pop-up windows. The following steps of the assessment continue in the same way as described for the assessment using the default weights.

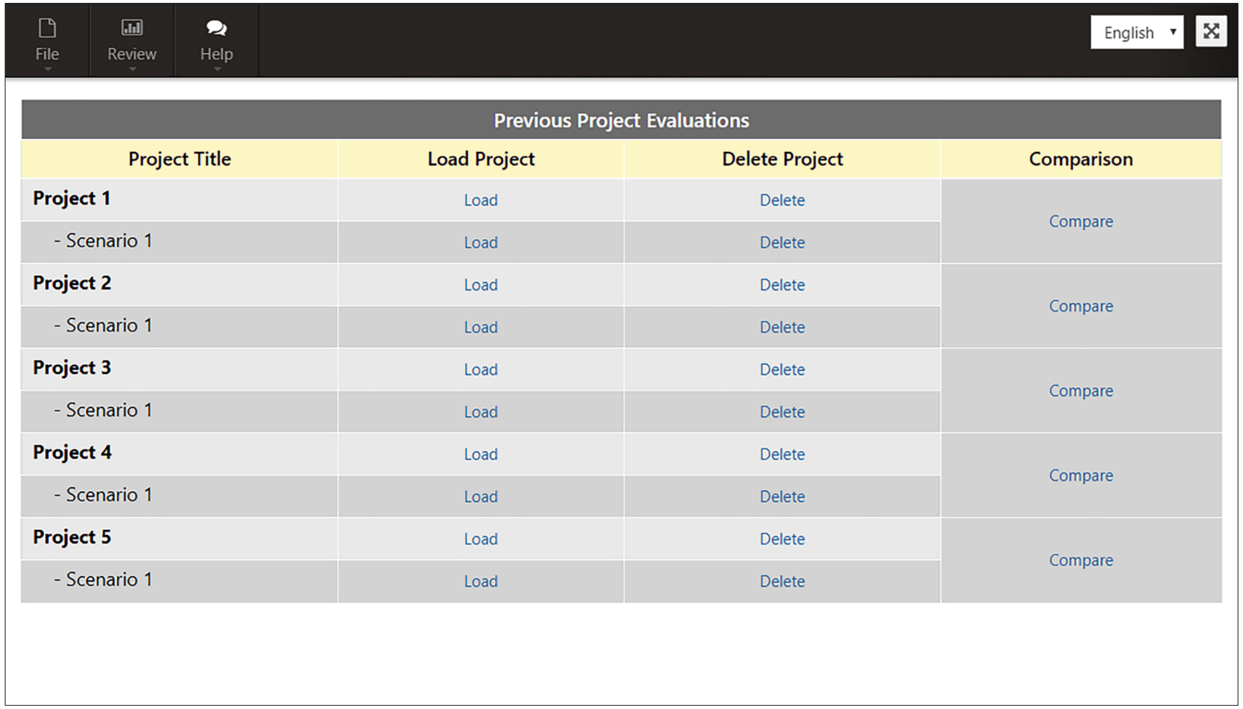


Figure 4.11. **Previous Project Evaluations** screen

Comparison of the Generated Scenario/Scenarios to the Baseline Assessment
Project 1

Alternatives	Project Performance Rating	Selected Strategies
Baseline	3.34 / 5.00 (Medium-to-high)	-
Scenario 1	3.43 / 5.00 (Medium-to-high)	Including clauses in the contract to enable adopting the changing conditions and demand during the operation period
		Specifying a proper dispute resolution process within the contract
		Identifying the possible effects of project changes and taking the necessary corrective measures so that changes do not result in disputes
		Preparation of change/variation protocols to deal with the contingent future project changes, as part of the project agreement

Figure 4.12. The table of comparison for the project performance ratings of the baseline and scenario assessments

CHAPTER 5

TESTING AND VALIDATION

In this chapter, the testing and validation of the developed decision support system is explained in detail. In Section 5.1, the material and method used for the process are elaborated, whereas Section 5.2 covers the presentation of the data gathered through the testing procedure and the revealed results are discussed in separate sub-sections.

5.1 Material and Method

For the testing and validation of the proposed decision support system, testing sessions were held separately with three groups of experts representing three leading construction companies. Information about the respondent companies and the participated experts, and details about the sessions and the projects are given in this section, together with a detailed description of the testing procedure.

5.1.1 Information about the Respondent Companies and the Experts

The testing sessions were held with the same group of companies and experts that were participated in the preliminary interviews (See Sections 3.1.1 and 3.1.2).

5.1.2 Information about the Sessions

The sessions were carried out at different times in July 2018, each of which lasted for two to three hours. In each session, the expert group tested the decision support system on one or two real projects that they were involved in. The reason to conduct the sessions with a group of experts instead of a single company representative was to reduce the subjectivity in the responses. The evaluations required to be made throughout the sessions were obtained by means of the consensus of the experts; whereas for the items that require comments and interpretation, it was attempted to get remarks from each expert. The sessions were structured with the use of a testing protocol, to obtain feedback from all of the expert groups in a consistent manner. A sample of the utilized testing protocol is provided in Appendix H.

5.1.3 Information about the Projects

In the testing and validation of the proposed decision support system, five real PPP healthcare projects carried out in Turkey were used. Company A was in charge of Project 1, whereas Projects 2 and 3 were undertaken by Company B, and Projects 4 and 5 were undertaken by Company C. To test the use of the tool in different project phases, it was intended to select projects with various completion rates. Due to the confidentiality issues, the information of the projects provided by the experts is presented with the use of categorization (Table 5.1).

Table 5.1. Information about the projects assessed in the testing sessions

Features	Project 1	Project 2	Project 3	Project 4	Project 5
Project Size (m^2)	> 1,000,000.00	< 500,000.00	500,000.00 - 1,000,000.00	> 1,000,000.00	< 500,000.00
Number of Project Partners	2	2	1	1	1
Current Project Phase	Construction	Operation	Pre-Design	Construction	Construction
Project Duration (From Project Start to Construction Completion)	3.5 years (Anticipated)	2 years and 11 months (Actual)	2.5 years (Anticipated)	5 years and 2 months (Anticipated)	3 years (Anticipated)
Number of Beds	> 2000	1500-2000	1500-2000	> 2000	1000-1500
Specific Project Requirements	- Use of trigeneration systems and sustainable technologies - Full disabled access - Extensive landscaping works	- Full disabled access	- Full disabled access	- Use of seismic isolators - Objective to get LEED Gold Certification - Full disabled access	- Use of seismic isolators - Objective to get LEED Gold Certification - Full disabled access

5.1.4 Testing Procedure

The testing procedure was comprised of three major stages:

1. Provision of a set of performance predictions by the experts, regarding the particular phases of the project under consideration,
2. Assessment of the project performance using the system,
3. Getting remarks from the experts on the project performance rating revealed by the tool, comparing it to the prediction provided by the experts at the initial stage of the session and receiving feedback on the tool's contents, functions, potential contributions and improvement.

In the first stage, the experts were asked to make a set of performance predictions considering the overall performance at the particular project phases. In the primary prediction, it was required to assign a performance rating regarding the current state of the project. For this estimation, the experts were asked to consider the factors that may affect the success of the project and evaluate the performance according to their company's point of view (short-term profitability, long-term profitability, *etc.*) and expectations. A 1-5 point Likert scale was used for the estimation, in which, the correspondences of the levels were given as follows:

(1) Very low (Far below expectations)
(2) Low (Below expectations)
(3) Medium (At a level that meets expectations)
(4) High (Above expectations)
(5) Very high (Far above expectations)

It was also requested from the experts to evaluate how confident they feel when assigning the project performance rating (*i.e.* Not sure at all, Not sure, Neutral, Sure, Very sure). The other evaluations included the opinion that they had had at the beginning of the project regarding project performance, the percent completion rate of the project and the anticipated performance for the construction completion of the project.

At the beginning of the second stage, the tool was introduced to the experts. Upon the demonstration, the experts were asked to assess the performance of a real PPP healthcare project that they were involved in, using the tool. Following the registration of the project with relevant information, the evaluation of the factors was carried out through the consensus of the expert group and fed into the system. The system outputs were reviewed, which consisted of six different reports, including examples from dependence diagrams and strategies lists. Subsequently, the experts selected a number of project strategies applicable to the project under consideration. Following the selection, a scenario was generated with the selected strategies and the relevant factor ratings were updated accordingly. The experts reviewed the comparison of the project performance ratings revealed for the baseline and the scenario assessment. Supportive documents within the tool, which are presented under the *Help* tab, were also demonstrated to the experts, together with the *Assessment with User-Defined Weights* option, to provide a complete overview of the system. Other than the introduction and presentation of the supportive documents and options, the steps followed for the testing of the system can be outlined as follows:

1. Registering the project with the relevant information,
2. Performing the assignment of factor ratings,
3. Reviewing the outputs of the system,
4. Selecting a set of applicable performance improvement strategies for the project,
5. Generating a scenario with the selected strategies and updating the relevant factor ratings,
6. Reviewing the comparison of the baseline and scenario performance ratings revealed by the tool.

In the final stage, the experts were asked to comment on the functions and outputs of the decision support system. They were expected to give remarks on the project performance rating revealed by the tool, comparing it to the prediction that they had provided at the initial stage of the session. Other questioned issues included the potential benefits of the system for the performance prediction and assessment process and the observed problems in using the system. Furthermore, the experts evaluated and commented on the six primary functions of the system, which were identified as follows:

1. Project registration, storage and retrieval,
2. Listing of the CSFs for the PPP healthcare projects and assessment of the project performance based on these compiled factors,
3. Calculation and display of the project performance rating using an algorithm that takes all the factors and their interrelationships into account,
4. Through the evaluation reports, presenting an overview of the assessment, the strengths and weaknesses of the project, critical factors for the improvement of project performance and the dependence diagrams for the factors,
5. Proposal and display of project performance improvement strategies,
6. Creation of alternative project scenarios based on the strategies to be implemented in the project.

Each function was evaluated by the experts using a 1-5 point Likert scale (1: Very low, 2: Low, 3: Medium, 4: High, 5: Very high), regarding the performance of the system and the extent of the function's contribution to the project processes. For the evaluation of the tool's performance with respect to each function, the question raised was: "How well does the function fulfill its task?", while for the evaluation of its contribution, the question posed was: "To what extent can this function improve the project processes?". An open-ended question, *i.e.*, "How can this function contribute to the processes and to the resolution of the key issues that you have identified at the initial stage of the session?", was also directed to the experts to get their comments on the system's functions.

5.2 Presentation and Interpretation of the Data Gathered Through the Testing Procedure and Evaluation of the Results

In this section, the gathered qualitative and quantitative data throughout the testing sessions are presented and discussed under headings consistent with the testing protocol utilized in the sessions. Accordingly, the section is comprised of the discussion of the expert groups' responses organized in three steps, and the recommendations provided by the experts for the further improvement of the proposed system are devised as a separate sub-section.

5.2.1 Step 1: Anticipation of the Project Performance Rating by the Experts

For the projects, the information about the current project phase and about the completion rates are provided in Table 5.2. Accordingly, Project 1 and Project 4 were at halfway through the construction phase, whereas the design work was also being continued simultaneously. For Project 2, the testing and commissioning procedures were completed, and the project was at the beginning of the operation phase. In Project 5, the construction process was about to be completed and the preparations were being made for the operation phase. Project 3 was in the pre-design stage and the mobilization work had started for the project.

Table 5.2. Information regarding the current project phases and completion rates

	Project 1	**Project 2**	**Project 3**	**Project 4**	**Project 5**
Current Project Phase	Construction	Operation	Pre-Design	Construction	Construction
Design Complete (%)	95%	100%	0%	51%	100%
Construction Complete (%)	50%	100%	0%	12%	98%
Years in Operation	-	Less than a year	-	-	-

In the first step of the testing procedure, the expert groups made a set of performance predictions regarding the particular phases of the project under consideration. The obtained responses are given in Table 5.3. The estimated project performance ratings were in the range of 3.5-4.0 out of 5.0, for the current status of the projects under consideration. In assigning the performance ratings, all of the expert groups mentioned that they were confident, except for the case of Project 4. It was opined by the experts of Company C that they had a neutral attitude, owing to the consideration that it was a mega project in its early stages of project delivery and there were a number of unknowns for the rest of the project life cycle. It can be said that the ratings assigned for the three phases of a project had close values for each case, except for Project 2. The experts of Company B mentioned that they had expected a very high performance at the beginning of Project 2; but due to the various obstacles encountered, the performance could then be evaluated to be around 3.8 out of 5.0.

Table 5.3. Expert groups' performance estimations for different project phases

Questioned Item		Project 1	Project 2	Project 3	Project 4	Project 5
Opinion and confidence at the current status of the project	Estimated performance rating	4.0	3.8	4.0	3.8	3.5
	Level of confidence	Sure	Sure	Sure	Neutral	Sure
Opinion had at the beginning of the project	Anticipated performance rating	4.0	5.0	4.0	4.0	3.5
Estimation for construction completion and commissioning	Anticipated performance rating	3.8	-	4.0	4.0	3.5

5.2.2 Step 2: Assessment of the Project Performance Using the Proposed Tool

In Step 2, the expert groups conducted a performance assessment for the project/projects under consideration, using the proposed decision support system. This assessment was referred to as the *baseline assessment* for the project. As revealed by the assessment results, all of the cases under consideration fell into the performance category of medium-to-high. The assigned ratings to the factors and the obtained weighted ratings for the factors are presented in Table 5.4, together with the revealed project performance ratings.

Table 5.4. The factor evaluations obtained through the testing sessions

ID	Weight	Project 1		Project 2		Project 3		Project 4		Project 5	
		Rating	W. Rating	Rating	W. Rating	Rating	W. Rating	Rating	W. Rating	Rating	W. Rating
E1	0.045	4	0.180	4	0.180	4	0.180	4	0.180	4	0.180
E2	0.044	2	0.088	2	0.088	1	0.044	2	0.088	2	0.088
E3	0.028	3	0.084	1	0.028	3	0.084	3	0.084	3	0.084
E4	0.002	5	0.010	5	0.010	3	0.006	3	0.006	4	0.008
F1	0.033	3	0.099	3	0.099	2	0.066	4	0.132	3	0.099
F2	0.062	5	0.310	5	0.310	5	0.310	4	0.248	4	0.248
F3	0.105	5	0.525	5	0.525	5	0.525	4	0.420	4	0.420
PS1	0.098	2	0.196	1	0.098	1	0.098	3	0.294	3	0.294
PS2	0.038	1	0.038	1	0.038	1	0.038	3	0.114	2	0.076
PS3	0.134	4	0.536	3	0.402	4	0.536	4	0.536	4	0.536
PS4	0.026	4	0.104	4	0.104	4	0.104	4	0.104	4	0.104
PS5	0.048	3	0.144	4	0.192	5	0.240	4	0.192	4	0.192
PS6	0.027	3	0.081	3	0.081	3	0.081	3	0.081	3	0.081
PS7	0.006	3	0.018	3	0.018	3	0.018	3	0.018	3	0.018
PS8	0.004	4	0.016	4	0.016	4	0.016	4	0.016	4	0.016
P1	0.040	1	0.040	2	0.080	3	0.120	2	0.080	2	0.080
P2	0.020	2	0.040	2	0.040	2	0.040	2	0.040	2	0.040
P3	0.020	3	0.060	4	0.080	4	0.080	3	0.060	3	0.060
P4	0.058	4	0.232	3	0.174	3	0.174	4	0.232	3	0.174
PM1	0.017	4	0.068	4	0.068	4	0.068	4	0.068	3	0.051
PM2	0.018	3	0.054	3	0.054	3	0.054	3	0.054	3	0.054
PM3	0.009	1	0.009	1	0.009	1	0.009	3	0.027	3	0.027
PM4	0.012	4	0.048	4	0.048	4	0.048	4	0.048	3	0.036
PM5	0.020	2	0.040	1	0.020	3	0.060	3	0.060	3	0.060
PM6	0.008	4	0.032	4	0.032	4	0.032	3	0.024	2	0.016
PM7	0.003	4	0.012	3	0.009	4	0.012	4	0.012	3	0.009
DCO1	0.017	3	0.051	4	0.068	4	0.068	4	0.068	3	0.051
DCO2	0.015	4	0.060	4	0.060	4	0.060	4	0.060	4	0.060
DCO3	0.015	4	0.060	3	0.045	5	0.075	4	0.060	3	0.045
DCO4	0.010	3	0.030	4	0.040	4	0.040	4	0.040	3	0.030
DCO5	0.005	5	0.025	5	0.025	5	0.025	5	0.025	3	0.015
DCO6	0.010	4	0.040	5	0.050	5	0.050	4	0.040	4	0.040
DCO7	0.003	2	0.006	4	0.012	4	0.012	4	0.012	4	0.012
Project Performance Rating		3.34 / 5.00 (Medium-to-high)		3.10 / 5.00 (Medium-to-high)		3.37 / 5.00 (Medium-to-high)		3.52 / 5.00 (Medium-to-high)		3.30 / 5.00 (Medium-to-high)	

Upon the derivation of the project performance rating, the assessment reports were reviewed. The expert groups selected a set of appropriate strategies from the system and a project scenario was generated based on the selected strategies. The ratings of the relevant factors were updated accordingly and a project performance rating was obtained for the *scenario assessment*. The selected strategies for each project and the improvement of the baseline assessment ratings are shown in Table 5.5.

Table 5.5. Scenario details for each project

Project Performance Rating	Factor	Selected Strategy
Project 1 Baseline: 3.34 Scenario: 3.43	**P4**	**S12.** Including clauses in the contract to enable adopting the changing conditions and demand during the operation period **S13.** Specifying a proper dispute resolution process within the contract
	PM5	**S2.** Identifying the possible effects of project changes and taking the necessary corrective measures so that changes do not result in disputes **S3.** Preparation of change/variation protocols to deal with the contingent future project changes, as part of the project agreement
Project 2 Baseline: 3.09 Scenario: 3.16	**P4**	**S12.** Including clauses in the contract to enable adopting the changing conditions and demand during the operation period
	DCO6	**S6.** Establishment of a systematic reporting and record keeping mechanism for the operation phase **S8.** Defining appropriate and explicit rectification periods for the defective/inadequate services
Project 3 Baseline: 3.37 Scenario: 3.43	**PM2**	**S2.** Setting up multidisciplinary teams to ensure that activities carried out at different stages of the project life cycle are coordinated with each other
	PM5	**S2.** Identifying the possible effects of project changes and taking the necessary corrective measures so that changes do not result in disputes **S5.** Providing a high percentage of design complete at construction start
Project 4 Baseline: 3.52 Scenario: 3.62	**P4**	**S2.** Involvement of the public sector staff responsible for the operation of the hospital in contract negotiations **S11.** Ensuring government risk guarantees for political/legal/regulatory risks, which are not under the control of the private sector
	PM1	**S1.** Ensuring the contribution of the operator, contractor's consultants and other relevant stakeholders in the approval of the project budget and schedule prepared by the contractor **S5.** Establishment of an appropriate project organization structure and work breakdown structure
	PM5	**S3.** Preparation of change/variation protocols to deal with the contingent future project changes, as part of the project agreement
Project 5 Baseline: 3.30 Scenario: 3.34	**PM4**	**S6.** Conduct of monthly audits and random checks by the public agency and the consortium during the operation phase and preparation of monthly performance reports
	DCO5	**S4.** Carrying out regular quality control and quality assurance activities **S5.** Establishing effective health, safety and environmental compliance and auditing programs
	DCO6	**S4.** Establishment of a payment mechanism linking service payments to the availability of assets and performance of the services, based on the specified performance criteria **S8.** Defining appropriate and explicit rectification periods for the defective/inadequate services

Though the primary objective of the sessions was to test and validate the developed decision support system, looking into the ratings assigned by the experts for the assessment of the five real cases was considered to be beneficial. The obtained results cannot be generalized, as they are based on the subjective assessment of a group of experts included in each project and also as these projects are random cases of the PPP healthcare projects carried out in Turkey. But nevertheless, the evaluations provide a better idea of the factors involved in the assessment and the experts' point of view. Due to the mentioned concerns, statistical analysis was not utilized for the interpretation of the results. A discussion of the obtained factor ratings, which were interpreted using the remarks made by the experts during the sessions, is presented in this sub-section.

5.2.2.1 External Environment

Regarding all of the projects under consideration, one of the identical responses was related to the strength of political support for the project and stability of the government. The significance of the project in terms of government policies and a positive governmental attitude towards private sector cooperation in the project were evaluated with a high level of rating for all of the cases.

Concerning the domestic and global economic conditions for the project, all of the evaluations fell into the range of very low-low for the considered projects, consistent with the fact that all of the cases were being carried out in Turkey, in close time periods. Neither the global nor the domestic economic environment was evaluated as favorable, and this was mentioned to be one of the greatest challenges for all of the projects. It was expressed that there was a great deal of foreign exchange risk, especially with respect to the medical equipment imported. It was stated that the lack of stability in prices brought about time and cost overruns in the projects.

For the factor regarding the transparency and maturity of the legal and regulatory framework, the four evaluations obtained were at the medium-level. Only a single expert group assigned a very low-level of rating to this factor, mentioning that this rating was given with regards to the maturity of the framework at the beginning of their initial PPP healthcare project, though it had been relatively improved through the process. But still, all of the expert groups opined that the then-current legal and regulatory framework had many deficiencies. As the framework valid for PPP healthcare projects in Turkey was mainly taken from the PFI model of the UK, the adaptation of it to the project processes and mechanisms in Turkey is a demanding task, which has not been fully accomplished to date.

The last factor within this group is related to the convenience of the location, weather and site conditions of the project. There were diverse responses regarding this factor, from a medium-level to a very high-level rating. Some of the projects were considered to be advantageous in terms of the maturity of the subcontractor and supplier network in and around the region and favorability of the weather conditions, while some of them were mentioned to be challenging in terms of factors such as windy weather conditions and unfavorable ground conditions in the project site.

5.2.2.2 Financial Characteristics

For the first factor within the *Financial Characteristics* cluster, which is on the favorability of the financing interest rates and financing costs, and the strength and profitability of the project, the assigned ratings for the five projects varied between the low-level and the high-level. While most of these projects were considered to have the potential of high profitability, they were also mentioned to be exposed to high financing interest rates and financing costs. As a project in the stage of pre-design, Project 3 was stated to have a high level of interest rate and financing risk due to the current economic environment in Turkey, and was assigned a low-level rating with regards to this factor. On the other hand, the only project that was denoted to have a low profit margin was Project 5.

In terms of the provision of adequate government guarantees, all of the expert groups pointed out that the provided guarantees by the government were satisfactory. Government debt guarantee, minimum demand guarantee and special tax allowances were among the mentioned guarantees provided by the government.

The last factor in this group is concerned with the inclusion of strong investors and sponsors in the project, which was evaluated with a very high-level rating for the first three projects. Project 4 was rated at a high-level, whereas Project 5, which was mentioned to have a low profit margin, was rated at a medium-level with regards to this factor. On the other hand, it was denoted that all of the five projects included foreign creditors, while in Projects 1 and 2, there was also the inclusion of foreign investors.

5.2.2.3 Project Stakeholders

The first two factors in the *Project Stakeholders* cluster pertain to the public agency and its consultant. The initial one addresses the organizational structure of the public agency, together with the resources, knowledge and experience in healthcare projects and the BLT model. All of the assigned ratings were between the range of very low to medium, indicating a deficiency of experience and knowledge for this project type and delivery method within the public sector. The lack of competent and experienced staff within the public agency was mentioned as an obstacle for the proper execution of the projects, slowing down the process. On the other hand, the public agency was denoted to be getting more mature in terms of its organizational structure and experience, as the initiated projects progress and as more PPP projects are being launched. The second factor within this group focuses on the public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model, which was evaluated within the range of very low to medium. It was stated that the public agency consultant's contribution was very limited all through the processes.

Most of the expert groups evaluated the factor on the contractor’s experience, technical and management competencies, resource adequacy, knowledge and experience in healthcare projects and the BLT model with a high-level rating, except for Project 3, which was assigned a medium-level rating. The relevant expert group mentioned that Project 3 was the first healthcare project undertaken by the company. All of the expert groups considered their budgetary and equipment resources to be sufficient, and pointed out some degree of deficiency in workforce.

Via the fourth factor in this cluster, the contractor's consultants focusing on various issues such as traffic, ESIA, fire, risk and green building were addressed in terms of their experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model. For all of the projects under consideration, a high-level rating was assigned to this factor, and it was mentioned that the consultants’ works were satisfactory.

The fifth factor in this cluster is concerned with the operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model. This factor was assigned a rating with a level of high or very high for each case, except for Project 1, evaluated with a medium-level rating. When the organizational structure with regards to each project was examined, it was seen that for Projects 2-5, the operating company had been established by the contractor, and by that means, the construction and operation of the facility had been executed under the structure of the same organization. On the other hand, in Project 1, the operation of the healthcare facility had been outsourced to an operating company. Via the comments of the experts, it was inferred that the issues pertaining to the operator were rather vague in Project 1, when compared to those in other projects.

The sixth stakeholder involved within this cluster is the design firm, and the experience, competencies, resource and staff adequacy, financial capability, knowledge and experience in healthcare projects and the BLT model of the design firm were examined through the relevant factor. All of the expert groups evaluated this factor with a medium-level rating for their projects. For all cases, it was expressed that the design firm was a foreign company, which was unfamiliar with the project specifications and procedures applied in Turkey, and as a result, had had difficulties throughout the process.

Another factor in this cluster is on the subcontractors' (*e.g.* electrical, mechanical) experience, competencies, adequacy of financial, labor and equipment resources, knowledge and experience in healthcare projects and the BLT model. For all projects, this factor was assigned a medium-level rating, referring to a deficiency in the subcontractor selection process, a deficiency to attract strong subcontractors or a deficiency in the management of subcontractors, each of which was mentioned in different cases.

The last factor in this group is related to the suppliers' experience, competence, commercial strength and long-term accessibility, which also covers their coordination skills, reliability, market dominance and commercial capacity. This factor was rated at a high-level by all of the expert groups. It was expressed that no significant problems emerged from the processes pertaining to the suppliers. The problems encountered in the supply of medical equipment was the only drawback denoted regarding the procurement process.

5.2.2.4 Planning, Tender and Contracting Processes

Within the *Planning, Tender and Contracting Processes* cluster, the first two factors are related to the pre-tender stage. The initial one is concerned with the clear definition of project scope and public authority's requirements prior to the tender process, and proper integration of end users' needs, inputs of operational staff, healthcare experts and all other interest groups in this process. Evaluated with a low-level rating for three of the projects, and with a very low-level rating and a medium-level rating for the other two, this factor was mentioned to be addressing a primary deficiency for the PPP healthcare projects carried out in Turkey. It was stated by all of the expert groups that the project requirements provided by the public agency were immature and that the project scope and requirements were subject to change for a number of times, which form a threat for the budget and schedule of the project. It was pointed out as a major obstacle that the integration of end users' needs, inputs of operational staff, healthcare experts and relevant institutions was not provided by the public agency in the determination of project requirements early in the process. Rather, these parties were denoted to be included in the project shortly before the operation phase, and it was stated that their claims cause design changes, construction rework and delays.

The second factor within this cluster pertains to the preparation of a comprehensive and realistic feasibility study by the public agency or its consultants, prior to tender. This factor was evaluated with a low-level rating for all of the projects under consideration, pointing to a major shortcoming. None of the experts believed in the sufficiency of the feasibility studies carried out, whereas a proper feasibility study is regarded as essential for project success.

The characteristics of the tender phase were in the focus of the third factor within this cluster, to ensure a properly designed, competitive and transparent tender process and the adequacy of the tender documents. The factor was evaluated with a medium or high-level rating by the expert groups. It was stated that no major problems had occurred regarding the defined tender procedure or its transparency. On the other hand, a deficiency was expressed with respect to ensuring competition in the process and the adequacy of the tender documents provided, including the project specifications.

For the factor concerning the comprehensiveness and clarity of the final contract documentation prepared by the public agency and the contractor, a medium-level or a high-level rating was assigned by the expert groups for the projects under consideration. There were two different views within the comments: one holding that the final contract was rather clear and had left no rooms for misinterpretations, owing to the contribution of the creditors in the contract preparation; and the other one holding that it was rather generic and overlooked. On the other hand, it was a common sight that the plans and specifications included in the contract were inadequate and unclear.

5.2.2.5 Project Management

The first factor within the *Project Management* cluster, which focuses on effective budget and schedule planning with the consideration of the entire project life cycle including the operation and transfer phases, received a high-level rating regarding four of the projects. The only exception was Project 5, which was denoted to include unexpected cost overruns especially in the testing and commissioning stages. It was pointed out that the commissioning stage should be properly planned, in conjunction with the preparation carried out for the operation phase. It was stated that the undertaking of the operation of the facility by the private sector stakeholders is effective in improving the project budget planning and the quality offered.

The obstacles encountered in the communication and coordination between project stakeholders were listed among the shortcomings of these projects in the preliminary interviews, and consistently, the factor pertaining to the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders was evaluated with a medium-level rating for all of the cases. It was pointed out in the sessions that proper communication channels did not exist between the private sector stakeholders and the public agency, and furthermore, it was opined that the claims remained unanswered by the public agency most of the times, bringing about conflicts, design changes, construction rework and time delay.

The third factor in this cluster, which focuses on the necessity of effective control and supervision by the public agency throughout the life cycle of the project and an efficient governmental approval process, received a very low-level rating for three of the projects and a medium-level rating for the other two. The ineffectiveness of the public approval mechanism was asserted to be a major obstacle for the projects executed, together with the inadequate and late feedback provided by the public agency.

Efficient monitoring, evaluation, reporting and control of project performance is a factor mainly under the responsibility of the contractor, together with the operator. This factor was evaluated with a high-level rating for most of the cases and it was mentioned that regular control meetings, and project schedule and budget updates were carried out throughout the project life cycle and relative course of actions were identified and taken. Project 5 was rated at a medium-level for this factor and it was stated that it stemmed from the inefficiencies and coordination problems regarding the management team.

With respect to the establishment of an efficient system for controlling project changes and resolving disputes, the public agency and its consultant were regarded as primarily responsible, and this factor's status was attached ratings within the range of very low to medium level. All of the respondents were aware of the criticality of effective change management and dispute resolution mechanisms, but evaluated their implementation in the assessed projects to be immature. It was expressed that the proper set up of such a system has the potential of improving project performance especially in terms of design development and scope management.

The factor concerning the effective implementation of risk management processes across all project phases was rated within the range of low to high for the projects under consideration. On the other hand, neither a formal risk management system with defined processes nor a dedicated risk management department existed in any of the companies. It was denoted by one of the expert groups that the evaluation of the time and cost impacts of the risks and preparation of contingency plans are especially critical for the success of these projects. The group that assigned a high-level rating to this factor believed that they achieved to manage the project risks encountered without using a formal mechanism.

The factor on the establishment of a proper documentation system for the project and storage of lessons learned through an accessible PPP projects database was regarded as two-fold. For all of the cases, it was mentioned that a proper documentation system existed. On the other hand, an accessible PPP projects database enabling the recording of lessons learned was not available in any of the companies. It was opined that data of previous PPP projects were stored, but there was not such a system enabling systematic storage, together with easy and proper access to data. Accordingly, the assigned ratings for this factor varied between the levels of medium and high.

5.2.2.6 Design, Construction and Operation Processes

Within the *Design, Construction and Operation Processes* cluster, for the first factor, which consists of the further development of the pre-tender feasibility study and preparation of a detailed technical and financial analysis early on in the design-construction phase with the contribution of the private sector stakeholders, the assigned ratings were in the range of medium to high levels. For all of the projects, it was mentioned that technical feasibility was conducted by the contractor and financial plans were developed and updated accordingly. On the other hand, as it was stated, some project-specific issues had been overlooked, due to the limited experience in this project type.

For the factor concerning the further development of the project specifications with the contribution of the stakeholders early on in the design-construction phase, all of the expert groups assigned a high-level rating and denoted that it was a necessity since the specifications provided by the public agency in the tender phase was not project-specific and elaborate. It was opined that all of the project-specific items regarding the materials and work were established by the contractor subsequent to the award of the tender, together with the public agency and its consultant.

The third factor in this cluster pertains to the integration of design with the construction and operation phases, ensuring its flexibility and optimization, which received a range of ratings between medium and very high. With respect to Project 3, which was assigned a very high-level rating for this factor, the experts mentioned that the company had gained considerable experience with the other PPP healthcare projects completed or ongoing. The advantage of ensuring collaboration with the operator by means of an appropriate project organization structure was highlighted for facilitating the integration of the phases.

Effective site management was another factor that received ratings of medium and high levels, on which, the experts made the comment that the management of projects of this scale is not an easy task. For the two projects with the largest scale, it was pointed out that the project should be split into sections and their management should be conducted separately by several project managers assigned; although that was not the case for the projects under consideration.

The factor concerning the establishment of an efficient quality, health, safety and environment management system for the construction and operation phases was regarded as one of the factors that the companies paid the upper most attention. It was mentioned that this issue is also highlighted by the creditors to ensure the effectiveness of the processes. Accordingly, for all of the projects, the factor was rated with a very high-level rating, except for Project 5, which suffered from some issues regarding the quality.

For all of the projects, the factor focusing on taking the necessary measures to provide and maintain maximum performance throughout the operation phase received high or very high-level ratings and it was made clear that this was one of the issues dwelled on as the public agency has very strict and compelling requirements for the operation phase. On the other hand, it was stated that there were ambiguities with respect to the administration of the specifications.

The last factor within this cluster addressed the proper transfer of the facility to the public authority at the end of the contract phase. Uncertainties were mentioned with regards to this issue by the experts of Company A when the terms of the contract were considered, and accordingly, the factor was evaluated with a low-level rating for Project 1. On the other hand, for the other projects, the factor was assigned a high-level rating, with the assumption that the proper operation of the facility might bring about its successful transfer at the end of the operation period.

5.2.3 Step 3: Comparison of the Revealed Rating with Expert Estimates and Providing Feedback

Subsequent to the project performance assessment carried out using the proposed decision support system and reviewing the system outputs, the experts gave remarks on the revealed performance rating by the system, potential benefits of the system, the problems observed through their experience of using the system and finally evaluated the six different functions of the system, all of which are presented in this sub-section.

5.2.3.1 The Experts' Opinion of the Project Performance Rating Revealed by the Tool When Compared to the Rating Anticipated Prior to the Use of the Tool

Although making statistically significant inferences was not possible due to the sample size, it can be said that in all cases, the experts provided more optimistic estimates for the project performance rating when compared to the rating revealed by the tool (Table 5.6). On the other hand, subsequent to exploring the included factors and the inherent principles of the tool, all of the expert groups considered the revealed result to be reasonable.

Table 5.6. Comparison of the experts' estimates to tool's prediction

Rating	Project				
	1	2	3	4	5
Project Performance Rating (Estimated by the Experts)	4.00	3.80	4.00	3.80	3.50
Project Performance Rating (Revealed by the Tool)	3.34	3.09	3.37	3.52	3.30

The expert group of Company A regarded the performance rating revealed by the system as realistic and accurate. The experts mentioned that they had provided a rough estimate for the project performance rating at the beginning of the session, but pointed out that the system is precise and includes an elaborate breakdown structure. As denoted, the correct addressing of the factors, the detailed breakdown structure and one-by-one assessment of the factors certainly provide clearer results. Accordingly, the experts opined that it could be misleading to comment on the whole with a deductive approach, without the use of an appropriate hierarchy. As further stated by the experts, it was seen that there were weaknesses needed to be addressed with respect to the project under consideration and also with respect to the future projects, by the help of the revealed results.

Concerning the derived project performance ratings for Projects 2 and 3, which were both being executed by Company B, the experts mentioned that Project 2 was the initial PPP healthcare project of the company. Accordingly, the experts expressed that the company had been inexperienced in healthcare projects and in PPP model during the course of the project. For Project 3, they regarded the company's project processes as more mature and the project team as more experienced, owing to the lessons learned so far. Consistently, the system revealed a performance rating of 3.10 for the former project, and a rating of 3.37 for the latter. This increment was considered to be reasonable by the experts. In terms of their anticipated project performance ratings obtained prior to the assessment, the executives mentioned that they had been rather optimistic in the estimation, since they had had no idea on the factors included in the model.

According to the experts of Company C, as the tool performs the assessment of project performance covering the external factors, factors related to the public sector stakeholders and contractual issues besides the factors pertaining to the private sector stakeholders and the relevant processes, it can be regarded as holistic and comprehensive. The revealed performance rating values by the tool were evaluated as reasonable. As mentioned by the experts, since the system uses the factor importance weights derived by the knowledge and experience of the experts, the algorithm can be regarded as valid and it can be said that the system works well.

5.2.3.2 Experts' Commentaries on the Potential Benefits of the System for the Project Performance Prediction and Assessment Process

According to the experts of Company A, the tool provides the factors in the assessment process to be visible. Therefore, the system was considered to be beneficial in terms of the elaboration of the sub-items that have influence on the project performance and provision of a systematic and comprehensive approach for project performance assessment. It was mentioned that the system helps in identifying the shortcomings of the project and guides for improvement, and provides a means to strengthen these areas in the future projects.

As commented by the experts of Company B, the developed software facilitates the recording of the estimations and evaluations about the project, and by that means, provides the necessary monitoring and control on the relevant issues. It leads to the improvement of the deficient areas through binding the assessment process with a mathematical background. The experts of Company B mentioned that they may prefer to redefine the importance weights of the factors, as they had the opinion that the factors related to public sector stakeholders and their tasks should be assigned lower weights within the system. As denoted, if appropriate ratios are found, it will be useful to utilize the tool in the pre-tender stage of the project and monitor the changes throughout the project's life cycle.

According to the expert group of Company C, rather than focusing only on the internal factors for performance, the system provides a wide-angle assessment for the companies, indicating the importance of exogeneous factors such as factors related to the public sector stakeholders and the relationships among the stakeholders, which is beneficial in terms of the decision-making process. The system was also regarded as helpful by means of showing the impact of each deficiency on the performance rating. The reporting section, providing a means for observing which factors are important and to what extent, and which factor to focus on to improve another, was considered to be of value in terms of facilitating the decision-making process. According to the comments, the major advantage from the system can be gained by utilizing it in the tender stage. As denoted, during the course of the project, the project management teams and top management make performance estimations and monitor the actualized project performance with the use of the KPIs such as the accident rates, environmental damage, time delay, cost overrun and rework amount. As expressed, these evaluations show the financial result; but in terms of improving it, one needs to know the relevant process with the influences inherent in it and their effects on the outcome. It was mentioned that the tool provides an additional layer for this estimation and monitoring, by showing which areas are deficient and what to focus on for performance improvement, and guiding for the preparation of an improvement plan. The provided dependence diagrams were evaluated as beneficial in terms of showing the interrelationships that are normally ignored in the assessments, demonstrating a detailed map of what to consider at the first place. Along with the prediction of performance, selection of appropriate improvement strategies together with assessing their contribution to performance was regarded as a major benefit for the process. It was stated that the comparison of the baseline and the scenario assessments may also contribute to a cost-benefit analysis and guide the relevant resource allocation for various tasks. As these projects cover a long-term period, it was regarded as necessary to renew some parts of the evaluation in different phases of the project life cycle, provision of feedback during the course of the project and storing the different versions of the assessments. By that means, another primary benefit of the system was mentioned to be the compilation of lessons learned for the future projects. It was pointed out that by using the system, providing a snapshot of each project at the end of their construction period and recording the end results may also trigger performance improvement over time.

5.2.3.3 Experts' Commentaries on the Observed Problems in Using the System

Most of the commentaries made during the sessions were rather in the form of suggestions for the further improvement of the system. These recommendations are presented in Section 5.2.4, some of which also reflect the shortcomings of the system. One issue mentioned was concerned with the subjective nature of the assessment process, as the subjective judgments of the experts provide the basis for the evaluation. The experts stated that it is a shortcoming of most of the decision support tools and some measures were suggested to reduce the inherent subjectivity, which are also presented in the aforementioned section.

As the proposed tool has a web-based system, it was pointed out that securing the data storage is necessary. A password must be defined for each user and the confidentiality of the information and data entered into the system must be ensured. Another specified problem was concerned with the dependence diagrams, which were deemed complicated by some of the experts. It was denoted that it is not easy to grasp the relations between the success factors and interpret the demonstrated impacts for a user who is unfamiliar with the tool. It was stated that the mentioned section requires the detailed examination and concentration of the user, which may bring about a handicap for its utilization in practice.

5.2.3.4 Experts' Evaluation and Commentaries on the Six Primary Functions of the System

Through the expert groups' evaluations for the six major functions of the system, project registration, storage and retrieval function of the system received the highest performance score from the experts, as there was no divergence among the assigned scores regarding this function's effective delivery by the tool (Table 5.7). It was stated by the experts that the project registration interface is easy to use and involves the necessary project information. As denoted, the interface displaying the list of previous project evaluations enables easy retrieval of the registered projects and project scenarios. The other relatively better-established functions of the system were evaluated to be listing of the CSFs and performing the evaluation, reporting the results of the assessment, and proposing and displaying project performance improvement strategies, all of which attained a mean performance score of 4.67 out of 5.00. It was mentioned by all of the expert groups that the success factors included in the system had been identified properly and the assessment procedure is easy and understandable. The provided definitions of the factors were regarded as useful. It was expressed that the visual presentation of data facilitates the user's easy comprehension and assists in strategy development. Proposal of performance improvement strategies through lists provided in the respective pop-up windows and enabling for the registration of new project strategies by the user were considered to be among the major strengths of the developed tool. These functions were followed by the calculation and display of the project performance rating using the defined algorithm and the generation of alternative project scenarios, both with a mean score of 4.33 assigned with respect to their performance. The algorithm was deemed successful in terms of providing a reasonable result. The provided guidance for using the scenario generation component was regarded as effective. Overall, the performance of the proposed system was calculated with a mean score of 4.61 out of 5.00, as to the judgment of the experts.

With respect to the experts' evaluations on the contribution of the functions to project processes, the highest ranked functions were revealed to be listing of the success factors and performing the evaluation, and displaying the project performance improvement strategies, both with a mean score of 4.67. These functions were followed by the scenario generation function, which received a mean score of 4.33; and calculation and reporting functions, both with a mean score of 4.00. The lowest ranked factor in terms of its contribution to project processes was revealed to be the storage and retrieval function, with a mean score of 3.33. Different from the similarity observed in the evaluations of the experts with regards to the performance of the system functions, the expert groups' evaluations on the contribution of the functions to project processes varied. The major variation was observed in the evaluations of the experts of Company B, with relatively lower scores regarding the contribution of the tool, when compared to the scores assigned by the other expert groups. This was explained with the company's standpoint by the experts. The benefit of decision support systems was regarded as limited by the experts of Company B, due to the excessive time pressure inherent in these large-scale projects. It was opined that there is no such time for extensive planning and the pre-assessment of the decisions, but instead, the actions should be rapidly identified and implemented, in accordance with the company's management style. It was pointed out that instead of managing the tasks using exhaustive analysis, the company adopts a rather hands-on and responsive approach for the management of the projects, and therefore, the contribution of the system functions to project processes were evaluated with a mean score round about the medium level by the expert group of Company B. In the overall picture, the mean score of the proposed system with respect to its contribution to the project processes was calculated to be 4.17 out of 5.00.

Through the individual remarks of the experts, it was seen that different sections of the system were favored by different participants, which was regarded as a positive feedback for the developed decision support system. Those parts consisted of the dependence diagrams, listing and proposal of performance improvement strategies and the scenario generation. Proposal of strategies and scenario generation were considered to be the most beneficial functions in terms of the practical use of the tool. As stated, the scenario generation function is advantageous in terms of showing the potential effects of the selected strategies on the performance rating, while the option of comparing different scenarios was deemed very useful in terms of assisting the decision-making process.

Table 5.7. Experts' evaluation with regards to the six primary functions of the system

Function	Company A		Company B		Company C		Performance (Average)	Contribution (Average)
	Performance of the Function	Contribution of the Function to Project Processes	Performance of the Function	Contribution of the Function to Project Processes	Performance of the Function	Contribution of the Function to Project Processes		
1. Project registration, storage and retrieval	5	3	5	3	5	4	5.00	3.33
2. Listing of the critical success factors and performing the evaluation	5	5	4	4	5	5	4.67	4.67
3. Calculation and display of the performance rating using the defined algorithm	5	5	4	3	4	4	4.33	4.00
4. Reporting the results of the assessment as well as the strengths and weaknesses	4	4	5	3	5	5	4.67	4.00
5. Proposal and display of project performance improvement strategies	4	5	5	4	5	5	4.67	4.67
6. Creation of alternative project scenarios	5	5	4	3	4	5	4.33	4.33
Average	4.67	4.50	4.50	3.33	4.67	4.67	**4.61**	**4.17**

5.2.4 Recommendations Revealed Through the Test Sessions

The experts provided a number of valuable recommendations for the further improvement of the proposed decision support system, considering its practical use and its ultimate contribution to the projects. The recommendations obtained were two-folded: the first group is comprised of the ones related to the format and hence objected to enhance the visual performance of the tool, whereas the second group includes suggestions pertaining to the contents and capabilities of the tool, to provide the maximum benefit.

5.2.4.1 Recommendations to Improve the Visual Performance of the Tool

To facilitate the easy comprehension of the factors and the assessment reports, a color-code was suggested to be used in the designation of the factors throughout the entire system, to distinguish different factor groups. By that means, the factors of a cluster are always to be shown with the same color in the main assessment diagram, in the lists and graphs of reports, *etc.*, through which, the user can directly identify the cluster that the considered factor belongs to.

In addition to the assessment overview dashboard presented in Report 1, it was suggested that an importance-performance matrix can also be provided, using the same intervals. By that means, it can be possible to cluster the factors in the relevant sections of the matrix, showing the position of each factor in the overall picture. As a result, it can be possible to directly observe the intersection set of the indicators, *e.g.*, the intersection set of the factors with the highest importance and lowest performance.

The experts stated that it may be beneficial to provide a benchmark for the performance ratings of the registered projects via a graphical representation. By that means, the company may have the chance to see the performance of the project in the big picture and an overall snapshot of all of the executed projects' performance ratings. Indicating the level of average performance for the projects in the relevant diagram was also mentioned to be useful. Furthermore, it was asserted that demonstration with a diagram may also assist the comparison of the baseline and scenario assessments.

5.2.4.2 Recommendations to Improve the Contents of the Tool

As the expectations from a PPP project and the perception of performance may differ for various stakeholders, it was denoted to be advantageous to introduce various stakeholders to the system via adding an option to the project registration interface, enabling the selection of the stakeholder such as the Special Purpose Vehicle (SPV), public agency, public agency consultant and operator, as well as the main contractor. By that means, different stakeholders may define their own importance weights for the factors and it may be beneficial to categorize the evaluations with respect to different stakeholders.

Another recommendation concerned with the project registration interface was related to the information recorded. It was stated that, in addition to the provided items, it may be useful to store other project information such as percentage of cost overrun, percentage of time delay and percentage of rework. Thus, the obtained project performance rating can be interpreted by means of the actual project data provided.

To reduce the subjectivity inherent in the assessment process, several measures were suggested by the experts. The first one was the provision of detailed descriptions for the attributes of each level, to help the user for the proper assignment of the factor ratings. Together with the assigned factor ratings, it may be advantageous if the software also records the then-current attributes for the respective factor, to provide guidance in scenario generation or in the reassessment of the project performance in a different project phase, as well as in future assessments of other projects. Another recommendation given for the reduction of subjectivity was the utilization of a multiple-user assessment instead of a single-user entry. The system can be designed to enable a group evaluation on the respective project so that it can consolidate the evaluations of different individuals and reveal an ultimate project performance rating accordingly.

Regarding some of the factors, it was suggested that three distinct evaluations can be performed with respect to the design, construction and operation phases. This branching was considered to be necessary for a few relevant factors, to provide a more detailed assessment.

As a further improvement, it was asserted that the system can be reconfigured with a dynamic structure, so that it enables the definition of new parameters and their interrelations. Therefore, at the beginning of the assessment, the user may have the chance to identify all the valid factors for the project under consideration, and then, continue with weighting their importance and weighting the magnitude of the interrelationships between the factors. Accordingly, the dependence diagrams can also have a dynamic structure, which may result in an entirely customized assessment. Furthermore, with the utilization of a dynamic system, it may be advantageous if the user can select the modules to be used in the assessment. Thus, the user may focus only on the relevant clusters for the then-current phase of the project or on the clusters which the user intends to make a detailed assessment upon. For example, as desired, the user may form the assessment structure with the *Project Management* and *Design, Construction and Operation Processes* clusters only and provide a more detailed assessment for the relevant phases.

It was recommended by the experts that instead of having equal weights for each strategy, it may be beneficial to define the cost, risk and impact of implementing each strategy. This attribute can be integrated into the system by enabling the user to assign a cost and impact factor to each strategy, and accordingly, providing that the system reveals the performance rating of the scenario directly, in line with the defined weights of the selected strategies.

It was also mentioned to be useful if the actual outcome of an implemented strategy is also assessed and recorded in the system subsequent to the selection and implementation of the strategies. It may be helpful in the demonstration of the actual relation between the relevant strategy and performance.

5.2.4.3 Recommendation on an Alternative Utilization of the Tool

Another mentioned recommendation was concerned with the utilization of the system by the public agency, as the public agency has the information and experience with every single project case carried out. As denoted, evaluation of all of the executed PPP healthcare projects by the public agency may result in the provision of a snapshot of the PPP healthcare initiative of Turkey. This was indicated as a means to create a benchmark for the future PPP healthcare projects.

CHAPTER 6

CONCLUSIONS AND FURTHER WORK

In the final chapter are presented a brief outline of the study, the major findings and contribution of the study to the relevant literature, limitations of the study and a discussion of how this study may pave the way for future research.

6.1 Summary of the Research

PPP has become a major approach for delivering infrastructure projects in the last two decades, with the objectives including promoting infrastructure development, reducing the whole life costs, relieving the financial burden on the government budget and increasing construction and operation efficiencies by virtue of the private sector knowledge, expertise and capital. PPP schemes have also been increasingly used for the delivery of healthcare projects across the world. This is also valid for Turkey, which has been undertaking an infrastructure development program comprising a great number of healthcare projects planned to be delivered across the country. These projects cover a wide range of stakeholders, a long-term partnership period encompassing the project design, construction and operation phases, and a broad range of risks and uncertainties stemming from the contracts tying the stakeholders. Therefore, the vital importance of proper planning and delivery in accordance with the project objectives becomes prominent for these projects. These concerns were also consistent with the commentaries obtained in the preliminary interviews conducted with the experts from the private sector at the outset of the study. From this point of view, the key factors that determine the success of PPP healthcare projects were looked into and a gap was specified in the literature with respect to modeling the success of healthcare PPP projects in particular, with a holistic approach considering the interrelationships between the CSFs and integrating project performance improvement strategies. The aim was to develop a decision support system to provide guidance to contractors during the planning and execution phases of the projects undertaken, in terms of project performance assessment and improvement. In line with the aim of the study, an extensive literature review was carried out on several dimensions of PPPs and also on project success and the CSFs. The success factors with regards to construction projects, PPP projects and healthcare projects were explored, and accordingly, a conceptual framework was proposed for PPP healthcare project success. In-depth interviews were conducted with six experts from the private sector with the guidance of an assistive questionnaire which was formed on the basis of the conceptual framework. In light of the findings, the proposed framework was revised so as to be used in the subsequent phase of the research, which targeted the development of a success model for PPP healthcare projects using the ANP. For the construction of the model, a discussion session was held with the participation of five experts from the private sector. The interrelationships between the CSFs and between the factor clusters, and the relative importance of the model elements were assessed based on the experts' collective judgment, and the relative importance weights of the CSFs were derived accordingly. The model was tested via the assessment of two real projects' performance by the experts during the session, which yielded favorable results. At the subsequent phase, a decision support system was developed for PPP healthcare projects, based on the constructed model. The system was intended for the assessment of project performance, setting forth the projects' strengths and weaknesses, pointing out the most critical factors for the improvement of performance, visualizing the interrelationships between the CSFs and proposing performance improvement strategies for the project. The developed decision support system was tested on five real cases through the conducted expert discussion sessions and the results were found to be satisfactory. Recommendations were provided by the experts for the further improvement of the tool in terms of its visual performance and its contents.

6.2 Major Findings and Contribution

In this study, a framework was proposed for PPP healthcare projects, comprised of 33 CSFs organized in six groups. Using this framework, the success of PPP healthcare projects was modeled with the ANP, based on the collective judgment of experts from the private sector construction companies. The interrelationships between the factors and between the factor clusters were analyzed, and the relative importance weights of the CSFs for PPP healthcare projects were derived accordingly. The constructed model was tested on two real cases and the findings were reported. A decision support system targeting performance assessment and improvement in PPP healthcare projects was developed and tested via five real PPP healthcare projects provided by the expert groups from three leading construction companies in Turkey. Other contributions of the study and the major findings can be given as follows:

- With an extensive literature review, the current practices in Turkey with respect to the PPP healthcare projects were explored and discussed, as well as the practices in other countries, especially the UK.
- A thorough literature survey was carried out on studies related to success in construction projects, and the studies focusing on CSFs for (1) construction projects, (2) PPP projects and (3) healthcare projects were outlined. A research gap was determined which pertains to the in-depth analysis of PPP project success with a holistic approach and addressing the successful planning and delivery of PPP healthcare projects. Thus, it was objected to cover the CSFs together with the interrelationships between the factors and together with the relevant performance improvement strategies in the construction of the PPP healthcare project success model.
- As revealed through the initial interviews conducted with experts from the private sector, there was no defined process or formal procedure used for the identification and assessment of the factors or risks that may affect the success of the project, by the interviewed companies. The actions taken for the management of risk factors rather have a responsive basis. There is not a

tool devoted to the identification or assessment of the critical factors or risks in the project, being utilized by the companies. All of the expert groups regarded the process as challenging, with a great number of inherent risks and factors, and reported a semi-satisfaction with respect to their existing processes.

- Through the semi-structured interviews held with experts from the private sector, it was inferred that factors concerned with the green building implementation were not regarded as CSFs for the PPP healthcare projects. In the same manner, the importance of the *green building performance* criterion was assigned a lower weight compared to the other success criteria (*i.e.* on-time and on-budget delivery, conformity to quality specifications, profitability, conformity to health and safety requirements, functionality, participants' satisfaction, meeting design goals, contribution to the company's reputation and conformity to users' expectations) for PPP healthcare projects. According to the experts, successful green building implementation is associated with the planning and design phases of the project, and taking the necessary measures at the beginning of the project (*e.g.* early adoption of green principles and specifications in the design phase, working with an experienced and competent design firm as well as competent green building consultants) was mentioned as its enabler. Although not considered to be among the critical issues for PPP healthcare project success, green building implementation was regarded as important for the company's reputation and public interest.
- As to the obtained results, the factors with the highest importance weights in the model belong to the *Project Stakeholders*, *Financial Characteristics*, *Planning, Tender and Contracting Processes* and *External Environment* clusters, whereas factors of the *Project Management* and *Design, Construction and Operation Processes* clusters attained relatively lower importance weights. Accordingly, it was inferred that factors mainly under the control of a single party were deemed to be more manageable by the experts and attached a lower importance. This can be interpreted with the experts' perception of the factors related to public sector stakeholders'

characteristics and the processes undertaken by those stakeholders, factors that require an integrated contribution of both public and private sectors, and also the factors related to the external environment and financial characteristics, which were regarded as the sources of risk threatening the successful planning and delivery of the project. That also indicates the high importance attached to the project preparation phase and stakeholder assemble for project success, together with the planning efforts.

- According to the results of the study, the highest ranked factors for the success of PPP healthcare projects are contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model; inclusion of investors and sponsors with sufficient financial strength in the project; and public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model. These were regarded as the components forming the backbone of a successful project, together with provision of adequate government guarantees and preparation of comprehensive and clear final contract documentation by the public agency and the contractor.
- As revealed by the results of the analysis, the lowest ranked factors for the success of PPP healthcare projects are convenient location, favorable weather and site conditions; establishment of a proper documentation system for the project and storage of lessons learned through an accessible PPP projects database; ensuring the proper transfer of the facility to the public authority at the end of the contract phase; and suppliers' experience, competence, commercial strength and long-term accessibility, in the descending order. Although being uncontrollable, it was noted by the experts that the factor concerning the convenient location, weather and site conditions is not critical since this factor was considered to be manageable with proper planning and implementation processes. The factor on the establishment of a proper documentation system for the project and storage of lessons learned through an accessible PPP projects database was also revealed to be less influential for project success when compared to the others. This can be due to the

difficulty of properly implementing the factor and observing its impact on the performance outcomes, as it requires a comprehensive process and a considerable time to exploit its potential benefits. The reason for the factor concerned with ensuring the proper transfer of the facility to the public authority at the end of the contract phase to attain a relatively low importance weight can be the experts' assumption that the proper operation of the facility may bring about the successful transfer of the facility at the end of the operation period. Regarding the suppliers' experience, competence, commercial strength and long-term accessibility, the reason for the low importance attached can be related to the experts' perception that this factor is rather manageable, since single-party control is also valid for this factor.

- When evaluated as a whole, it was inferred that the experience and competencies of the major stakeholders, strong project sponsors, public agency's contribution and support throughout the project, controlling major financial risks, sophistication of project requirements and scope, and elaboration and inclusiveness of the final contract were revealed as the most important determinants of PPP healthcare project success.

6.3 Limitations of the Study

One of the bottlenecks of the study lies in the subjective nature of the assessment utilized for the ANP. The evaluations were based on the subjective judgments of the experts participated in the model development session. Due to the confidentiality issues with regards to these projects, it was not possible to support or validate the subjective judgments of the experts with the provision of documentation for the projects, such as corporate reports, progress charts, financial data, *etc*.

The implementation of the ANP was carried out based on the judgments made by an expert group comprised of five professionals of a company. Involvement of more companies in this process could have revealed more generic results, with the reflection of various perceptions on the subject domain. On the other hand, it was not possible regarding the scope of this study, as the ANP method has some limitations with regards to practicality. In proportion with the number of parameters included in the model and the number of interrelations constructed between the parameters, the number of matrices used to build the ANP model also increases and the pairwise comparison process becomes burdensome. To overcome this shortcoming to an extent, it was attempted to reduce the number of parameters involved in the model and the insignificant links between the model parameters were ignored.

In order to minimize the inherent subjectivity within the process, engaging a large number of experts' independent evaluations for the determination of the importance weights of the factors within the system could be applied. On the other hand, considering the scope of this study, using consensus decision making approach was favored to using a geometric mean of the experts' evaluations for the comparison of the elements in the system, as it was believed that the brainstorming within the session was beneficial in terms of preventing misunderstandings on the relevant issues, to obtain a more valid assessment. Furthermore, for ensuring consistency in the evaluations, hosting a collective discussion session provided practicality, as the evaluations were reviewed on spot and the necessary revisions were made in order to provide the consistency in pairwise comparisons by monitoring the inconsistency ratio revealed by the software.

Considering the total number of PPP healthcare projects carried out in Turkey, the assessed projects comprise a considerable majority of the complete set and accordingly, the sample size of the study can be regarded as satisfactory. Also, the projects covered in the study are the prominent ones due to their scale and features. In a similar vein, the companies participated in the study are the leading ones in this area, owing to their extensive PPP project portfolio and experience in this specific project type. On the other hand, conclusions are not generic and only reflect the subjective evaluations of the experts taken part in the study. The derived importance weights of the CSFs may not be suitable for the use of all companies due to different perceptions. To overcome this bottleneck, the proposed decision support system was provided with an option to enable the user to assess the relative importance of the factors at the outset and perform the assessment with the user-defined weights instead of the default ones. It is believed that the whole assessment process should be custom-made, for it to meet the organization’s expectations precisely.

Although the factors were extracted with an extensive literature review, the gathered data are mostly valid for the Turkish construction sector. The semi-structured interviews and the model development session were conducted with experts from the Turkish construction sector and the cases used in model testing were PPP healthcare projects carried out in Turkey. Therefore, the proposed framework and the constructed PPP healthcare project success model may be inclined to reflect the characteristics of the PPP healthcare construction projects executed in Turkey. On the other hand, the model can be adapted to other cases in different countries, as well as to other types of PPP projects in Turkey.

Another limitation is concerned with the proposed decision support system, as the user cannot rearrange the factors included in the model. Adding or removing factors is not possible since the interaction of the system with the ANP software could not be provided due to the restrictions inherent in the Super Decisions Software.

The performance of the decision support system was tested on five real projects, assessed by expert groups from three different companies. The major aim was to provide in-depth commentaries of the experts with regards to the revealed project performance rating, different functions of the system and potential contribution of the system to project processes. In order to justify the prediction capability of the model, five cases are not sufficient. On the other hand, this was not within the scope of this study and the results provided a preliminary idea about the model’s prediction potential.

Although the tool was tested on five projects through sessions held with the participation of experts, the tool’s usability was not tested with a specific usability test, which can be conducted in a laboratory environment. Usability tests are aimed at analyzing attributes such as the effectiveness of the tool, learnability provided by the tool, its user guidance capability and ease of use. On the other hand, in the testing and validation phase, the emphasis was given to the tool's performance with respect to its assessment capability and decision support objective, and the contribution of its functions to the project processes of the construction companies.

6.4 Recommendations for Further Work

In the proposed CSFs framework, each factor was provided with a number of definitive sub-items to provide a comprehensive layout. In the proposed system, these items support the evaluation process by providing insight for the factors. Further work might be of value, in which, these definitive sub-items are redefined as sub-factors and the fuzzy borders between these sub-factors are considered in the analysis, to provide a more precise evaluation for each factor.

As it was mentioned among the limitations of the study, the ANP used for model construction has impracticalities in dealing with a large number of factors and their interrelationships. On the other hand, due to the constrains encountered in accessing real project data, the ANP was determined as the most appropriate method for the development of the model. However, with the provision of sufficient amount of project data in future studies, artificial intelligence techniques can be used to construct the performance assessment model. By that means, a more objective assessment is to be performed and the prediction capacity of the tool is to be enhanced. Artificial neural networks, expert systems and case-based reasoning are examples of such techniques which can be used to detect the patterns and relationships in data. Therefore, the model can be built with weighted inputs and transfer function, and the output can be predicted accordingly, which is the project performance rating in this case. On the other hand, this requires real project data related to cost performance, schedule performance, rework amount, accident rates, *etc.*, with respect to a large number of projects. Thus, a knowledge base can be formed, which is to be utilized in the revealing of meaningful rules for the prediction of the project performance rating, based on facts rather than subjective judgment. On the other hand, the artificial intelligence techniques lack explanation capability. As this study targets decision support on project performance improvement rather than performance prediction, these methods also have shortcomings with respect to the scope of this research.

The success model was constructed with 33 CSFs, which were obtained as a result of an extensive literature review and preliminary expert interviews. On the other hand, in future work, the model used within the decision support system can be reconfigured with a dynamic basis, enabling the user to add or remove factors, reconstruct the links between the factors, assess the interrelationships between the factors and the importance of the factors, and derive the relative importance weights of the factors accordingly. In this way, the dependence diagrams may also have a dynamic structure and the user may be provided with an entirely custom-made system.

The proposed decision support system addresses the contractors within the PPP project organization. The system can be developed in a way to provide access to different PPP project stakeholders, such as the SPV, public agency, public agency consultant and the operator, as well as the main contractor. It may be of value if stakeholder-specific models are constructed and integrated into the system, as the expectations and perceptions of each stakeholder with regards to project performance may vary.

The strategies embedded within the system were extracted from the reviewed studies of literature and arranged in line with the experts' commentaries obtained during the interviews and during the ANP model development session. With further work, the strategies can be augmented and the risk factor and impact of implementing each strategy can be explored. This may also contribute to the scenario generation component of the proposed system, by providing a means to assess the outcome of each strategy on a more objective basis.

As to the scope of this study, the private sector experts' judgment was utilized for the enhancement of the preliminary project success framework and for the development of the PPP Healthcare Project Success Model. On the other hand, the success factors involved are multidimensional and address the performance assessment of a PPP healthcare project as a whole. Therefore, besides construction companies, the proposed tool is applicable for the public-sector stakeholders as well. The tool can be used by the public agency to provide a snapshot of the PPP healthcare projects carried out throughout the country and by that means, a benchmark can be created for the future projects.

For the effective use and exploitation of a decision support system to its full potential, the company culture can be regarded as the determining factor. For the firms that adopt a management style based on responsive actions rather than adopting a proactive approach, in which the organizational culture is rather immature, the contribution and benefit of decision support systems are considered to be limited. The attitude of such organizations may not lean towards the usage of tools and other implementations of information technology, and thus, the provided benefits of using a decision support system will be limited.

Each company may have different perceptions of project success. In line with its perception, each company has its own targets and should develop its company and project strategies accordingly. Therefore, it is believed that the performance assessment process should be custom-made, tailored to the perception and expectations of the company and to the characteristics and objectives of each project. To meet this need, a decision support system should enable customization. Hence, in the development of the tool, it may be proper to apply in-depth analysis through a single-case study research. This approach may enable to carry out an exploratory study providing more insight into a company's processes, practices and culture, and lead to the development of a case-specific decision support system accordingly.

REFERENCES

Abdel Aziz, A. M. (2007). Successful delivery of public-private partnerships for infrastructure development. *Journal of Construction Engineering and Management*, 133(12), 918-931.

Abdou, A. and Al Zarooni, S. (2011). Preliminary critical success factors of public private partnership (PPP) in UAE public healthcare projects. *Sixth International Conference on Construction in the 21st Century (CITC-VI): Construction Challenges in the New Decade, 5-7 July 2011, Kuala Lumpur, Malaysia*. Paper 23, pp. 208-216.

Abdou, A., Al Zarooni, S. and Lewis, J. (2005). Risk identification and rating for public healthcare projects in the United Arab Emirates. *RICS COBRA 2005: The Construction, Building and Real Estate Research Conference of the Royal Institution of Chartered Surveyors, 4-5 July 2005, Brisbane, Australia*.

Akintoye, A. (2007). Developments in the UK public private partnerships: lessons for the new PPP ventures. *2007 International Conference on Concession Public/Infrastructural Projects (ICCPIP), 24-26 August 2007, Dalian University of Technology, China*. Keynote Paper.

Akintoye, A., Beck, M., Hardcastle, C., Chinyio, E. and Asenova, D. (2001). *Framework for risk assessment and management of private finance initiative projects*. Working Paper, Glasgow Caledonian University, Scotland, UK.

Akintoye, A. and Chinyio, E. (2005). Private finance initiative in the healthcare sector: trends and risk assessment. *Engineering, Construction and Architectural Management*, 12(6), 601-616.

Akintoye, A., Hardcastle, C., Beck, M., Chinyio, E. and Asenova, D. (2003). Achieving best value in private finance initiative project procurement. *Construction Management and Economics*, 21(5), 461–470.

Algarni, A. M., Arditi, D. and Polat, G. (2007). Build-operate-transfer in infrastructure projects in the United States. *Journal of Construction Engineering and Management*, 133(10), 728-735.

Almarri, K. and Boussabaine, H. (2017). Interdependency of the critical success factors and ex-post performance indicators of PPP projects. *Built Environment Project and Asset Management*, 7(5), 546-556.

Al-Saadi, R. and Abdou, A. (2016). Factors critical for the success of public-private partnerships in UAE infrastructure projects: experts' perception. *International Journal of Construction Management*, 16(3), 234-248.

Alzahrani, J. I. and Emsley, M. W. (2013). The impact of contractors' attributes on construction project success: a post construction evaluation. *International Journal of Project Management*, 31(2), 313-322.

Ashley, D. B., Laurie, C. S. and Jaselskis, E. J. (1987). Determinants of construction project success. *Project Management Journal*, 18(2), 69-79.

Babatunde, S. O., Opawole, A. and Akinsiku, O. E. (2012). Critical success factors in public-private partnership (PPP) on infrastructure delivery in Nigeria. *Journal of Facilities Management*, 10(3), 212-225.

Bassioni, H. A., Price, A. D. F. and Hassan, T. M. (2005). Building a conceptual framework for measuring business performance in construction: an empirical evaluation. *Construction Management and Economics*, 23(5), 495-507.

Belassi, W. and Tukel, O. I. (1996). A new framework for determining critical success/failure factors in projects. *International Journal of Project Management*, 14(3), 141-151.

Blanken, A. and Dewulf, G. (2010). PPPs in health: static or dynamic? *Australian Journal of Public Administration*, 69(1), 35-47.

Boynton, A. C. and Zmud, R. W. (1984). An assessment of critical success factors. *Sloan Management Review*, 25(4), 17-27.

Boz, S. S. (2013). Public private partnership (PPP) model [Kamu özel işbirliği (PPP) modeli]. *İnönü Üniversitesi Hukuk Fakültesi Dergisi*, 4(2), 277-332.

Broadbent, J. and Laughlin, R. (2003). Public private partnerships: an introduction. *Accounting, Auditing & Accountability Journal*, 16(3), 332-341.

Bu-Qammaz, A. S., Dikmen, I. and Birgonul, M. T. (2009). Risk assessment of international construction projects using the analytic network process. *Canadian Journal of Civil Engineering*, 36(7), 1170–1181.

Chan, A. P. C. and Chan, A. P. L. (2004). Key performance indicators for measuring construction success. *Benchmarking: An International Journal*, 11(2), 203-221.

Chan, A. P. C., Ho, D. C. K. and Tam, C. M. (2001). Design and build project success factors: multivariate analysis. *Journal of Construction Engineering and Management*, 127(2), 93-100.

Chan, A. P. C., Lam, P. T. I., Chan, D. W. M. and Cheung, E. (2008). Application of public private partnership (PPP) in Hong Kong special administrative region: the critics' perspectives. *First International Conference on Construction in Developing Countries (ICCIDC-I): Advancing and Integrating Construction Education, Research and Practice, 4-5 August 2008, Karachi, Pakistan*. pp. 302-311.

Chan, A. P. C., Lam, P. T. I., Chan, D. W. M., Cheung, E. and Ke, Y. (2010). Critical success factors for PPPs in infrastructure developments: Chinese perspective. *Journal of Construction Engineering and Management*, 136(5), 484-494.

Chan, A. P. C., Scott, D. and Chan, A. P. L. (2004). Factors affecting the success of a construction project. *Journal of Construction Engineering and Management*, 130(1), 153-155.

Chan, A. P. L., Chan, A. P. C. and Chan, D. W. M. (2005). An empirical survey of the success criteria for running healthcare projects. *Architectural Science Review*, 48(1), 61-68.

Chen, Z., Li, H. and Wong, C. T. C. (2005). EnvironalPlanning: analytic network process model for environmentally conscious construction planning. *Journal of Construction Engineering and Management*, 131(1), 92–101.

Chen, Y. Q., Zhang, Y. B., Liu, J. Y. and Mo, P. (2012). Interrelationships among critical success factors of construction projects based on the structural equation model. *Journal of Management in Engineering*, 28(3), 243-251.

Cheng, E. W. L. and Li, H. (2004). Contractor selection using the analytic network process. *Construction Management and Economics*, 22(10), 1021-1032.

Cheng, E. W. L. and Li, H. (2005). Analytic network process applied to project selection. *Journal of Construction Engineering and Management*, 131(4), 459-466.

Cheng, E. W. L., Li, H. and Yu, L. (2005). The analytic network process (ANP) approach to location selection: a shopping mall illustration. *Construction Innovation*, 5(2), 83–97.

Cheung, E., Chan, A. P. C. and Kajewski, S. (2012). Factors contributing to successful public private partnership projects: comparing Hong Kong with Australia and the United Kingdom. *Journal of Facilities Management*, 10(1), 45-58.

Cho, K. M., Hong, T. H. and Hyun, C. T. (2009). Effect of project characteristics on project performance in construction projects based on structural equation model. *Expert Systems with Applications*, 36(7), 10461-10470.

Chou, J. S. and Pramudawardhani, D. (2015). Cross-country comparisons of key drivers, critical success factors and risk allocation for public-private partnership projects. *International Journal of Project Management*, 33(5), 1136-1150.

Chou, J. S., Tserng, H. P., Lin, C. and Yeh, C. P. (2012). Critical factors and risk allocation for PPP policy: comparison between HSR and general infrastructure projects. *Transport Policy*, 22, 36-48.

Chowdhury, A. N., Chen, P. H. and Tiong, R. L. K. (2011). Analysing the structure of public–private partnership projects using network theory. *Construction Management and Economics*, 29(3), 247–260.

Chua, D. K. H., Kog, Y. C. and Loh, P. K. (1999). Critical success factors for different project objectives. *Journal of Construction Engineering and Management*, 125(3), 142-150.

Chua, D. K. H., Kog, Y. C., Loh, P. K. and Jaselskis, E. J. (1997). Model for construction budget performance: neural network approach. *Journal of Construction Engineering and Management*, 123(3), 214-222.

Collin, J. (2002). *Measuring the success of building projects: improved project delivery initiatives*. Queensland Department of Public Works, Brisbane, Australia.

Cooke-Davies, T. (2002). The "real" success factors on projects. *International Journal of Project Management*, 20(3), 185-190.

Cruz, C. O. and Marques, R. C. (2011). Contribution to the study of PPP arrangements in airport development, management and operation. *Transport Policy*, 18(2), 392-400.

Cruz, C. O. and Marques, R. C. (2013). Integrating infrastructure and clinical management in PPPs for health care. *Journal of Management in Engineering*, 29(4), 471-481.

Delmon, J. and Delmon, V. R. (2010). *International project finance and PPPs: a legal guide to key growth markets*. The Netherlands: Kluwer Law International BV.

De Wit, A. (1986). Measuring project success: an illusion. *18th Annual Seminar/Symposium, Project Management Institute, Montreal, Canada*. pp. 13-21.

Dikmen, I., Birgonul, M. T. and Ozorhon, B. (2007). Project appraisal and selection using the analytic network process. *Canadian Journal of Civil Engineering*, 34(7), 786-792.

Dikmen, I., Birgonul, M. T., Ozorhon, B. and Egilmezer Sapci, N. (2010). Using analytic network process to assess business failure risks of construction firms. *Engineering, Construction and Architectural Management*, 17(4), 369-386.

Doulabi, R. Z. and Asnaashari, E. (2016). Identifying success factors of healthcare facility construction projects in Iran. *Procedia Engineering*, 164, 409-415.

El-Abbasy, M. S., Zayed, T., Ahmed, M., Alzraiee, H. and Abouhamad, M. (2013). Contractor selection model for highway projects using integrated simulation and analytic network process. *Journal of Construction Engineering and Management*, 139(7), 755-767.

European Commission. (2003). *Guidelines for successful public-private partnerships* [online]. [Viewed 5 May 2018]. Available from: http://ec.europa.eu/regional_policy/sources/docgener/guides/ppp_en.pdf

European Investment Bank. (2004). *The EIB's role in public-private partnerships (PPPs)* [online]. [Viewed 5 May 2018]. Available from: http://www.eib.org/attachments/thematic/eib_ppp_en.pdf

European Investment Bank. (2012). *The guide to guidance: how to prepare, procure and deliver PPP projects* [online]. [Viewed 5 May 2018]. Available from: https://ppp.worldbank.org/public-private-partnership/sites/ppp.worldbank.org/files/documents/EPEC_Guide%20to%20Guidance_EN.pdf

Flyvbjerg, B., Bruzelius, N. and Rothengatter, W. (2003). *Megaprojects and risk: an anatomy of ambition*. Cambridge: Cambridge University Press.

Galvin, R. (2003). Purchasing health care: an opportunity for a public-private partnership. *Health Affair*, 22(2), 191-195.

Grimsey, D. and Lewis, M. K. (2002). Evaluating the risks of public private partnerships for infrastructure projects. *International Journal of Project Management*, 20(2), 107-118.

Gudiene, N., Banaitis, A. and Banaitiene, N. (2013). Evaluation of critical success factors for construction projects: an empirical study in Lithuania. *International Journal of Strategic Property Management*, 17(1), 21-31.

Gultekin, P., Korkmaz, S., Riley, D. R. and Leicht, R. M. (2013). Process indicators to track effectiveness of high-performance green building projects. *Journal of Construction Engineering and Management*, 139(12).

Gurgun, A. P. and Touran, A. (2014). Public-private partnership experience in the international arena: case of Turkey. *Journal of Management in Engineering*, 30(6).

Handley-Schachler, M. and Gao, S. S. (2003). Can the private finance initiative be used in emerging economies? - lessons from the UK's successes and failures. *Managerial Finance*, 29(5/6), 36-51.

Hashim, H. A., Sapri, M. and Low, S. T. (2016). Public private partnership (PPP) facilities management for healthcare services in Malaysia: the challenges of implementation. *Journal of Facilities Management*, 14(4), 350-362.

Hatush, Z. and Skitmore, M. (1997). Evaluating contractor prequalification data: selection criteria and project success factors. *Construction Management and Economics*, 15(2), 129-147.

He, Q., Luo, L., Hu, Y. and Chan, A. P. C. (2015). Measuring the complexity of mega construction projects in China: a fuzzy analytic network process analysis. *International Journal of Project Management*, 33(3), 549-563.

HM Treasury. (2006). *Value for money assessment guidance* [online]. Norwich: Crown Copyright. [Viewed 16 June 2018]. Available from: http://webarchive.nationalarchives.gov.uk/20130103024255/www.hm-treasury.gov.uk/d/vfm_assessmentguidance061006opt.pdf

Hwang, B. G. and Lim, E. S. J. (2013). Critical success factors for key project players and objectives: case study of Singapore. *Journal of Construction Engineering and Management*, 139(2), 204-215.

Islamoglu, A. (1998). *Privatisation and the use of concession contracts in Turkey*. Unpublished MPhil Dissertation, The University of Manchester Institute of Science and Technology, UK.

Jacobson, C. and Choi, S. O. (2008). Success factors: public works and public-private partnerships. *International Journal of Public Sector Management*, 21(6), 637-657.

Jamali, D. (2004). Success and failure mechanisms of public private partnerships (PPPs) in developing countries. *International Journal of Public Sector Management*, 17(5), 414-430.

Jaselskis, E. J. and Ashley, D. B. (1991). Optimal allocation of project management resources for achieving success. *Journal of Construction Engineering and Management*, 117(2), 321-340.

Javed, A. A., Lam, P. T. I. and Chan, A. P. C. (2013). A model framework of output specifications for hospital PPP/PFI projects. *Facilities*, 31(13/14), 610-633.

Jefferies, M., Gameson, R. and Rowlinson, S. (2002). Critical success factors of the BOOT procurement system: reflections from the Stadium Australia case study. *Engineering, Construction and Architectural Management*, 9(4), 352-361.

Jia, G., Ni, X., Chen, Z., Hong, B., Chen, Y., Yang, F. and Lin, C. (2013). Measuring the maturity of risk management in large-scale construction projects. *Automation in Construction*, 34, 56-66.

Kagiannas, A. G., Patlitzianas, K. D. and Psarras, J. (2003). *The role of build operate transfer in promoting RES projects* [online]. European Commission (Directorate-General for Energy and Transport). [Viewed 16 June 2018]. Available from: http://www.opet-chp.net/download/wp6/epuntua_theroleofbuildoperatetransferinpromotingresproject.pdf

Kagioglou, M., Cooper, R. and Aouad, G. (2001). Performance management in construction: a conceptual framework. *Construction Management and Economics*, 19(1), 85-95.

Karahanogullari, Y. (2012). Financial assessment of the public private partnership model [Kamu özel ortaklığı modelinin mali değerlendirmesi]. *Ankara Üniversitesi SBF Dergisi*, 67(2), 95-125.

Karasu, K. (2011). Public-private partnership in the organization of health services [Sağlık hizmetlerinin örgütlenmesinde kamu-özel ortaklığı]. *Ankara Üniversitesi SBF Dergisi*, 66(3), 217-262.

Ke, Y., Wang, S., Chan, A. and Cheung, E. (2009). Research trend of public-private partnership in construction journals. *Journal of Construction Engineering and Management*, 135, 1076-1086.

Keating, M. (1998). Commentary: public-private partnerships in the United States from a European perspective. In: J. Pierre, ed. *Partnerships in urban governance: European and American experience*. New York: St Martin's Press. pp. 163-186.

Kog, Y. C., Chua, D. K. H., Loh, P. K. and Jaselskis, E. J. (1999). Key determinants for construction schedule performance. *International Journal of Project Management*, 17(6), 351-359.

Koppenjan, J. (2005). The formation of public-private partnerships: lessons from nine transport infrastructure projects in the Netherlands. *Public Administration*, 83(1), 135-157.

Korkmaz, S., Riley, D. and Horman, M. (2010). Piloting evaluation metrics for sustainable high-performance building project delivery. *Journal of Construction Engineering and Management*, 136(8), 877-885.

Korkmaz, S., Riley, D. and Horman, M. (2011). Assessing project delivery for sustainable, high-performance buildings through mixed methods. *Architectural Engineering and Design Management*, 7(4), 266-274.

Kumaraswamy, M. M. and Morris, D. A. (2002). Build-operate-transfer-type procurement in Asian megaprojects. *Journal of Construction Engineering and Management*, 128(2), 93-102.

Kwak, Y. H., Chih, Y. Y. and Ibbs, C. W. (2009). Towards a comprehensive understanding of public private partnerships for infrastructure development. *California Management Review*, 51(2), 52-78.

Lam, E. W. M., Chan, A. P. C. and Chan, D. W. M. (2008). Determinants of successful design-build projects. *Journal of Construction Engineering and Management*, 134(5), 333-341.

Leiringer, R. (2003). *Technological innovations in the context of public-private partnership projects*. Unpublished Ph.D. Thesis, Royal Institute of Technology, Stockholm.

Levy, S. M. (1996). *Build, operate, transfer: paving the way for tomorrow's infrastructure*. New York: John Wiley & Sons.

Li, B. (2003). *Risk management of construction public private partnership projects*. Unpublished Ph.D. Thesis, Glasgow Caledonian University, UK.

Li, B. and Akintoye, A. (2003). An overview of public-private partnership. In: A. Akintoye, M. Beck and C. Hardcastle, eds. *Public-private partnerships: managing risks and opportunities*. Oxford: Blackwell Science. pp. 3-30.

Li, B., Akintoye, A., Edwards, P. J. and Hardcastle, C. (2005a). Critical success factors for PPP/PFI projects in the UK construction industry. *Construction Management and Economics*, 23(5), 459-471.

Li, B., Akintoye, A., Edwards, P. J. and Hardcastle, C. (2005b). The allocation of risk in PPP/PFI construction projects in the UK. *International Journal of Project Management*, 23(1), 25-35.

Li, Y. Y., Chen, P. H., Chew, D. A. S., Teo, C. C. and Ding, R. G. (2011). Critical project management factors of AEC firms for delivering green building projects in Singapore. *Journal of Construction Engineering and Management*, 137(12), 1153-1163.

Lim, C. S. and Mohamed, M. Z. (1999). Criteria of project success: an exploratory re-examination. *International Journal of Project Management*, 17(4), 243-248.

Ling, F. Y. Y., Chan, S. L., Chong, E. and Ee, L. P. (2004). Predicting performance of design-build and design-bid-build projects. *Journal of Construction Engineering and Management*, 130(1), 75-83.

Liu, J., Love, P. E. D., Davis, P. R., Smith, J. and Regan, M. (2015a). Conceptual framework for the performance measurement of public-private partnerships. *Journal of Infrastructure Systems*, 21(1).

Liu, J., Love, P. E. D., Smith, J., Regan, M. and Davis, P. R. (2015b). Life cycle critical success factors for public-private partnership infrastructure projects. *Journal of Management in Engineering*, 31(5).

Mbugua, L. M., Harris, P., Holt, G. D. and Olomolaiye, P. O. (1999). A framework for determining critical success factors influencing construction business performance. In: W. Hughes, ed. *15th Annual Association of Researchers in Construction Management (ARCOM) Conference, 5-7 September 1999, Liverpool John Moores University, Reading*. pp. 255-264.

Mohr, J. and Spekman, R. (1994). Characteristics of partnership success: partnership attributes, communication behavior, and conflict resolution techniques. *Strategic Management Journal*, 15(2), 135-152.

Molenaar, K. R. and Songer, A. D. (1998). Model for public sector design-build project selection. *Journal of Construction Engineering and Management*, 124(6), 467-479.

Morledge, R. and Owen, K. (1998). Critical success factors in PFI projects. In: W. Hughes, ed. *14th Annual Association of Researchers in Construction Management (ARCOM) Conference, 9-11 September 1998, University of Reading, Reading, UK*. pp. 565-574.

Mustafa, A. (1999). Public-private partnership: an alternative institutional model for implementing the private finance initiative in the provision of transport infrastructure. *The Journal of Structured Finance*, 5(1), 56-71.

Ng, S. T., Wong, Y. M. W. and Wong, J. M. W. (2012). Factors influencing the success of PPP at feasibility stage: a tripartite comparison study in Hong Kong. *Habitat International*, 36(4), 423-432.

Nguyen, L. D., Ogunlana, S. O. and Lan, D. T. X. (2004). A study on project success factors in large construction projects in Vietnam. *Engineering, Construction and Architectural Management*, 11(6), 404-413.

Nikolic, I. A. and Maikisch, H. (2006). *Public-private partnerships and collaboration in the health sector: an overview with case studies from recent European experience*. Health, Nutrition and Population (HNP) Discussion Paper, The World Bank, Washington, DC.

Ofori-Boadu, A., Owusu-Manu, D. G., Edwards, D. and Holt, G. (2012). Exploration of management practices for LEED projects: lessons from successful green building contractors. *Structural Survey*, 30(2), 145-62.

Osei-Kyei, R. and Chan, A. P. C. (2017). Perceptions of stakeholders on the critical success factors for operational management of public-private partnership projects. *Facilities*, 35(1/2), 21-38.

Osei-Kyei, R., Chan, A. P. C. and Ameyaw, E. E. (2017). A fuzzy synthetic evaluation analysis of operational management critical success factors for public-private partnership infrastructure projects. *Benchmarking: An International Journal*, 24(7), 2092-2112.

Owen, K. J. (1997). *Critical success factors of PFI*. May 1997, Unpublished Dissertation.

Ozcan, B. (2015). *Analysing public private partnership model in Turkish Healthcare Sector: things to consider during the implementation process and lessons from the UK experience*. Unpublished MSc Dissertation, The University of Edinburgh, UK.

Ozorhon, B., Dikmen, I. and Birgonul, M. T. (2007). Using analytic network process to predict the performance of international construction joint ventures. *Journal of Management in Engineering*, 23(3), 156-163.

Parfitt, M. K. and Sanvido, V. E. (1993). Checklist of critical success factors for building projects. *Journal of Management in Engineering*, 9(3), 243-249.

Payne, H. (1997). Key legal issues in projects procured under the private finance initiative. *Engineering, Construction and Architectural Management*, 4(3), 195-202.

Polat, G. and Donmez, U. (2010). ANP-based marketing activity selection model for construction companies. *Construction Innovation*, 10(1), 89-111.

Pongsiri, N. (2002). Regulation and public-private partnerships. *International Journal of Public Sector Management*, 15(6), 487-495.

Qiao, L., Wang, S. Q., Tiong, R. L. K. and Chan, T. S. (2001). Framework for critical success factors of BOT projects in China. *The Journal of Structured Finance*, 7(1), 53-61.

Rebeiz, K. S. (2012). Public-private partnership risk factors in emerging countries: BOOT illustrative case study. *Journal of Management in Engineering*, 28(4), 421-428.

Renda, A. and Schrefler, L. (2006). *Public-private partnerships national experiences in the European Union* [online]. Briefing Note, European Parliament. [Viewed 16 June 2018]. Available from: http://www.europarl.europa.eu/RegData/etudes/note/join/2006/369858/IPOL-IMCO_NT(2006)369858_EN.pdf

Republic of Turkey Ministry of Development. (2012). *Developments regarding the implementations of public-private cooperation in the world and in Turkey* [*Dünyada ve Türkiye'de kamu-özel işbirliği uygulamalarına ilişkin gelişmeler*]. Yatırım Programlama İzleme ve Değerlendirme Genel Müdürlüğü. [Viewed 10 March 2018]. Available from: http://www.kalkinma.gov.tr/KamuOzelIsbirligiYayinlar/2_Password_Removed.pdf

Republic of Turkey Ministry of Development. (2014). *The tenth development plan 2014-2018* [online]. Public Private Cooperation Specialized Commission Report. [Viewed 10 March 2018]. Available from: http://www.kalkinma.gov.tr/Pages/OzelIhtisasKomisyonuRaporlari.aspx

Republic of Turkey Ministry of Health. (2011). *Republic of Turkey Ministry of Health planning guide for healthcare facilities* [*T.C. Sağlık Bakanlığı yataklı sağlık tesisleri planlama rehberi*] [online]. Tedavi Hizmetleri Genel Müdürlüğü. [Viewed 05 July 2018]. Available from: http://rapor.saglik.gov.tr/SHGM/shgm_yatirim.pdf

Republic of Turkey Ministry of Health General Directorate of Health Investments. (2018). City hospitals [Şehir hastaneleri] [online]. [Viewed 05 July 2018]. Available from: http://www.saglikyatirimlari.gov.tr/TR,33960/sehir-hastaneleri.html

Robichaud, L. B. and Anantatmula, V. S. (2011). Greening project management practices for sustainable construction. *Journal of Management in Engineering*, 27(1), 48-57.

Robinson, H. S. and Scott, J. (2009). Service delivery and performance monitoring in PFI/PPP projects. *Construction Management and Economics*, 27(2), 181-197.

Rockart, J. F. (1982). The changing role of the information systems executive: a critical success factors perspective. *Sloan Management Review*, 24(1), 3-13.

Saaty, T. L. (2000). *Fundamentals of decision making with the analytic hierarchy process*. Pittsburgh, PA: RWS Publications.

Saaty, T. L. (2001). Decision-making with the AHP: why is the principal eigenvector necessary? *Sixth International Symposium on the Analytic Hierarchy Process (ISAHP), 2-4 August 2001, Berne, Switzerland*.

Saaty, R.W. (2003). *Decision making in complex environments: the analytic hierarchy process (AHP) for decision making and the analytic network process (ANP) for decision making with dependence and feedback*. Pittsburgh, PA: RWS Publications.

Saaty, T. L. (2005). *Theory and applications of the analytic network process: decision making with benefits, opportunities, costs, and risks*. Pittsburgh, PA: RWS Publications.

Saaty, T. L. and Vargas, L. G. (2013). *Decision making with the analytic network process: economic, political, social and technological applications with benefits, opportunities, costs and risks*. 2nd ed. New York: Springer.

Sanvido, V., Grobler, F., Parfitt, K., Guvenis, M. and Coyle, M. (1992). Critical success factors for construction projects. *Journal of Construction Engineering and Management*, 118(1), 94-111.

Shaw, E. (2003). Privatization by stealth? The Blair government and public-private partnerships in the National Health Service. *Contemporary Politics*, 9(3), 277-292.

Singh, A. and Prakash, G. (2010). Public-private partnerships in health services delivery: a network organizations perspective. *Public Management Review*, 12(6), 829-856.

Songer, A. D. and Molenaar, K. R. (1997). Project characteristics for successful public-sector design-build. *Journal of Construction Engineering and Management*, 123(1), 34-40.

Sozer, A. N. (2013). City hospitals as a continuation of the restructuring (privatization) in healthcare [Sağlıkta yeniden yapılanmanın (özelleştirmenin) devamı olarak şehir hastaneleri]. *Dokuz Eylül Üniversitesi Hukuk Fakültesi Dergisi*, 15(Özel S.), 215-253.

Spackman, M. (2002). Public-private partnerships: lessons from the British approach. *Economic Systems*, 26(3), 283-301.

Swarup, L., Korkmaz, S. and Riley, D. (2011). Project delivery metrics for sustainable, high-performance buildings. *Journal of Construction Engineering and Management*, 137(12), 1043-1051.

Tabish, S. Z. S. and Jha, K. N. (2011). Identification and evaluation of success factors for public construction projects. *Construction Management and Economics*, 29(8), 809-823.

Tang, L. and Shen, Q. (2013). Factors affecting effectiveness and efficiency of analyzing stakeholders' needs at the briefing stage of public private partnership projects. *International Journal of Project Management*, 31(4), 513-521.

Tekin, P. S. and Celik, Y. (2010). Analysing public-private partnership policy as a financing method in Turkey health sector with political mapping. *7th Biennial Conference in Organisational Behaviour in Health Care (OBHC), Mind the Gap: Policy and Practice in the Reform of Health Care, 11-14 April 2010, Birmingham, UK*.

Tekin, P. S. and Celik, Y. (2012). Analysing public-private partnership policy as a financing method in the health sector of Turkey with political mapping [Türkiye'de sağlık sektöründe bir finansman yöntemi olarak kamu-özel ortaklığı politikasının politika haritalama yöntemi ile analiz edilmesi]. *Ankara Sağlık Bilimleri Dergisi*, 1(3), 81-98.

The Construction Management Association of America. (2012). *An owner's guide to project delivery methods* [online]. [Viewed 15 June 2018]. Available from: https://www.cmaanet.org/sites/default/files/inline-files/owners-guide-to-project-delivery-methods.pdf

World Bank Group. (2018). *Public-Private-Partnership Legal Resource Center*. [Viewed 15 June 2018]. Available from: https://ppp.worldbank.org/public-private-partnership/

Toor, S. R. and Ogunlana, S. O. (2008). Critical COMs of success in large-scale construction projects: evidence from Thailand construction industry. *International Journal of Project Management*, 26(4), 420-430.

Toor, S. R. and Ogunlana, S. O. (2009). Construction professionals' perception of critical success factors for large-scale construction projects. *Construction Innovation*, 9(2), 149-167.

Torchia, M., Calabro, A. and Morner, M. (2015). Public-private partnerships in the health care sector: a systematic review of the literature. *Public Management Review*, 17(2), 236-261.

Tuman, J. (1986). Success modeling: a technique for building a winning project team. *18th Annual Seminar/Symposium, Project Management Institute, Montreal, Canada*. pp. 29-34.

Turner, J. (1999). *The handbook of project-based management*. 2nd ed. London: McGraw-Hill.

United Nations Economic Commission for Europe. (2007). A guide to promoting good governance in public private partnerships. *International Conference on Knowledge Sharing and Capacity Building on Promoting Successful Public-Private Partnerships in the UNECE Region, 5-8 June 2007, Tel Aviv, Israel*.

United Nations Industrial Development Organisation. (1996). *Guidelines for infrastructure development through build-operate-transfer (BOT) projects*. Vienna: UNIDO Publications.

Uz, A. (2007). Public-private partnership (PPP) (The concept and legal framework) [Kamu-özel ortaklığı/public-private partnership (PPP) (Kavram ve hukuksal çerçeve)]. *Gazi Üniversitesi Hukuk Fakültesi Dergisi*, 11(1-2), 1165-1182.

Valipour, A., Yahaya, N., Md Noor, N., Kildienė, S., Sarvari, H. and Mardani, A. (2015). A fuzzy analytic network process method for risk prioritization in freeway PPP projects: an Iranian case study. *Journal of Civil Engineering and Management*, 21(7), 933-947.

Van Marrevijk, A. H. (2005). Strategies of cooperation: control and commitment in mega-projects. *Management*, 8(4), 89-104.

Walker, D. H. T. (1995). An investigation into construction time performance. *Construction Management and Economics*, 13(3), 263-274.

Walker, D. H. T. (1996). The contribution of the construction management team to good construction time performance: an Australian experience. *Journal of Construction Procurement*, 2(2), 4-18.

Walker, C., Mulcahy, J., Smith, A., Lam, P. T. I. and Cochrane, R. (1995). *Privatized infrastructure: the build operate transfer approach*. London: Thomas Telford.

Wang, W. X., Li, Q. M., Deng, X. P. and Li, J. H. (2007). Critical success factors of infrastructure projects under PPP model in China. *2007 International Conference on Wireless Communications, Networking and Mobile Computing (WiCOM 2007), 21-25 September 2007, Shanghai, China*.

Yitmen, I., Akiner, I. and Tekce, I. (2012). Applicability of second generation public private partnership projects in Turkey: a conceptual framework. *7th International Conference on Innovation in Architecture, Engineering & Construction (AEC), 15-17 August 2012, Sao Paulo, Brazil*.

Yondem, T. (2012). *Information notice on PPP projects (selected countries)*. PPP Days 2012 Hosted by United Nations Economic Commission for Europe, World Bank and Asian Development Bank.

Yong, H. K. ed. (2010). *Public-private partnerships policy and practice: a reference guide*. London, UK: Commonwealth Secretariat.

Yuan, J., Wang, C., Skibniewski, M. J. and Li, Q. (2012). Developing key performance indicators for public-private partnership projects: questionnaire survey and analysis. *Journal of Management in Engineering*, 28(3), 252-264.

Zhang, X. Q. (2005a). Critical success factors for public-private partnerships in infrastructure development. *Journal of Construction Engineering and Management*, 131(1), 3-14.

Zhang, X. Q. (2005b). Paving the way for public-private partnerships in infrastructure development. *Journal of Construction Engineering and Management*, 131(1), 71-80.

Zhang, X. Q. (2006). Factor analysis of public clients' best value objective in public-privately partnered infrastructure projects. *Journal of Construction Engineering and Management*, 132(9), 956-965.

Zhang, X. Q. and Kumaraswamy, M. M. (2001). Procurement protocols for public-private partnered projects. *Journal of Construction Engineering and Management*, 127(5), 351-358.

APPENDIX A

Assistive Questionnaire for the Semi-Structured Interviews

Within the context of a PhD study conducted in the Building Science Graduate Program in Middle East Technical University, a success model is aimed to be developed for PPP healthcare projects. With this survey, it is intended to identify the critical success factors for these projects and investigate the relative importance of the factors, and accordingly, provide a basis for the evaluation of project success. By participating in this study, you will contribute to the validation and refinement of the framework, and provide research data. Any information provided from the participants will be kept confidential and used for academic purposes only. We would like to thank you for your time and your contribution to our study.

Section 1. Company and Respondent Information

Information about the Company

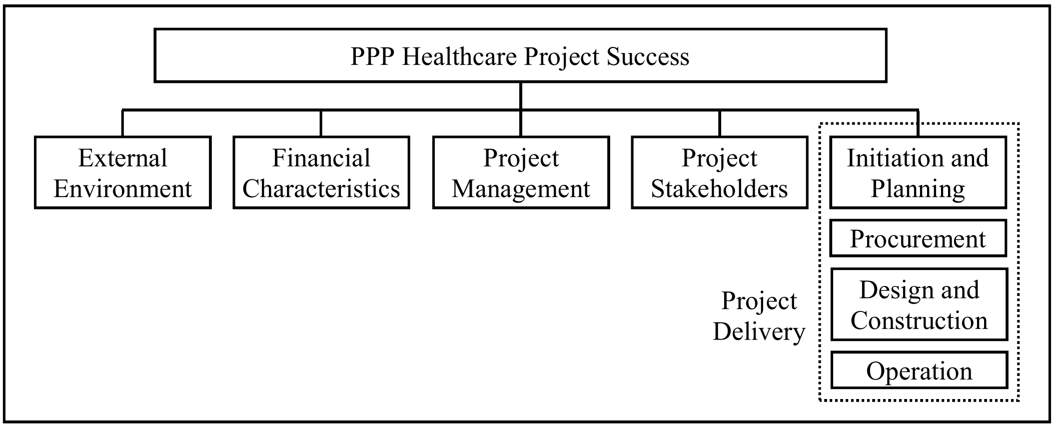
1. The name of your company: ....
2. Number of employees within the organization: □ < 100 □ 100-500 □ > 500
3. Years your company has been active in the construction sector: ....
4. Yearly average turnover of your organization: ....

Information about the Respondent

1. Your Position/Title: ....
2. Your E-mail address: ....
3. Years of experience in the construction sector: ....
4. Years of experience in PPP projects: ....

Section 2. Evaluation of the Factors

The proposed framework is composed of 64 factors organized in eight groups, as shown in the following figure.



Structure of the conceptual framework

- In this study, project success is used as a broad term encompassing on-time and on-budget delivery, conformity to quality specifications, profitability, green building performance, conformity to health and safety requirements, functionality, participants' satisfaction, meeting design goals, contribution to the company's reputation and conformity to users' expectations.
- Please assess the level of impact of the factors given under eight different clusters and also the level of impact of each cluster on the success of a PPP healthcare project, using the 1-5 point Likert scale, in which the scores refer to: (1) Very low, (2) Low, (3) Medium, (4) High, (5) Very high.

Evaluation of Factors: What is the level of impact of each factor on the success of a PPP healthcare project?

Overall Evaluation: What is the level of impact of each cluster on the success of a PPP healthcare project?

1. External Environment

Factors	Level of Impact				
	1	2	3	4	5
E1. A stable political and economic environment	☐	☐	☐	☐	☐
E2. A transparent and mature legal and regulatory framework	☐	☐	☐	☐	☐
E3. A mature and available market (contractors and suppliers) in and around the region	☐	☐	☐	☐	☐
E4. Strong government support	☐	☐	☐	☐	☐
E5. Convenient location, weather and site conditions	☐	☐	☐	☐	☐
E6. Public support for the project	☐	☐	☐	☐	☐
Other (please specify) ……………………………………………………………	☐	☐	☐	☐	☐
…………………………………………………………………………………………	☐	☐	☐	☐	☐

Overall Evaluation	Level of Impact				
	1	2	3	4	5
Assess the impact of the External Environment cluster on project success by considering all of the relevant factors listed above.	☐	☐	☐	☐	☐

2. Financial Characteristics

Factors	Level of Impact				
	1	2	3	4	5
F1. High equity/debt ratio	☐	☐	☐	☐	☐
F2. Fixed and low interest rate financing, low financial charges	☐	☐	☐	☐	☐
F3. Sufficiency of domestic financial resources	☐	☐	☐	☐	☐
F4. Favorable exchange rates and a predictable level of exchange risk	☐	☐	☐	☐	☐
F5. Sufficient profitability of the project to attract investors	☐	☐	☐	☐	☐
F6. High credit rating of the investors	☐	☐	☐	☐	☐
Other (please specify) ……………………………………………………………	☐	☐	☐	☐	☐
…………………………………………………………………………………………	☐	☐	☐	☐	☐

Overall Evaluation	Level of Impact				
	1	2	3	4	5
Assess the impact of the Financial Characteristics cluster on project success by considering all of the relevant factors listed above.	☐	☐	☐	☐	☐

3. Project Management

Factors	Level of Impact				
	1	2	3	4	5
PM1. An efficient system for controlling changes and resolving disputes	☐	☐	☐	☐	☐
PM2. Effective control and supervision of the public agency throughout the project life cycle	☐	☐	☐	☐	☐
PM3. The usage of collaborative tools (*e.g.* project management software, Building Information Modeling, online databases) between the stakeholders for effective communication and coordination	☐	☐	☐	☐	☐
PM4. Maintaining an up-to-date risk management plan and effective contract management	☐	☐	☐	☐	☐
PM5. Integration of formalized rules and procedures, new tools and techniques appropriate for green building project delivery	☐	☐	☐	☐	☐
PM6. Regular control meetings, project schedule and budget updates	☐	☐	☐	☐	☐
PM7. Availability of a proper documentation system for the project and a PPP lessons learned database accessible to all employees and other stakeholders	☐	☐	☐	☐	☐
Other (please specify) ………………………………………………………………	☐	☐	☐	☐	☐
………………………………………………………………………………………	☐	☐	☐	☐	☐

Overall Evaluation	Level of Impact				
	1	2	3	4	5
Assess the impact of the Project Management cluster on project success by considering all of the relevant factors listed above.	☐	☐	☐	☐	☐

4. Project Stakeholders

Factors	Level of Impact				
	1	2	3	4	5
PS1. Early collaboration of project team including the public agency, contractor, design team, operator, consultants, subcontractors and suppliers, and assuring their continuous involvement through all project phases	☐	☐	☐	☐	☐
PS2. Sufficient public agency staffing and well-established organizational structure of the public agency	☐	☐	☐	☐	☐
PS3. Technical and project management competencies of the contractor	☐	☐	☐	☐	☐
PS4. Adequate financial, labor and equipment resources of the contractor	☐	☐	☐	☐	☐
PS5. Sufficient knowledge and experience of the public agency in healthcare projects and the BLT model	☐	☐	☐	☐	☐
PS6. Sufficient knowledge and experience of the consortium members in healthcare projects and the BLT model	☐	☐	☐	☐	☐
PS7. Design firm's competition-based selection and green building experience	☐	☐	☐	☐	☐
PS8. Subcontractors' experience, competencies and financial credibility	☐	☐	☐	☐	☐
PS9. Suppliers' experience, reliability and convenient location	☐	☐	☐	☐	☐
PS10. Public agency consultant's experience, competencies and adequate staffing	☐	☐	☐	☐	☐
PS11. Operator's competencies and reliability	☐	☐	☐	☐	☐
PS12. Well-defined roles and responsibilities of different stakeholders	☐	☐	☐	☐	☐
Other (please specify) ………………………………………………………………	☐	☐	☐	☐	☐
………………………………………………………………………………………	☐	☐	☐	☐	☐

Overall Evaluation	Level of Impact				
	1	2	3	4	5
Assess the impact of the Project Stakeholders cluster on project success by considering all of the relevant factors listed above.	☐	☐	☐	☐	☐

5. Initiation and Planning

Factors	Level of Impact				
	1	2	3	4	5
IP1. A comprehensive feasibility study encompassing technical, financial, economic, legal, social and environmental issues	☐	☐	☐	☐	☐
IP2. Selection of site with the participation of stakeholders	☐	☐	☐	☐	☐
IP3. Clear definition of the project scope and public agency's requirements	☐	☐	☐	☐	☐
IP4. Proper integration of end users' needs, inputs of operational staff, healthcare experts and all other interest groups in preparation of project brief	☐	☐	☐	☐	☐
IP5. Defining clear and assessable output specifications including performance requirements	☐	☐	☐	☐	☐
IP6. Determination of the targeted green building certification level early in the project life cycle	☐	☐	☐	☐	☐
IP7. Defining the process for performance monitoring and evaluation systems	☐	☐	☐	☐	☐
IP8. Effective risk identification and assessment throughout the project	☐	☐	☐	☐	☐
IP9. Life cycle-based budget planning	☐	☐	☐	☐	☐
Other (please specify) …………………………………………………………………	☐	☐	☐	☐	☐
…………………………………………………………………………………………	☐	☐	☐	☐	☐

Overall Evaluation	Level of Impact				
	1	2	3	4	5
Assess the impact of the Initiation and Planning cluster on project success by considering all of the relevant factors listed above.	☐	☐	☐	☐	☐

6. Procurement

Factors	Level of Impact				
	1	2	3	4	5
P1. Transparent, competitive and clearly defined tender process	☐	☐	☐	☐	☐
P2. Tender evaluation based on a combination of price and qualifications	☐	☐	☐	☐	☐
P3. Prequalification of potential tenderers	☐	☐	☐	☐	☐
P4. Inclusion of project's green specifications in the request for proposal	☐	☐	☐	☐	☐
P5. Inclusion of stipulations for minimum number of bids and a maximum of four bidders short-listed to prepare a full tender	☐	☐	☐	☐	☐
P6. Adequate government guarantees	☐	☐	☐	☐	☐
P7. Reasonable risk allocation in the contract	☐	☐	☐	☐	☐
P8. Payment mechanism linked to services availability and performance	☐	☐	☐	☐	☐
P9. Contractual incentives for exceeding sustainability goals	☐	☐	☐	☐	☐
Other (please specify) …………………………………………………………………	☐	☐	☐	☐	☐
…………………………………………………………………………………………	☐	☐	☐	☐	☐

Overall Evaluation	Level of Impact				
	1	2	3	4	5
Assess the impact of the Procurement cluster on project success by considering all of the relevant factors listed above.	☐	☐	☐	☐	☐

7. Design and Construction

Factors	Level of Impact				
	1	2	3	4	5
DC1. Providing the built-in flexibility of design and reserved land for future growth and changes	☐	☐	☐	☐	☐
DC2. Use of prefabrication, modularization and automation in the project	☐	☐	☐	☐	☐
DC3. Providing the integration of design with the construction and operation phases	☐	☐	☐	☐	☐
DC4. Using energy and lighting simulations and envelope mock-ups for tracking the sustainability performance during the design phase	☐	☐	☐	☐	☐
DC5. Conducting constructability analyses during the design phase	☐	☐	☐	☐	☐
DC6. Charging an independent works checker	☐	☐	☐	☐	☐
DC7. An effective governmental approval process and no major changes in government's requirements during the construction phase	☐	☐	☐	☐	☐
DC8. Effective site management	☐	☐	☐	☐	☐
DC9. Effective quality, environment, health and safety control and supervision	☐	☐	☐	☐	☐
DC10. Training sessions on green building for on-site construction personnel and for subcontractors	☐	☐	☐	☐	☐
Other (please specify) …………………………………………………………………	☐	☐	☐	☐	☐
………………………………………………………………………………………	☐	☐	☐	☐	☐

Overall Evaluation	Level of Impact				
	1	2	3	4	5
Assess the impact of the Design and Construction cluster on project success by considering all of the relevant factors listed above.	☐	☐	☐	☐	☐

8. Operation

Factors	Level of Impact				
	1	2	3	4	5
O1. Monitoring of the energy performance during the operation phase and updating design simulations	☐	☐	☐	☐	☐
O2. Training end users on energy efficiency measures, systems operation and repair reporting	☐	☐	☐	☐	☐
O3. Use of appropriate metrics and monitoring methods for performance measurement (*e.g.* independent audits, customer satisfaction surveys, performance and fault reporting systems)	☐	☐	☐	☐	☐
O4. Specific record keeping requirements	☐	☐	☐	☐	☐
O5. Effective transfer mechanism	☐	☐	☐	☐	☐
Other (please specify) …………………………………………………………………	☐	☐	☐	☐	☐
………………………………………………………………………………………	☐	☐	☐	☐	☐

Overall Evaluation	Level of Impact				
	1	2	3	4	5
Assess the impact of the Operation cluster on project success by considering all of the relevant factors listed above.	☐	☐	☐	☐	☐

Section 3. Evaluation of the Project Success Criteria

Evaluation of the Project Success Criteria: What is the level of importance of the mentioned criteria for the success of a PPP healthcare project?

Project Success Criteria	Level of Importance				
	1	2	3	4	5
SC1. On-time delivery	☐	☐	☐	☐	☐
SC2. On-budget delivery	☐	☐	☐	☐	☐
SC3. Conformity to quality specifications	☐	☐	☐	☐	☐
SC4. Profitability	☐	☐	☐	☐	☐
SC5. Green building performance	☐	☐	☐	☐	☐
SC6. Conformity to health and safety requirements	☐	☐	☐	☐	☐
SC7. Functionality	☐	☐	☐	☐	☐
SC8. Participants' satisfaction	☐	☐	☐	☐	☐
SC9. Meeting design goals	☐	☐	☐	☐	☐
SC10. Contribution to the company's reputation	☐	☐	☐	☐	☐
SC11. Conformity to users' expectations	☐	☐	☐	☐	☐

APPENDIX B

Data Revealed from the Semi-Structured Interviews

Table B.1. Impact of the factors on PPP healthcare project success

Factor	Expert						Mean Rating	STD	Normalized Mean Rating
	A	B	C	D	E	F			
PS3	5	5	5	5	5	5	5.00	0.00	0.018
PS4	5	5	5	5	5	5	5.00	0.00	0.018
PS6	5	5	5	5	5	5	5.00	0.00	0.018
IP5	5	5	5	5	5	5	5.00	0.00	0.018
P6	5	-	5	5	5	5	5.00	0.00	0.018
DC3	5	5	5	5	5	5	5.00	0.00	0.018
DC7	5	5	5	5	5	5	5.00	0.00	0.018
E4	5	5	4	5	5	5	4.83	0.41	0.018
PS10	5	5	5	5	5	4	4.83	0.41	0.018
IP1	5	5	4	5	5	5	4.83	0.41	0.018
DC8	5	4	5	5	5	5	4.83	0.41	0.018
DC9	5	4	5	5	5	5	4.83	0.41	0.018
P8	5	-	4	5	5	5	4.80	0.45	0.018
O2	5	-	4	5	5	5	4.80	0.45	0.018
O3	5	-	4	5	5	5	4.80	0.45	0.018
O4	4	-	5	5	5	5	4.80	0.45	0.018
P7	5	-	4	-	5	5	4.75	0.50	0.018
E2	5	4	5	5	4	5	4.67	0.52	0.017
PS1	4	5	4	5	5	5	4.67	0.52	0.017
PS2	4	5	5	5	5	4	4.67	0.52	0.017
PS5	4	5	5	5	5	4	4.67	0.52	0.017
PS11	5	4	4	5	5	5	4.67	0.52	0.017
IP3	5	5	4	4	5	5	4.67	0.52	0.017
IP9	5	-	5	5	4	4	4.60	0.55	0.017
DC5	4	-	5	4	5	5	4.60	0.55	0.017
F4	-	-	4	5	5	4	4.50	0.58	0.017
F5	-	-	4	4	5	5	4.50	0.58	0.017
F6	-	-	4	5	5	4	4.50	0.58	0.017
PM4	5	4	4	5	5	4	4.50	0.55	0.017
PM6	5	4	4	5	5	4	4.50	0.55	0.017
IP4	5	5	4	4	4	5	4.50	0.55	0.017
IP2	5	4	4	4	-	5	4.40	0.55	0.016
O1	5	-	4	4	4	5	4.40	0.55	0.016
E1	4	4	4	5	5	4	4.33	0.52	0.016
PM1	4	4	4	5	5	4	4.33	0.52	0.016
IP6	5	5	3	4	5	4	4.33	0.82	0.016
F2	-	-	4	4	5	4	4.25	0.50	0.016
O5	5	-	5	5	2	-	4.25	1.50	0.016
P1	4	-	4	4	5	4	4.20	0.45	0.015
P2	4	-	4	5	4	4	4.20	0.45	0.015
E5	5	4	4	4	5	3	4.17	0.75	0.015
PM2	5	4	3	5	4	4	4.17	0.75	0.015
PS9	3	4	4	5	5	4	4.17	0.75	0.015
PS12	4	4	4	4	5	4	4.17	0.41	0.015
IP7	4	4	4	4	5	4	4.17	0.41	0.015

Table B.1. Impact of the factors on PPP healthcare project success (continued)

Factor	Expert						Mean Rating	STD	Normalized Mean Rating
	A	B	C	D	E	F			
IP8	3	4	4	5	5	4	4.17	0.75	0.015
P3	3	-	4	5	5	3	4.00	1.00	0.015
P9	5	-	1	5	5	4	4.00	1.73	0.015
DC2	5	4	3	4	4	4	4.00	0.63	0.015
PM3	5	4	3	3	4	4	3.83	0.75	0.014
DC4	5	4	3	4	4	3	3.83	0.75	0.014
DC6	3	4	4	4	4	4	3.83	0.41	0.014
F1	-	-	-	4	3	4	3.67	0.58	0.014
PM7	4	2	3	4	5	4	3.67	1.03	0.014
E6	4	2	4	3	3	5	3.50	1.05	0.013
DC10	4	4	3	3	2	5	3.50	1.05	0.013
P4	3	-	1	5	4	4	3.40	1.52	0.013
PM5	5	4	3	3	2	3	3.33	1.03	0.012
PS8	3	3	3	3	4	4	3.33	0.52	0.012
DC1	5	3	1	3	5	3	3.33	1.51	0.012
E3	4	4	3	3	3	1	3.00	1.10	0.011
F3	-	-	1	3	3	3	2.50	1.00	0.009
PS7	3	3	1	1	2	3	2.17	0.98	0.008
P5	3	-	1	1	1	1	1.40	0.89	0.005

Table B.2. Impact of the clusters on PPP healthcare project success

Cluster	Expert						Mean Rating
	A	B	C	D	E	F	
Operation	5	-	5	5	4	5	4.80
Project Management	5	4	5	5	5	4	4.67
Initiation and Planning	5	4	5	5	5	4	4.67
Financial Characteristics	-	-	4	4	5	5	4.50
Design and Construction	5	5	4	4	4	5	4.50
Procurement	4	-	3	5	5	5	4.40
Project Stakeholders	5	4	4	4	5	4	4.33
External Environment	4	3	4	4	4	4	3.83

Table B.3. Importance of the success criteria for a PPP healthcare project

Success Criteria	Expert						Mean Rating
	A	B	C	D	E	F	
SC1	5	5	5	5	5	5	5.00
SC2	5	5	5	5	5	5	5.00
SC6	5	5	5	5	5	5	5.00
SC7	5	5	4	5	5	5	4.83
SC9	5	5	5	4	4	5	4.67
SC10	3	5	5	5	5	5	4.67
SC3	5	4	4	5	4	5	4.50
SC8	5	5	3	4	5	5	4.50
SC11	4	4	5	5	4	5	4.50
SC4	4	4	5	3	5	5	4.33
SC5	5	3	2	4	4	5	3.83

APPENDIX C

The List of the Success Factors Used in the Model

Table C.1. Proposed success factors together with their descriptions

1. External Environment	
E1	**A stable political environment and strong government support** - The strength and stability of the government - The significance of the project in terms of government policies, a positive governmental attitude towards private sector cooperation in the project - A favorable global political environment
E2	**Favorable global economic conditions and exchange rates, a strong and stable economic environment in the host country** - A favorable global economic environment - Strong and stable domestic economic conditions and a robust macroeconomic policy - Favorable exchange rates and a predictable level of exchange risk - High credit rating of the host country
E3	**A transparent and mature legal and regulatory framework** - Comprehensive, transparent and well-prepared legislation and regulations for PPP healthcare projects
E4	**Convenient location, favorable weather and site conditions** - Location advantage of the project site - Favorable weather and site conditions in the project area
2. Financial Characteristics	
F1	**Favorable financing interest rates and financing costs, the strength and profitability of the project** - Fixed and low interest rate financing and low financial charges - The strength, financial feasibility and sustainability of the project - Sufficient profitability of the project to attract domestic/foreign investors
F2	**Provision of adequate government guarantees** - Provision of government debt guarantee - Provision of minimum demand guarantee by the government - Provision of special tax allowances for the contractor - Use of an appropriate method for the adjustment of payments (*e.g.* escalation with respect to changes in foreign exchange rates)
F3	**Inclusion of investors and sponsors with sufficient financial strength in the project** - High credit rating of the investors - Project sponsors' reliability and financial capability

Table C.1. Proposed success factors together with their descriptions (continued)

3. Project Stakeholders	
PS1	**Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model** - Adequate number of competent staff, sufficient budgetary resources and strong organizational structure of the public agency - Public agency's sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model - The public agency staff having comprehensive knowledge of PPP legislation and regulations - Establishment of a dedicated department for PPP healthcare projects within the Ministry, with specialized units focusing on different project phases/tasks (*e.g.* preparation of the contract, preliminary project and project budget, management of the tender phase and administration of the contract, continuous supervision) - Clear distribution of responsibilities among the authorized public institutions in the project, cooperation in project planning and effective communication/coordination between the institutions
PS2	**Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model** - Sufficient experience, competencies and staff adequacy of the public agency consultant - Public agency consultant's sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model
PS3	**Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model** - Sufficient experience, technical and project management competencies of the contractor - Contractor's sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model - Adequacy of financial, labor and equipment resources of the contractor
PS4	**Contractor's consultants' (*e.g.* traffic, ESIA*, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model** *** Environmental and Social Impact Assessment** - Sufficient experience, competencies and staff adequacy of the consultants to attend to contractor - Consultants' sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model
PS5	**Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model** - Sufficient experience, competencies, staff adequacy and financial capability of the operator - Operator's sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model
PS6	**Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model** - Sufficient experience, competencies, staff adequacy and financial capability of the design firm - Design firm's sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model

Table C.1. Proposed success factors together with their descriptions (continued)

3. Project Stakeholders (continued)	
PS7	**Subcontractors' (*e.g.* electrical, mechanical) experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model** - Sufficient experience, competencies, adequacy of financial, labor and equipment resources of the subcontractors - Subcontractors' sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model
PS8	**Suppliers' experience, competence, commercial strength and long-term accessibility** - Sufficient experience, coordination skills, reliability, market dominance and commercial capacity of the suppliers - Long-term accessibility of the suppliers involved in the operation phase
4. Planning, Tender and Contracting Processes	
P1	**Clear definition of project scope and public authority's requirements prior to the tender process, proper integration of end users' needs, inputs of operational staff, healthcare experts and all other interest groups in this process** - Well-defined purpose and objectives for the project - Detailed and clear project scope and requirements specified by the public agency prior to the tender process - Proper integration of end users' needs, inputs of operational staff, healthcare experts, relevant institutions, non-governmental organizations and all other interest groups early on in the determination of project requirements
P2	**Preparation of a comprehensive and realistic feasibility study prior to tender** - Conduct of a detailed feasibility analysis encompassing technical, financial, economic, legal, social and environmental issues and demand projections
P3	**A well-designed, competitive and transparent tender process, clarity and adequacy of tender documents** - Clearly defined tender procedures - Developing appropriate and explicit tender evaluation criteria and their weighting, based on a combination of bid price and qualifications (*e.g.* technical, financial and managerial competence, experience, past performance) - Application of competitive tender procedures and ensuring a sufficient number of qualified bidders in the process - A transparent tender process, in which, the rules are made available to all participants and the process is made open and public - Adequacy and reliability of the tender documents, comprehensive and well-defined tender specifications presented by the public agency
P4	**Comprehensive and clear final contract documentation prepared by the public agency and the contractor** - A comprehensive final contract including the well-defined roles and responsibilities of the stakeholders, explicit project objectives and scope - Adequacy and clarity of plans and specifications included in the contract - Specification of risks in the contract with fair and reasonable risk allocation among project stakeholders

Table C.1. Proposed success factors together with their descriptions (continued)

4. Project Management	
PM1	**Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases** - Detailed and well-prepared budget and schedule, in line with whole life cost assessment and effective strategic planning for the project
PM2	**Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders** - Providing the contribution of the public agency, public agency consultant, contractor, contractor's consultants, operator, designer, subcontractors and suppliers in all project phases - Ensuring adequate and effective communication/coordination between project participants through proper communication channels
PM3	**Effective control and supervision by the public agency through the life cycle of the project and an efficient governmental approval process** - Regular monitoring and feedback provided by the public agency through all project phases by competent staff - The effectiveness of the public approval mechanism, timely and proper interventions on the project by the public agency
PM4	**Efficient monitoring, evaluation, reporting and control of project performance** - Regular control meetings, project schedule and budget updates throughout the project life cycle - Identification of deviations from plan, evaluating possible alternative course of actions and taking appropriate corrective actions
PM5	**Establishment of an efficient system for controlling project changes and resolving disputes** - Taking effective change management and dispute resolution measures to properly manage deviations from the project plan - Providing adaptability to changes in project plan/scope
PM6	**Effective implementation of risk management processes across all project phases** - Establishment of an effective risk management system for the project, which encompasses risk identification, assessment, response development, monitoring and control, and documentation processes
PM7	**Establishment of a proper documentation system for the project and storage of lessons learned through an accessible PPP projects database** - Ensuring that the documentation process is defined and formalized for all project phases - Development of an accessible PPP projects database for continuous learning and improvement
6. Design, Construction and Operation Processes	
DCO1	**Further development of the pre-tender feasibility study and preparation of a detailed technical and financial analysis early on in the design-construction phase with the contribution of the private sector stakeholders** - Further development of the feasibility study conducted by the public agency at the planning stage - Carrying out thorough technical, financial and economic analysis and developing workable financial plans
DCO2	**With the contribution of the stakeholders early on in the design-construction phase, further development of the project specifications prepared by the public agency** - Defining explicit, specific and assessable project specifications considering the entire project life cycle

Table C.1. Proposed success factors together with their descriptions (continued)

6. Design, Construction and Operation Processes (continued)	
DCO3	**Providing the integration of design with the construction and operation phases, ensuring its flexibility and optimization** - Active participation of the contractor and the operator in the design process, incorporating construction and operation knowledge and experience into the early stages of planning and design - Providing the flexibility of design with adaptable design solutions for the contingent future needs and changes, and undertaking a design optimization process
DCO4	**Effective site management** - A proper site layout - Effective planning and management of site operations
DCO5	**Establishment of an efficient quality, health, safety and environment management system for the construction and operation phases** - Providing extensive supervision and control in terms of quality, health, safety and environment
DCO6	**Taking the necessary measures to provide and maintain maximum performance throughout the operation phase** - Optimization of the processes pertaining to the operation phase - Establishment of an efficient performance management system with a systematic performance measurement and reporting mechanism
DCO7	**Ensuring the proper transfer of the facility to the public authority at the end of the contract phase** - Developing effective hand over procedures to ensure that the performance is maintained through the transfer of the facility - Determining the obligations of the public and private sector stakeholders and defining the process to be followed, involving the principles of the inspections and monitoring to be undertaken in this period

APPENDIX D

A List of Strategies Compiled with Respect to Specific Success Factors

Table D.1. Project performance improvement strategies

Factor	Strategy
F1. Favorable financing interest rates and financing costs, the strength and profitability of the project	**S1.** Provision of adequate government guarantees for the project **S2.** Inclusion of reliable investors and sponsors with sufficient financial strength in the project
F3. Inclusion of investors and sponsors with sufficient financial strength in the project	**S1.** Ensuring the development of a detailed and realistic feasibility study **S2.** Providing a comprehensive, explicit and reliable contract agreement
P1. Clear definition of project scope and public authority's requirements prior to the tender process, proper integration of end users' needs, inputs of operational staff, healthcare experts and all other interest groups in this process	**S1.** Carrying out a comprehensive project needs assessment **S2.** Consulting advisers in the medical field to determine what to specify for the project **S3.** Development of a project brief that reflects project requirements accurately with realistic obligations, clear goals and objectives **S4.** Ensuring that the project brief provides information concerning the project program, risk management, output specifications, operational services, payment mechanism and other contractual terms
P2. Preparation of a comprehensive and realistic feasibility study prior to tender	**S1.** Carrying out a comparative economic and financial analysis of the PPP model against traditional forms of project delivery **S2.** Conducting a thorough and realistic assessment of the cost and benefits **S3.** Providing realistic revenue and cost estimates **S4.** Performing proper affordability, bankability, constructability and maintainability assessments **S5.** Ensuring the existence of a long-term demand for the proposed services in the community with realistic project demand and capacity projections **S6.** Conducting a detailed assessment of the project risks, anticipated guarantees and risk allocation for the project **S7.** Performing a comprehensive pre-tender site investigation **S8.** Carrying out a realistic and comprehensive environmental impact assessment **S9.** Carrying out a realistic and comprehensive social impact assessment

Table D.1. Project performance improvement strategies (continued)

Factor	Strategy
P3. A well-designed, competitive and transparent tender process, clarity and adequacy of tender documents	**S1.** Developing project-specific and explicit bidder prequalification criteria and keeping prequalification conditions at a high level for potential tenderers **S2.** Preparation of the draft contract and specifications clearly prior to launching the tender, defining the responsibilities of stakeholders, output specifications and required service standards, proposed risk allocation and payment mechanism in detail **S3.** Charging a competent consultant for assistance in drafting the PPP contract, output requirements and specifications, tender preparation, bidding and evaluation processes and final negotiations **S4.** Providing a realistic timetable for the procurement process **S5.** Distributing clear and acceptable guidelines for bidding to all participants and ensuring that those guidelines are consistently followed **S6.** Preparation of an effective and flexible request for proposal **S7.** Involving the public sector staff responsible for the operation of the facility in the tender phase **S8.** Ensuring that the operator is included in the tender phase by the contractor and cooperates with the bid management team **S9.** Adequate and effective communication of the public agency with bidders, open as far as possible to public inspection
P4. Comprehensive and clear final contract documentation prepared by the public agency and the contractor	**S1.** Developing proper procedures for contract negotiations between parties **S2.** Involvement of the public sector staff responsible for the operation of the hospital in contract negotiations **S3.** Obtaining remarks and necessary information from the operator and other relevant stakeholders in contract negotiations and preparation **S4.** Providing closer communication with the project sponsors as early as possible in the contract negotiation process **S5.** Discussion of the design, output and future requirement specifications in the contract negotiation process **S6.** Providing a detailed final contract with an explicit set of output-based specifications and service quality standards, establishing the quantity and quality of infrastructure/services to be provided over the period of the contract **S7.** Careful review of the output specifications by the contractor and the operator during contract negotiations and ensuring that the criteria and methods specified for assessing performance are objective and measurable **S8.** Provision of contract incentives/penalties to the contracting parties with respect to the project performance criteria **S9.** Specifying the obligations and rights of the contracting parties in the contract **S10.** Identification of project risks, conduct of adequate and accurate risk assessment by all parties involved and appropriate allocation of risks to the parties that are best able to control and manage them via reliable contractual arrangements **S11.** Ensuring government risk guarantees for political/legal/regulatory risks, which are not under the control of the private sector **S12.** Including clauses in the contract to enable adopting the changing conditions and demand during the operation period **S13.** Specifying a proper dispute resolution process within the contract **S14.** Specifying a suitable payment adjustment mechanism within the contract

Table D.1. Project performance improvement strategies (continued)

Factor	Strategy
PM1. Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases	**S1.** Ensuring the contribution of the operator, contractor's consultants and other relevant stakeholders in the approval of the project budget and schedule prepared by the contractor **S2.** Proper distribution of project resources to all phases in line with the project objectives **S3.** Ensuring sufficient resource allocation for the performance management and control processes of the operation phase **S4.** Effective allocation of manpower **S5.** Establishment of an appropriate project organization structure and work breakdown structure **S6.** Using adequate planning methods in different phases of the project
PM2. Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders	**S1.** Early collaboration of project team including the public agency, public agency consultant, contractor, contractor's consultants, operator, designer, subcontractors and suppliers, and assuring their continuous involvement throughout the project life cycle **S2.** Setting up multidisciplinary teams to ensure that activities carried out at different stages of the project life cycle are coordinated with each other
PM3. Effective control and supervision by the public agency through the life cycle of the project and an efficient governmental approval process	**S1.** Ensuring clarity in the division of functional responsibilities of different government departments and proper internal coordination within government **S2.** Establishment of a multidisciplinary team within the public agency that continuously monitors project progress
PM4. Efficient monitoring, evaluation, reporting and control of project performance	**S1.** Establishing proper project control systems and defining the processes for performance monitoring and evaluation for all project phases **S2.** Adding performance evaluation measures to the contract linked to improved productivity **S3.** Regularly assessing performance to determine compliance with the output specifications and making payment deductions for performance failures in accordance with the payment mechanism **S4.** Conducting frequent meetings among stakeholders to evaluate overall performance **S5.** Performing regular site inspections during the construction phase **S6.** Conduct of monthly audits and random checks by the public agency and the consortium during the operation phase and preparation of monthly performance reports
PM5. Establishment of an efficient system for controlling project changes and resolving disputes	**S1.** Establishing efficient monitoring and approval mechanisms for project changes **S2.** Identifying the possible effects of project changes and taking the necessary corrective measures so that changes do not result in disputes **S3.** Preparation of change/variation protocols to deal with the contingent future project changes, as part of the project agreement **S4.** Incorporating necessary provisions into the contract for resolving disputes through negotiation before going to trial or arbitration (*e.g.* Dispute Adjudication Boards) **S5.** Providing a high percentage of design complete at construction start

Table D.1. Project performance improvement strategies (continued)

Factor	Strategy
PM6. Effective implementation of risk management processes across all project phases	**S1.** Identifying and assessing risks in a comprehensive and integrated manner by the involvement of all stakeholders at the start of the project **S2.** Ensuring effective risk monitoring and maintaining a regularly updated risk management plan through the life cycle of the project
PM7. Establishment of a proper documentation system for the project and storage of lessons learned through an accessible PPP projects database	**S1.** Ensuring the contribution of the public agency, public agency consultant, contractor and operator in the development of the database
DCO1. Further development of the pre-tender feasibility study and preparation of a detailed technical and financial analysis early on in the design-construction phase with the contribution of the private sector stakeholders	**S1.** Ensuring the contribution of the contractor, operator and their consultants in this process **S2.** Providing realistic revenue and cost estimations
DCO2. With the contribution of the stakeholders early on in the design-construction phase, further development of the project specifications prepared by the public agency	**S1.** Ensuring the contribution of the public agency, public agency consultant, contractor, contractor's consultants, operator and designer in this process **S2.** Providing that the project specifications include output-based items with performance orientated requirements **S3.** Providing remarks and input from the hospital management team and healthcare experts for the identification of output specifications **S4.** Taking a broad consideration of design, construction and service requirements in the elaboration of output specifications
DCO3. Providing the integration of design with the construction and operation phases, ensuring its flexibility and optimization	**S1.** Making a design effort through strong collaboration of the design firm, technical consultants, healthcare planner, contractor, operator and subcontractors so that design efficiencies can be maximized **S2.** Enhancement of the construction process through constructability and value engineering reviews performed during the design phase **S3.** Review and assessment of the design from operability, maintainability and serviceability point of view by the operator **S4.** Provision of sufficient detailing and timely finalization of the design documents
DCO4. Effective site management	**S1.** Effective coordination and control of subcontractors' works by the contractor **S2.** Conduct of regular site inspections by the public agency **S3.** Ensuring the availability of equipment and material, appropriately managing equipment and providing effective material distribution **S4.** Ensuring the availability of laborers on site **S5.** Using up-to-date technology and automation, special/innovative building techniques and materials for construction work **S6.** Integrating operations and maintenance knowledge into the construction process **S7.** Applying incentives/penalties for the contractor based on the project performance criteria specified in the contract

Table D.1. Project performance improvement strategies (continued)

Factor	Strategy
DCO5. Establishment of an efficient quality, health, safety and environment management system for the construction and operation phases	**S1.** Ensuring the efficiency of the contractor's own site inspection mechanism in the construction phase and the operator's own inspection mechanism in the operation phase **S2.** Conduct of regular inspections by the public agency during the construction and operation phases **S3.** Charging an independent construction inspector **S4.** Carrying out regular quality control and quality assurance activities **S5.** Establishing effective health, safety and environmental compliance and auditing programs
DCO6. Taking the necessary measures to provide and maintain maximum performance throughout the operation phase	**S1.** Monitoring of the energy performance during the operation phase, providing designers' and builders' input to ensure that the building operates at maximum performance **S2.** Tracking of the service performance by the public agency, the contractor and the operator in accordance with the performance criteria available in the specifications and taking necessary corrective measures **S3.** Ensuring that the considerations on expected change of the service requirements are stated in output specifications **S4.** Establishment of a payment mechanism linking service payments to the availability of assets and performance of the services, based on the specified performance criteria **S5.** Use of appropriate metrics and monitoring methods for performance measurement (*e.g.* independent audits, request of feedback from users, customer satisfaction surveys, performance and fault reporting systems) **S6.** Establishment of a systematic reporting and record keeping mechanism for the operation phase **S7.** Training end users and operators on energy efficiency measures, systems operation and repair reporting **S8.** Defining appropriate and explicit rectification periods for the defective/inadequate services **S9.** Assuring adequate government resources and the management of the public agency staff for effective supervision of services delivered by the operator **S10.** Charging an external adviser to audit and certify performance during the operation phase
DCO7. Ensuring the proper transfer of the facility to the public authority at the end of the contract phase	**S1.** Establishment of a joint inspection commission between the public and private sector parties towards the end of the contract to ensure the proper transfer of the facility to the public authority **S2.** Ensuring the stipulation of hand over requirements in the output specifications as to the expected conditions of the project assets **S3.** Including appropriate provisions in the contract for innovative transfer arrangements **S4.** To provide the continuity of operational performance, ensuring the active transfer of the operator’s acquired knowledge to the public authority at the transfer phase **S5.** Utilizing a third-party assessment of the condition of the assets and of the works to be completed to meet the required standards

APPENDIX E

A Sample of the Questionnaire Used in the ANP Model Development

Within the context of a PhD study conducted in the Building Science Graduate Program in Middle East Technical University, a success model is aimed to be developed for PPP healthcare projects. With semi-structured interviews conducted with experts from the private sector in May 2017, it was targeted to examine the importance of the factors in order to refine the framework by eliminating the relatively less critical ones and to make the necessary revisions. Accordingly, the proposed framework was re-formed with 33 factors organized in six groups (Figure E.1).

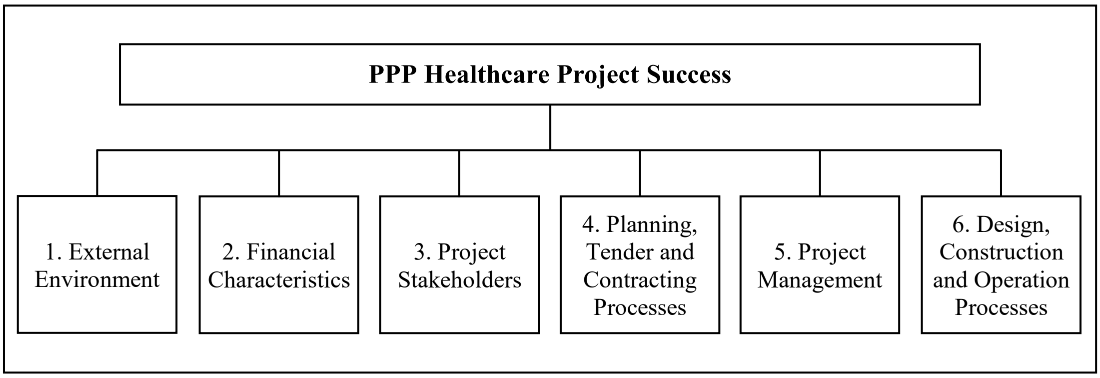


Figure E.1. Revised PPP healthcare project success framework

On the other hand, more than a half of the factors possess some degree of dependency upon each other and it was believed that these interrelationships are needed to be considered in order to provide a more realistic assessment of project success. The objective of this questionnaire is to assess the interrelationships between the factors, find out the relative importance weights of the factors and to develop a project success model to assess the performance level of a PPP healthcare project. To perform this analysis, the Analytic Network Process (ANP) was determined as the most appropriate method. For the implementation of the ANP, the links among the success factors and thus among the clusters were established (Figure E.2).

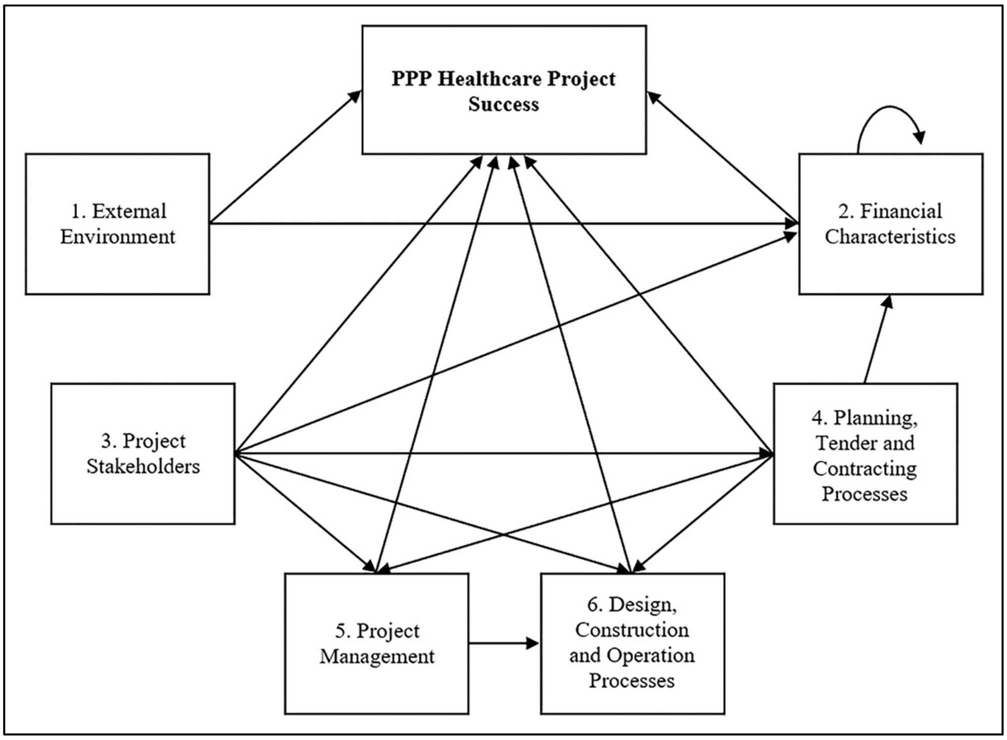


Figure E.2. The links established among the factor clusters

Hypotheses

Considering the success of a PPP healthcare project,

- *External Environment*, *Financial Characteristics*, *Project Stakeholders* and *Planning, Tender and Contracting Processes* are influential on **Financial Characteristics**.
- *Project Stakeholders* is influential on **Planning, Tender and Contracting Processes**.

- *Project Stakeholders* and *Planning, Tender and Contracting Processes* are influential on **Project Management**.
- *Project Stakeholders*, *Planning, Tender and Contracting Processes* and *Project Management* are influential on **Design, Construction and Operation Processes**.

In this study, project success is used as a broad term encompassing on-time and on-budget delivery, conformity to quality specifications, profitability, green building performance, conformity to health and safety requirements, functionality, participants' satisfaction, meeting design goals, contribution to the company's reputation and conformity to users' expectations. For the construction of the model, the elements and components within the model are to be compared in pairs, with respect to the given criterion. The pairwise comparisons are to be performed by using the 1-9 point scale of the ANP (Table E.1). In the scale, a score of 1 indicates equal importance of the two compared elements/clusters, where a score of 9 indicates overwhelming dominance of one element/cluster over the other.

Table E.1. The scale to be used through the assessment

The ANP Scale	
Degree	**Definition**
1	Equal importance
3	Moderately more dominant
5	Strongly more dominant
7	Very strongly more dominant
9	Extremely more dominant
2-4-6-8	Intermediate values

By participating in this study, you will contribute to the formation and validation of the model. Any information provided from participators will be kept confidential and used for academic purposes only. We would like to thank you for your time and your contribution to our study.

Section 1. The Degree of Impact of the Factors on Project Success

In this section, it is objected to relatively assess the level of impact of the factors in each cluster on the success of a PPP healthcare project. Each factor is individually compared against the other factors in its cluster, based on their level of impact on project success.

Impact on Project Success: Which of the compared factors is more influential on the success of a PPP healthcare project?

The Level of Impact: How much more influential is the factor you have favored when compared to the other, on the PPP healthcare project success? (Skip this part if you have evaluated it as "equal".)

1. External Environment

Impact on Project Success			Level of Impact							
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ E1. A stable political environment and strong government support	☐ E2. Favorable global economic conditions and exchange rates, a strong and stable economic environment in the host country	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ E1. A stable political environment and strong government support	☐ E3. A transparent and mature legal and regulatory framework	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ E1. A stable political environment and strong government support	☐ E4. Convenient location, favorable weather and site conditions	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ E2. Favorable global economic conditions and exchange rates, a strong and stable economic environment in the host country	☐ E3. A transparent and mature legal and regulatory framework	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ E2. Favorable global economic conditions and exchange rates, a strong and stable economic environment in the host country	☐ E4. Convenient location, favorable weather and site conditions	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ E3. A transparent and mature legal and regulatory framework	☐ E4. Convenient location, favorable weather and site conditions	☐	☐	☐	☐	☐	☐	☐	☐	☐

2. Financial Characteristics

Impact on Project Success			Level of Impact							
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ F1. Favorable financing interest rates and financing costs, the strength and profitability of the project	☐ F2. Provision of adequate government guarantees	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ F1. Favorable financing interest rates and financing costs, the strength and profitability of the project	☐ F3. Inclusion of investors and sponsors with sufficient financial strength in the project	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ F2. Provision of adequate government guarantees	☐ F3. Inclusion of investors and sponsors with sufficient financial strength in the project	☐	☐	☐	☐	☐	☐	☐	☐	☐

3. Project Stakeholders

Impact on Project Success			Level of Impact							
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐

Impact on Project Success		Level of Impact								
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS7. Subcontractors' (e.g. electrical, mechanical) experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS8. Suppliers' experience, competence, commercial strength and long-term accessibility	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS7. Subcontractors' (e.g. electrical, mechanical) experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS8. Suppliers' experience, competence, commercial strength and long-term accessibility	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐

Impact on Project Success		Level of Impact								
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS7. Subcontractors' (e.g. electrical, mechanical) experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS8. Suppliers' experience, competence, commercial strength and long-term accessibility	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS7. Subcontractors' (e.g. electrical, mechanical) experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS8. Suppliers' experience, competence, commercial strength and long-term accessibility	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐

Impact on Project Success		Level of Impact								
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS7. Subcontractors' (e.g. electrical, mechanical) experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS8. Suppliers' experience, competence, commercial strength and long-term accessibility	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS7. Subcontractors' (e.g. electrical, mechanical) experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS8. Suppliers' experience, competence, commercial strength and long-term accessibility	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS7. Subcontractors' (e.g. electrical, mechanical) experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS8. Suppliers' experience, competence, commercial strength and long-term accessibility	☐	☐	☐	☐	☐	☐	☐	☐	☐

4. Planning, Tender and Contracting Processes

Impact on Project Success		Level of Impact								
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ P1. Clear definition of project scope and public authority's requirements prior to the tender process, proper integration of end users' needs, inputs of operational staff, healthcare experts and all other interest groups in this process	☐ P2. Preparation of a comprehensive and realistic feasibility study prior to tender	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ P1. Clear definition of project scope and public authority's requirements prior to the tender process, proper integration of end users' needs, inputs of operational staff, healthcare experts and all other interest groups in this process	☐ P3. A well-designed, competitive and transparent tender process, clarity and adequacy of tender documents	☐	☐	☐	☐	☐	☐	☐	☐	☐

Impact on Project Success		Level of Impact								
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ P1. Clear definition of project scope and public authority's requirements prior to the tender process, proper integration of end users' needs, inputs of operational staff, healthcare experts and all other interest groups in this process	☐ P4. Comprehensive and clear final contract documentation prepared by the public agency and the contractor	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ P2. Preparation of a comprehensive and realistic feasibility study prior to tender	☐ P3. A well-designed, competitive and transparent tender process, clarity and adequacy of tender documents	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ P2. Preparation of a comprehensive and realistic feasibility study prior to tender	☐ P4. Comprehensive and clear final contract documentation prepared by the public agency and the contractor	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ P3. A well-designed, competitive and transparent tender process, clarity and adequacy of tender documents	☐ P4. Comprehensive and clear final contract documentation prepared by the public agency and the contractor	☐	☐	☐	☐	☐	☐	☐	☐	☐

5. Project Management

Impact on Project Success		Level of Impact								
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ PM1. Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases	☐ PM2. Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM1. Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases	☐ PM3. Effective control and supervision by the public agency through the life cycle of the project and an efficient governmental approval process	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM1. Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases	☐ PM4. Efficient monitoring, evaluation, reporting and control of project performance	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM1. Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases	☐ PM5. Establishment of an efficient system for controlling project changes and resolving disputes	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM1. Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases	☐ PM6. Effective implementation of risk management processes across all project phases	☐	☐	☐	☐	☐	☐	☐	☐	☐

Impact on Project Success			Level of Impact							
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ PM1. Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases	☐ PM7. Establishment of a proper documentation system for the project and storage of lessons learned through an accessible PPP projects database	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM2. Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders	☐ PM3. Effective control and supervision by the public agency through the life cycle of the project and an efficient governmental approval process	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM2. Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders	☐ PM4. Efficient monitoring, evaluation, reporting and control of project performance	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM2. Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders	☐ PM5. Establishment of an efficient system for controlling project changes and resolving disputes	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM2. Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders	☐ PM6. Effective implementation of risk management processes across all project phases	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM2. Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders	☐ PM7. Establishment of a proper documentation system for the project and storage of lessons learned through an accessible PPP projects database	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM3. Effective control and supervision by the public agency through the life cycle of the project and an efficient governmental approval process	☐ PM4. Efficient monitoring, evaluation, reporting and control of project performance	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM3. Effective control and supervision by the public agency through the life cycle of the project and an efficient governmental approval process	☐ PM5. Establishment of an efficient system for controlling project changes and resolving disputes	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM3. Effective control and supervision by the public agency through the life cycle of the project and an efficient governmental approval process	☐ PM6. Effective implementation of risk management processes across all project phases	☐	☐	☐	☐	☐	☐	☐	☐	☐

Impact on Project Success		Level of Impact								
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ PM3. Effective control and supervision by the public agency through the life cycle of the project and an efficient governmental approval process	☐ PM7. Establishment of a proper documentation system for the project and storage of lessons learned through an accessible PPP projects database	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM4. Efficient monitoring, evaluation, reporting and control of project performance	☐ PM5. Establishment of an efficient system for controlling project changes and resolving disputes	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM4. Efficient monitoring, evaluation, reporting and control of project performance	☐ PM6. Effective implementation of risk management processes across all project phases	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM4. Efficient monitoring, evaluation, reporting and control of project performance	☐ PM7. Establishment of a proper documentation system for the project and storage of lessons learned through an accessible PPP projects database	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM5. Establishment of an efficient system for controlling project changes and resolving disputes	☐ PM6. Effective implementation of risk management processes across all project phases	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM5. Establishment of an efficient system for controlling project changes and resolving disputes	☐ PM7. Establishment of a proper documentation system for the project and storage of lessons learned through an accessible PPP projects database	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM6. Effective implementation of risk management processes across all project phases	☐ PM7. Establishment of a proper documentation system for the project and storage of lessons learned through an accessible PPP projects database	☐	☐	☐	☐	☐	☐	☐	☐	☐

6. Design, Construction and Operation Processes

Impact on Project Success		Level of Impact								
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ DCO1. Further development of the pre-tender feasibility study and preparation of a detailed technical and financial analysis early on in the design-construction phase with the contribution of the private sector stakeholders	☐ DCO2. With the contribution of the stakeholders early on in the design-construction phase, further development of the project specifications prepared by the public agency	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ DCO1. Further development of the pre-tender feasibility study and preparation of a detailed technical and financial analysis early on in the design-construction phase with the contribution of the private sector stakeholders	☐ DCO3. Providing the integration of design with the construction and operation phases, ensuring its flexibility and optimization	☐	☐	☐	☐	☐	☐	☐	☐	☐

Impact on Project Success			Level of Impact							
Factor 1	Factor 2	1	2	3	4	5	6	7	8	9
☐ DCO1. Further development of the pre-tender feasibility study and preparation of a detailed technical and financial analysis early on in the design-construction phase with the contribution of the private sector stakeholders	☐ DCO4. Effective site management	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ DCO1. Further development of the pre-tender feasibility study and preparation of a detailed technical and financial analysis early on in the design-construction phase with the contribution of the private sector stakeholders	☐ DCO5. Establishment of an efficient quality, health, safety and environment management system for the construction and operation phases	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ DCO1. Further development of the pre-tender feasibility study and preparation of a detailed technical and financial analysis early on in the design-construction phase with the contribution of the private sector stakeholders	☐ DCO6. Taking the necessary measures to provide and maintain maximum performance throughout the operation phase	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ DCO1. Further development of the pre-tender feasibility study and preparation of a detailed technical and financial analysis early on in the design-construction phase with the contribution of the private sector stakeholders	☐ DCO7. Ensuring the proper transfer of the facility to the public authority at the end of the contract phase	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ DCO2. With the contribution of the stakeholders early on in the design-construction phase, further development of the project specifications prepared by the public agency	☐ DCO3. Providing the integration of design with the construction and operation phases, ensuring its flexibility and optimization	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ DCO2. With the contribution of the stakeholders early on in the design-construction phase, further development of the project specifications prepared by the public agency	☐ DCO4. Effective site management	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ DCO2. With the contribution of the stakeholders early on in the design-construction phase, further development of the project specifications prepared by the public agency	☐ DCO5. Establishment of an efficient quality, health, safety and environment management system for the construction and operation phases	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ DCO2. With the contribution of the stakeholders early on in the design-construction phase, further development of the project specifications prepared by the public agency	☐ DCO6. Taking the necessary measures to provide and maintain maximum performance throughout the operation phase	☐	☐	☐	☐	☐	☐	☐	☐	☐

Impact on Project Success		Level of Impact								
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ DCO2. With the contribution of the stakeholders early on in the design-construction phase, further development of the project specifications prepared by the public agency	☐ DCO7. Ensuring the proper transfer of the facility to the public authority at the end of the contract phase	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ DCO3. Providing the integration of design with the construction and operation phases, ensuring its flexibility and optimization	☐ DCO4. Effective site management	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ DCO3. Providing the integration of design with the construction and operation phases, ensuring its flexibility and optimization	☐ DCO5. Establishment of an efficient quality, health, safety and environment management system for the construction and operation phases	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ DCO3. Providing the integration of design with the construction and operation phases, ensuring its flexibility and optimization	☐ DCO6. Taking the necessary measures to provide and maintain maximum performance throughout the operation phase	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ DCO3. Providing the integration of design with the construction and operation phases, ensuring its flexibility and optimization	☐ DCO7. Ensuring the proper transfer of the facility to the public authority at the end of the contract phase	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ DCO4. Effective site management	☐ DCO5. Establishment of an efficient quality, health, safety and environment management system for the construction and operation phases	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ DCO4. Effective site management	☐ DCO6. Taking the necessary measures to provide and maintain maximum performance throughout the operation phase	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ DCO4. Effective site management	☐ DCO7. Ensuring the proper transfer of the facility to the public authority at the end of the contract phase	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ DCO5. Establishment of an efficient quality, health, safety and environment management system for the construction and operation phases	☐ DCO6. Taking the necessary measures to provide and maintain maximum performance throughout the operation phase	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ DCO5. Establishment of an efficient quality, health, safety and environment management system for the construction and operation phases	☐ DCO7. Ensuring the proper transfer of the facility to the public authority at the end of the contract phase	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ DCO6. Taking the necessary measures to provide and maintain maximum performance throughout the operation phase	☐ DCO7. Ensuring the proper transfer of the facility to the public authority at the end of the contract phase	☐	☐	☐	☐	☐	☐	☐	☐	☐

Section 2. The Interrelationships Between the Factors

In this section, it is objected to relatively assess the interrelationships between the factors, based on the success of a PPP healthcare project. For each factor, the factors that are considered to have an influence on that factor are compared to each other in terms of the magnitude of their influence.

1. Factors that are Influential on Financial Characteristics

Considering the success of the project, it was hypothesized that the *External Environment*, *Financial Characteristics*, *Project Stakeholders* and *Planning, Tender and Contracting Processes* are influential on **Financial Characteristics**.

F1. Favorable financing interest rates and financing costs, the strength and profitability of the project
- Fixed and low interest rate financing and low financial charges
- The strength, financial feasibility and sustainability of the project
- Sufficient profitability of the project to attract domestic/foreign investors

Influence on F1: Which of the compared factors has more influence on **F1**?

Level of Influence: How much more influential is the factor you have favored when compared to the other, on **F1**? (Skip this part if you have evaluated it as "equal".)

Influence on F1			Level of Influence							
Factor 1	Factor 2	1	2	3	4	5	6	7	8	9
☐ E1. A stable political environment and strong government support	☐ E2. Favorable global economic conditions and exchange rates, a strong and stable economic environment in the host country	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ E1. A stable political environment and strong government support	☐ E3. A transparent and mature legal and regulatory framework	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ E2. Favorable global economic conditions and exchange rates, a strong and stable economic environment in the host country	☐ E3. A transparent and mature legal and regulatory framework	☐	☐	☐	☐	☐	☐	☐	☐	☐

F3. Inclusion of investors and sponsors with sufficient financial strength in the project
- High credit rating of the investors
- Project sponsors' reliability and financial capability

Influence on F3: Which of the compared factors has more influence on **F3**?

Level of Influence: How much more influential is the factor you have favored when compared to the other, on **F3**? (Skip this part if you have evaluated it as "equal".)

Influence on F3		Level of Influence								
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ E1. A stable political environment and strong government support	☐ E2. Favorable global economic conditions and exchange rates, a strong and stable economic environment in the host country	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ E1. A stable political environment and strong government support	☐ E3. A transparent and mature legal and regulatory framework	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ E2. Favorable global economic conditions and exchange rates, a strong and stable economic environment in the host country	☐ E3. A transparent and mature legal and regulatory framework	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ F1. Favorable financing interest rates and financing costs, the strength and profitability of the project	☐ F2. Provision of adequate government guarantees	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐

Influence on F3		Level of Influence								
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐

Influence on F3			Level of Influence							
Factor 1	Factor 2	1	2	3	4	5	6	7	8	9
☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ P2. Preparation of a comprehensive and realistic feasibility study prior to tender	☐ P3. A well-designed, competitive and transparent tender process, clarity and adequacy of tender documents	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ P2. Preparation of a comprehensive and realistic feasibility study prior to tender	☐ P4. Comprehensive and clear final contract documentation prepared by the public agency and the contractor	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ P4. Comprehensive and clear final contract documentation prepared by the public agency and the contractor	☐ P4. Comprehensive and clear final contract documentation prepared by the public agency and the contractor	☐	☐	☐	☐	☐	☐	☐	☐	☐

2. Factors that are Influential on Planning, Tender and Contracting Processes

Considering the success of the project, it was hypothesized that the *Project Stakeholders* is influential on **Planning, Tender and Contracting Processes**.

P2. Preparation of a comprehensive and realistic feasibility study prior to tender
- Conduct of a detailed feasibility analysis encompassing technical, financial, economic, legal, social and environmental issues and demand projections

Influence on P2: Which of the compared factors has more influence on **P2**?

Level of Influence: How much more influential is the factor you have favored when compared to the other, on **P2**? (Skip this part if you have evaluated it as "equal".)

Influence on P2			Level of Influence							
Factor 1	Factor 2	1	2	3	4	5	6	7	8	9
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐

P3. A well-designed, competitive and transparent tender process, clarity and adequacy of tender documents

- Clearly defined tender procedures
- Developing appropriate and explicit tender evaluation criteria and their weighting, based on a combination of bid price and qualifications (e.g. technical, financial and managerial competence, experience, past performance)
- Application of competitive tender procedures and ensuring a sufficient number of qualified bidders in the process
- A transparent tender process, in which, the rules are made available to all participants and the process is made open and public
- Adequacy and reliability of the tender documents, comprehensive and well-defined tender specifications presented by the public agency

Influence on P3: Which of the compared factors has more influence on **P3**?

Level of Influence: How much more influential is the factor you have favored when compared to the other, on **P3**? (Skip this part if you have evaluated it as "equal".)

Influence on P3		Level of Influence								
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐

P4. Comprehensive and clear final contract documentation prepared by the public agency and the contractor

- A comprehensive final contract including the well-defined roles and responsibilities of the stakeholders, explicit project objectives and scope
- Adequacy and clarity of plans and specifications included in the contract
- Specification of risks in the contract with fair and reasonable risk allocation among project stakeholders

Influence on P4: Which of the compared factors has more influence on **P4**?

Level of Influence: How much more influential is the factor you have favored when compared to the other, on **P4**? (Skip this part if you have evaluated it as "equal".)

Influence on P4		Level of Influence								
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐

3. Factors that are Influential on Project Management

Considering the success of the project, it was hypothesized that the *Project Stakeholders* is influential on **Project Management**.

PM1. Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases
- Detailed and well-prepared budget and schedule, in line with whole life cost assessment and effective strategic planning for the project

Influence on PM1: Which of the compared factors has more influence on **PM1**?

Level of Influence: How much more influential is the factor you have favored when compared to the other, on **PM1**? (Skip this part if you have evaluated it as "equal".)

Influence on PM1			Level of Influence							
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ P1. Clear definition of project scope and public authority's requirements prior to the tender process, proper integration of end users' needs, inputs of operational staff, healthcare experts and all other interest groups in this process	☐ P2. Preparation of a comprehensive and realistic feasibility study prior to tender	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ P1. Clear definition of project scope and public authority's requirements prior to the tender process, proper integration of end users' needs, inputs of operational staff, healthcare experts and all other interest groups in this process	☐ P4. Comprehensive and clear final contract documentation prepared by the public agency and the contractor	☐	☐	☐	☐	☐	☐	☐	☐	☐

Influence on PM1			Level of Influence							
Factor 1	Factor 2	1	2	3	4	5	6	7	8	9
☐ P2. Preparation of a comprehensive and realistic feasibility study prior to tender	☐ P4. Comprehensive and clear final contract documentation prepared by the public agency and the contractor	☐	☐	☐	☐	☐	☐	☐	☐	☐

PM2. Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders

- Providing the contribution of the public agency, public agency consultant, contractor, contractor's consultants, operator, designer, subcontractors and suppliers in all project phases
- Ensuring adequate and effective communication/coordination between project participants through proper communication channels

Influence on PM2: Which of the compared factors has more influence on **PM2**?

Level of Influence: How much more influential is the factor you have favored when compared to the other, on **PM2**? (Skip this part if you have evaluated it as "equal".)

Influence on PM2			Level of Influence							
Factor 1	Factor 2	1	2	3	4	5	6	7	8	9
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐

Influence on PM2		Level of Influence								
Factor 1	Factor 2	1	2	3	4	5	6	7	8	9
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐

PM3. Effective control and supervision by the public agency through the life cycle of the project and an efficient governmental approval process

- Regular monitoring and feedback provided by the public agency through all project phases by competent staff
- The effectiveness of the public approval mechanism, timely and proper interventions on the project by the public agency

Influence on PM3: Which of the compared factors has more influence on **PM3**?

Level of Influence: How much more influential is the factor you have favored when compared to the other, on **PM3**? (Skip this part if you have evaluated it as "equal".)

Influence on PM3		Level of Influence								
Factor 1	Factor 2	1	2	3	4	5	6	7	8	9
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐

PM4. Efficient monitoring, evaluation, reporting and control of project performance

- Regular control meetings, project schedule and budget updates throughout the project life cycle
- Identification of deviations from plan, evaluating possible alternative course of actions and taking appropriate corrective actions

Influence on PM4: Which of the compared factors has more influence on **PM4**?

Level of Influence: How much more influential is the factor you have favored when compared to the other, on **PM4**? (Skip this part if you have evaluated it as "equal".)

Influence on PM4		Level of Influence								
Factor 1	Factor 2	1	2	3	4	5	6	7	8	9
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐

Influence on PM4		Level of Influence								
Factor 1	Factor 2	1	2	3	4	5	6	7	8	9
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐

PM5. Establishment of an efficient system for controlling project changes and resolving disputes

- Taking effective change management and dispute resolution measures to properly manage deviations from the project plan
- Providing adaptability to changes in project plan/scope

Influence on PM5: Which of the compared factors has more influence on **PM5**?

Level of Influence: How much more influential is the factor you have favored when compared to the other, on **PM5**? (Skip this part if you have evaluated it as "equal".)

Influence on PM5		Level of Influence								
Factor 1	Factor 2	1	2	3	4	5	6	7	8	9
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐

Influence on PM5		Level of Influence								
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐

Influence on PM5		Level of Influence								
Factor 1	Factor 2	1	2	3	4	5	6	7	8	9
☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐

PM6. Effective implementation of risk management processes across all project phases

- Establishment of an effective risk management system for the project, which encompasses risk identification, assessment, response development, monitoring and control, and documentation processes

Influence on PM6: Which of the compared factors has more influence on **PM6**?

Level of Influence: How much more influential is the factor you have favored when compared to the other, on **PM6**? (Skip this part if you have evaluated it as "equal".)

Influence on PM6		Level of Influence								
Factor 1	Factor 2	1	2	3	4	5	6	7	8	9
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐

Influence on PM6		Level of Influence								
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐

PM7. Establishment of a proper documentation system for the project and storage of lessons learned through an accessible PPP projects database

- Ensuring that the documentation process is defined and formalized for all project phases
- Development of an accessible PPP projects database for continuous learning and improvement

Influence on PM7: Which of the compared factors has more influence on **PM7**?

Level of Influence: How much more influential is the factor you have favored when compared to the other, on **PM7**? (Skip this part if you have evaluated it as "equal".)

Influence on PM7			Level of Influence							
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐

4. Factors that are Influential on Design, Construction and Operation Processes

Considering the success of the project, it was hypothesized that the *Project Stakeholders* and *Planning, Tender and Contracting Processes* are influential on **Design, Construction and Operation Processes**.

DCO1. Further development of the pre-tender feasibility study and preparation of a detailed technical and financial analysis early on in the design-construction phase with the contribution of the private sector stakeholders

- Further development of the feasibility study conducted by the public agency at the planning stage
- Carrying out thorough technical, financial and economic analysis and developing workable financial plans

Influence on DCO1: Which of the compared factors has more influence on **DCO1**?

Level of Influence: How much more influential is the factor you have favored when compared to the other, on **DCO1**? (Skip this part if you have evaluated it as "equal".)

Influence on DCO1			Level of Influence							
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ P1. Clear definition of project scope and public authority's requirements prior to the tender process, proper integration of end users' needs, inputs of operational staff, healthcare experts and all other interest groups in this process	☐ P2. Preparation of a comprehensive and realistic feasibility study prior to tender	☐	☐	☐	☐	☐	☐	☐	☐	☐

DCO2. With the contribution of the stakeholders early on in the design-construction phase, further development of the project specifications prepared by the public agency

- Defining explicit, specific and assessable project specifications considering the entire project life cycle

Influence on DCO2: Which of the compared factors has more influence on **DCO2**?

Level of Influence: How much more influential is the factor you have favored when compared to the other, on **DCO2**? (Skip this part if you have evaluated it as "equal".)

Influence on DCO2		Level of Influence								
Factor 1	Factor 2	1	2	3	4	5	6	7	8	9
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐

Influence on DCO2			Level of Influence							
Factor 1	Factor 2	1	2	3	4	5	6	7	8	9
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ P3. A well-designed, competitive and transparent tender process, clarity and adequacy of tender documents	☐ P4. Comprehensive and clear final contract documentation prepared by the public agency and the contractor	☐	☐	☐	☐	☐	☐	☐	☐	☐

DCO3. Providing the integration of design with the construction and operation phases, ensuring its flexibility and optimization

- Providing the integration of design with the construction and operation phases, ensuring its flexibility and optimization

Influence on DCO3: Which of the compared factors has more influence on **DCO3**?

Level of Influence: How much more influential is the factor you have favored when compared to the other, on **DCO3**? (Skip this part if you have evaluated it as "equal".)

Influence on DCO3		Level of Influence								
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS7. Subcontractors' (e.g. electrical, mechanical) experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS7. Subcontractors' (e.g. electrical, mechanical) experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐

Influence on DCO3		Level of Influence								
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS7. Subcontractors' (e.g. electrical, mechanical) experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS6. Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS7. Subcontractors' (e.g. electrical, mechanical) experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ P1. Clear definition of project scope and public authority's requirements prior to the tender process, proper integration of end users' needs, inputs of operational staff, healthcare experts and all other interest groups in this process	☐ P4. Comprehensive and clear final contract documentation prepared by the public agency and the contractor	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM2. Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders	☐ PM3. Effective control and supervision by the public agency through the life cycle of the project and an efficient governmental approval process	☐	☐	☐	☐	☐	☐	☐	☐	☐

DCO4. Effective site management

- A proper site layout
- Effective planning and management of site operations

Influence on DCO4: Which of the compared factors has more influence on **DCO4**?

Level of Influence: How much more influential is the factor you have favored when compared to the other, on **DCO4**? (Skip this part if you have evaluated it as "equal".)

Influence on DCO4		Level of Influence								
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐

Influence on DCO4			Level of Influence							
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ PM1. Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases	☐ PM2. Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM1. Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases	☐ PM4. Efficient monitoring, evaluation, reporting and control of project performance	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM1. Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases	☐ PM5. Establishment of an efficient system for controlling project changes and resolving disputes	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM1. Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases	☐ PM6. Effective implementation of risk management processes across all project phases	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM2. Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders	☐ PM4. Efficient monitoring, evaluation, reporting and control of project performance	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM2. Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders	☐ PM5. Establishment of an efficient system for controlling project changes and resolving disputes	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM2. Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders	☐ PM6. Effective implementation of risk management processes across all project phases	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM4. Efficient monitoring, evaluation, reporting and control of project performance	☐ PM5. Establishment of an efficient system for controlling project changes and resolving disputes	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM4. Efficient monitoring, evaluation, reporting and control of project performance	☐ PM6. Effective implementation of risk management processes across all project phases	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM5. Establishment of an efficient system for controlling project changes and resolving disputes	☐ PM6. Effective implementation of risk management processes across all project phases	☐	☐	☐	☐	☐	☐	☐	☐	☐

DCO5. Establishment of an efficient quality, health, safety and environment management system for the construction and operation phases

- Providing extensive supervision and control in terms of quality, health, safety and environment

Influence on DCO5: Which of the compared factors has more influence on **DCO5**?

Level of Influence: How much more influential is the factor you have favored when compared to the other, on **DCO5**? (Skip this part if you have evaluated it as "equal".)

Influence on DCO5			Level of Influence							
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM1. Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases	☐ PM6. Effective implementation of risk management processes across all project phases	☐	☐	☐	☐	☐	☐	☐	☐	☐

DCO6. Taking the necessary measures to provide and maintain maximum performance throughout the operation phase

- Establishment of an efficient performance management system with a systematic performance measurement and reporting mechanism

Influence on DCO6: Which of the compared factors has more influence on **DCO6**?

Level of Influence: How much more influential is the factor you have favored when compared to the other, on **DCO6**? (Skip this part if you have evaluated it as "equal".)

Influence on DCO6			Level of Influence							
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ P1. Clear definition of project scope and public authority's requirements prior to the tender process, proper integration of end users' needs, inputs of operational staff, healthcare experts and all other interest groups in this process	☐ P2. Preparation of a comprehensive and realistic feasibility study prior to tender	☐	☐	☐	☐	☐	☐	☐	☐	☐

Influence on DCO6			Level of Influence							
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ P1. Clear definition of project scope and public authority's requirements prior to the tender process, proper integration of end users' needs, inputs of operational staff, healthcare experts and all other interest groups in this process	☐ P4. Comprehensive and clear final contract documentation prepared by the public agency and the contractor	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ P2. Preparation of a comprehensive and realistic feasibility study prior to tender	☐ P4. Comprehensive and clear final contract documentation prepared by the public agency and the contractor	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM1. Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases	☐ PM2. Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM1. Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases	☐ PM3. Effective control and supervision by the public agency through the life cycle of the project and an efficient governmental approval process	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM1. Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases	☐ PM4. Efficient monitoring, evaluation, reporting and control of project performance	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM1. Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases	☐ PM5. Establishment of an efficient system for controlling project changes and resolving disputes	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM1. Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases	☐ PM6. Effective implementation of risk management processes across all project phases	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM2. Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders	☐ PM3. Effective control and supervision by the public agency through the life cycle of the project and an efficient governmental approval process	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM2. Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders	☐ PM4. Efficient monitoring, evaluation, reporting and control of project performance	☐	☐	☐	☐	☐	☐	☐	☐	☐

Influence on DCO6										Level of Influence
Factor 1	Factor 2	1	2	3	4	5	6	7	8	9
☐ PM2. Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders	☐ PM5. Establishment of an efficient system for controlling project changes and resolving disputes	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM2. Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders	☐ PM6. Effective implementation of risk management processes across all project phases	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM3. Effective control and supervision by the public agency through the life cycle of the project and an efficient governmental approval process	☐ PM4. Efficient monitoring, evaluation, reporting and control of project performance	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM3. Effective control and supervision by the public agency through the life cycle of the project and an efficient governmental approval process	☐ PM5. Establishment of an efficient system for controlling project changes and resolving disputes	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM3. Effective control and supervision by the public agency through the life cycle of the project and an efficient governmental approval process	☐ PM6. Effective implementation of risk management processes across all project phases	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM4. Efficient monitoring, evaluation, reporting and control of project performance	☐ PM5. Establishment of an efficient system for controlling project changes and resolving disputes	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM4. Efficient monitoring, evaluation, reporting and control of project performance	☐ PM6. Effective implementation of risk management processes across all project phases	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM5. Establishment of an efficient system for controlling project changes and resolving disputes	☐ PM6. Effective implementation of risk management processes across all project phases	☐	☐	☐	☐	☐	☐	☐	☐	☐

DCO7. Ensuring the proper transfer of the facility to the public authority at the end of the contract phase

- Developing effective hand over procedures to ensure that the performance is maintained through the transfer of the facility
- Determining the obligations of the public and private sector stakeholders and defining the process to be followed, involving the principles of the inspections and monitoring to be undertaken in this period

Influence on DCO7: Which of the compared factors has more influence on **DCO7**?

Level of Influence: How much more influential is the factor you have favored when compared to the other, on **DCO7**? (Skip this part if you have evaluated it as "equal".)

Influence on DCO7			Level of Influence							
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS1. Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS2. Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐

Influence on DCO7										
		Level of Influence								
Factor 1	**Factor 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS3. Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PS4. Contractor's consultants' (e.g. traffic, ESIA, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the BLT model	☐ PS5. Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the BLT model	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ P1. Clear definition of project scope and public authority's requirements prior to the tender process, proper integration of end users' needs, inputs of operational staff, healthcare experts and all other interest groups in this process	☐ P4. Comprehensive and clear final contract documentation prepared by the public agency and the contractor	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ PM1. Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases	☐ PM5. Establishment of an efficient system for controlling project changes and resolving disputes	☐	☐	☐	☐	☐	☐	☐	☐	☐

Section 3. The Degree of Impact of the Clusters on Project Success

In this section, it is objected to relatively assess the level of impact of the clusters on the success of a PPP healthcare project. Each cluster is individually compared against the other clusters, based on their level of impact on project success.

Impact on Project Success: Which of the compared clusters is more influential on the success of a PPP healthcare project?

The Level of Impact: How much more influential is the cluster you have favored when compared to the other, on the PPP healthcare project success? (Skip this part if you have evaluated it as "equal".)

Impact on Project Success			Level of Impact							
Cluster 1	**Cluster 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ 1. External Environment	☐ 2. Financial Characteristics	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ 1. External Environment	☐ 3. Project Stakeholders	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ 1. External Environment	☐ 4. Planning, Tender and Contracting Processes	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ 1. External Environment	☐ 5. Project Management	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ 1. External Environment	☐ 6. Design, Construction and Operation Processes	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ 2. Financial Characteristics	☐ 3. Project Stakeholders	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ 2. Financial Characteristics	☐ 4. Planning, Tender and Contracting Processes	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ 2. Financial Characteristics	☐ 5. Project Management	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ 2. Financial Characteristics	☐ 6. Design, Construction and Operation Processes	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ 3. Project Stakeholders	☐ 4. Planning, Tender and Contracting Processes	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ 3. Project Stakeholders	☐ 5. Project Management	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ 3. Project Stakeholders	☐ 6. Design, Construction and Operation Processes	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ 4. Planning, Tender and Contracting Processes	☐ 5. Project Management	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ 4. Planning, Tender and Contracting Processes	☐ 6. Design, Construction and Operation Processes	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ 5. Project Management	☐ 6. Design, Construction and Operation Processes	☐	☐	☐	☐	☐	☐	☐	☐	☐

Section 4. The Interrelationships Between the Clusters

In this section, it is objected to relatively assess the interrelationships between the clusters, based on the success of a PPP healthcare project. For each cluster, the clusters that are considered to have an influence on that cluster are compared to each other in terms of the magnitude of their influence. If the factors of a cluster have dependence upon each other, then the cluster is indicated with an inner dependence and the influence of the cluster on itself is also included in the comparisons.

1. Clusters that are Influential on Financial Characteristics

Considering the success of the project, it was hypothesized that the *External Environment*, *Financial Characteristics*, *Project Stakeholders* and *Planning, Tender and Contracting Processes* are influential on **Financial Characteristics**.

Financial Characteristics
- Favorable financing interest rates and financing costs, the strength and profitability of the project
- Provision of adequate government guarantees
- Inclusion of investors and sponsors with sufficient financial strength in the project

Influence on Financial Characteristics: Which of the compared factors has more influence on **Financial Characteristics**?

Level of Influence: How much more influential is the factor you have favored when compared to the other, on **Financial Characteristics**? (Skip this part if you have evaluated it as "equal".)

Impact on Financial Characteristics			Level of Impact							
Cluster 1	**Cluster 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ 1. External Environment	☐ 2. Financial Characteristics	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ 1. External Environment	☐ 3. Project Stakeholders	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ 1. External Environment	☐ 4. Planning, Tender and Contracting Processes	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ 2. Financial Characteristics	☐ 3. Project Stakeholders	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ 2. Financial Characteristics	☐ 4. Planning, Tender and Contracting Processes	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ 3. Project Stakeholders	☐ 4. Planning, Tender and Contracting Processes	☐	☐	☐	☐	☐	☐	☐	☐	☐

2. Clusters that are Influential on Project Management

Considering the success of the project, it was hypothesized that the *Project Stakeholders* and *Planning, Tender and Contracting Processes* are influential on **Project Management**.

Project Management
- Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases
- Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders
- Effective control and supervision by the public agency through the life cycle of the project and an efficient governmental approval process
- Efficient monitoring, evaluation, reporting and control of project performance
- Establishment of an efficient system for controlling project changes and resolving disputes
- Effective implementation of risk management processes across all project phases
- Establishment of a proper documentation system for the project and storage of lessons learned through an accessible PPP projects database

Influence on Project Management: Which of the compared factors has more influence on **Project Management**?

Level of Influence: How much more influential is the factor you have favored when compared to the other, on **Project Management**? (Skip this part if you have evaluated it as "equal".)

Impact on Project Management		Level of Impact								
Cluster 1	**Cluster 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
☐ 3. Project Stakeholders	☐ 4. Planning, Tender and Contracting Processes	☐	☐	☐	☐	☐	☐	☐	☐	☐

3. Clusters that are Influential on Design, Construction and Operation Processes

Considering the success of the project, it was hypothesized that the *Project Stakeholders*, *Planning, Tender and Contracting Processes* and *Project Management* are influential on **Design, Construction and Operation Processes.**

Design, Construction and Operation Processes

- Further development of the pre-tender feasibility study and preparation of a detailed technical and financial analysis early on in the design-construction phase with the contribution of the private sector stakeholders
- With the contribution of the stakeholders early on in the design-construction phase, further development of the project specifications prepared by the public agency
- Providing the integration of design with the construction and operation phases, ensuring its flexibility and optimization
- Effective site management
- Establishment of an efficient quality, health, safety and environment management system for the construction and operation phases
- Taking the necessary measures to provide and maintain maximum performance throughout the operation phase
- Ensuring the proper transfer of the facility to the public authority at the end of the contract phase

Influence on Design, Construction and Operation Processes: Which of the compared clusters has more influence on **Design, Construction and Operation Processes**?

Level of Influence: How much more influential is the factor you have favored when compared to the other, on **Design, Construction and Operation Processes**? (Skip this part if you have evaluated it as "equal".)

Impact on Design, Construction and Operation Processes			Level of Impact							
Cluster 1	Cluster 2	1	2	3	4	5	6	7	8	9
☐ 3. Project Stakeholders	☐ 4. Planning, Tender and Contracting Processes	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ 3. Project Stakeholders	☐ 5. Project Management	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ 4. Planning, Tender and Contracting Processes	☐ 5. Project Management	☐	☐	☐	☐	☐	☐	☐	☐	☐

APPENDIX F

The Limit Supermatrix Revealed by the ANP

Table F.1. The limit supermatrix

Cluster Node Labels		External Environment				Financial Characteristics		
		E1	E2	E3	E4	F1	F2	F3
External Environment	E1	0.00000	0.00000	0.00000	0.00000	0.42857	0.00000	0.07088
	E2	0.00000	0.00000	0.00000	0.00000	0.42857	0.00000	0.16799
	E3	0.00000	0.00000	0.00000	0.00000	0.14286	0.00000	0.16287
	E4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Financial Characteristics	F1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.06696
	F2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.26783
	F3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Project Stakeholders	PS1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.02334
	PS2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.04234
	PS3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.03899
	PS4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.04073
	PS5	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.02943
	PS6	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.01268
	PS7	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	PS8	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Planning, Tender and Contracting Processes	P1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	P2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.05065
	P3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.01266
	P4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.01266
Project Management	PM1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	PM2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	PM3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	PM4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	PM5	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	PM6	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	PM7	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Design, Construction and Operation Processes	DCO1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	DCO2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	DCO3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	DCO4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	DCO5	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	DCO6	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	DCO7	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

Table F.1. The limit supermatrix (continued)

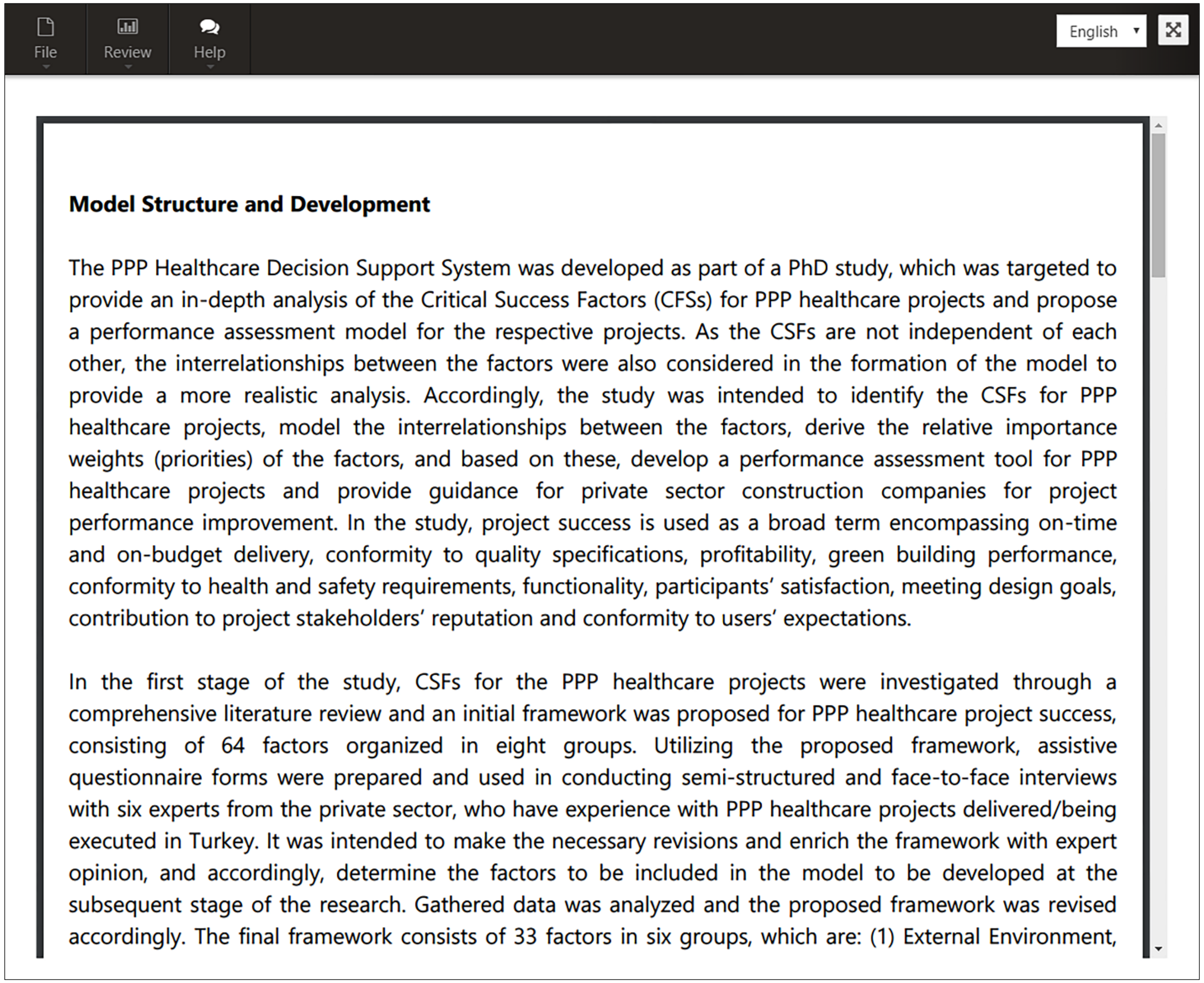
Cluster Node Labels		Project Stakeholders								Planning, Tender and Contracting Processes			
		PS1	**PS2**	**PS3**	**PS4**	**PS5**	**PS6**	**PS7**	**PS8**	**P1**	**P2**	**P3**	**P4**
External Environment	**E1**	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	E2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	E3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	E4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Financial Characteristics	**F1**	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	F2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	F3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Project Stakeholders	**PS1**	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.25000	0.00000	0.50000
	PS2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.75000	0.00000	0.00000
	PS3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.50000
	PS4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	PS5	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	PS6	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	PS7	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	PS8	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Planning, Tender and Contracting Processes	**P1**	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	P2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	P3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	P4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Project Management	**PM1**	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	PM2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	PM3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	PM4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	PM5	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	PM6	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	PM7	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Design, Construction and Operation Processes	**DCO1**	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	DCO2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	DCO3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	DCO4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	DCO5	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	DCO6	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	DCO7	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

Table F.1. The limit supermatrix (continued)

Cluster	Node Labels	Project Management							Design, Construction and Operation Processes							Goal
		PM1	PM2	PM3	PM4	PM5	PM6	PM7	DCO1	DCO2	DCO3	DCO4	DCO5	DCO6	DCO7	
External Environment	E1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.04478
	E2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.04430
	E3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.02813
	E4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00236
Financial Characteristics	F1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.03300
	F2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.06189
	F3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.10506
Project Stakeholders	PS1	0.06035	0.28795	0.88889	0.00000	0.38201	0.06268	0.24627	0.05000	0.17777	0.16266	0.03151	0.01607	0.24474	0.21334	0.09756
	PS2	0.02586	0.13767	0.11111	0.00000	0.21032	0.06268	0.29788	0.15000	0.10634	0.02195	0.01747	0.01278	0.07784	0.04693	0.03795
	PS3	0.58495	0.44858	0.00000	0.63699	0.15359	0.45628	0.24627	0.33973	0.31320	0.19252	0.53870	0.29532	0.08384	0.17092	0.13380
	PS4	0.06046	0.00000	0.00000	0.10473	0.06116	0.20918	0.00000	0.05586	0.03899	0.04706	0.10615	0.20464	0.04628	0.03716	0.02594
	PS5	0.09597	0.12580	0.00000	0.25828	0.15359	0.20918	0.20959	0.13775	0.03899	0.10522	0.04579	0.20803	0.16692	0.15178	0.04818
	PS6	0.00000	0.00000	0.00000	0.00000	0.03932	0.00000	0.00000	0.00000	0.03899	0.09412	0.00180	0.00000	0.00071	0.00352	0.02688
	PS7	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.02353	0.00000	0.00000	0.00000	0.00000	0.00640
	PS8	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00422
Planning, Tender and Contracting Processes	P1	0.03448	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.06667	0.00000	0.05882	0.00215	0.00329	0.11914	0.09319	0.03987
	P2	0.03448	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.20000	0.00000	0.00000	0.00215	0.00329	0.03423	0.00358	0.01999
	P3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.14286	0.00000	0.00000	0.00000	0.00000	0.00000	0.02028
	P4	0.10345	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.14286	0.11765	0.00644	0.00987	0.04145	0.10036	0.05827
Project Management	PM1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.05368	0.08224	0.04977	0.08961	0.01722
	PM2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.08823	0.02684	0.00000	0.02928	0.00000	0.01761
	PM3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.08823	0.00000	0.00000	0.05767	0.00000	0.00931
	PM4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.08104	0.00000	0.01500	0.00000	0.01161
	PM5	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.04577	0.00000	0.01813	0.08961	0.01990
	PM6	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.04052	0.16447	0.01500	0.00000	0.00807
	PM7	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00272
Design, Construction and Operation Processes	DCO1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.01742
	DCO2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.01509
	DCO3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.01509
	DCO4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.01001
	DCO5	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00454
	DCO6	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00961
	DCO7	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00291

APPENDIX G

Snapshots Provided from the Developed Decision Support System

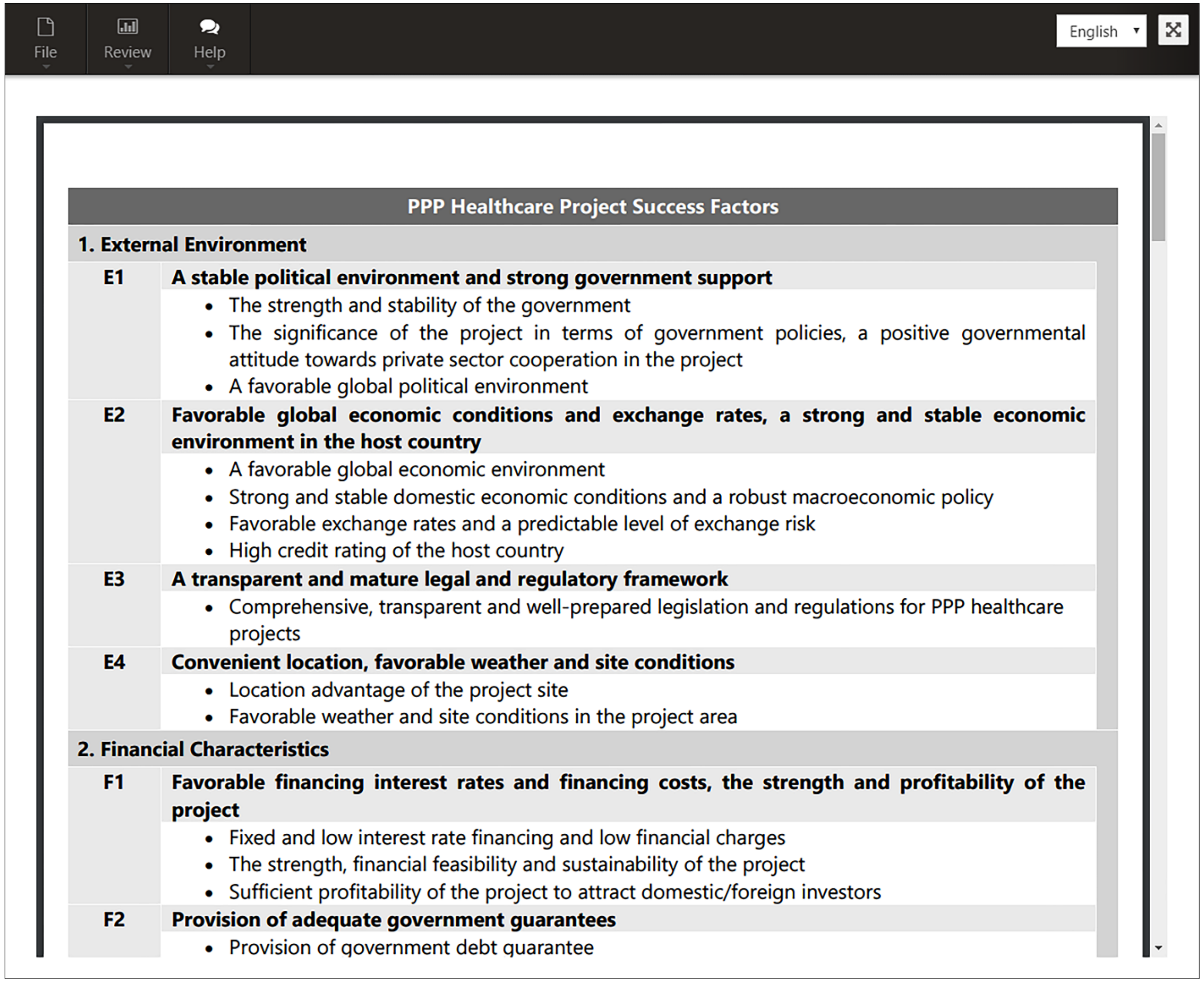


Model Structure and Development

The PPP Healthcare Decision Support System was developed as part of a PhD study, which was targeted to provide an in-depth analysis of the Critical Success Factors (CFSs) for PPP healthcare projects and propose a performance assessment model for the respective projects. As the CSFs are not independent of each other, the interrelationships between the factors were also considered in the formation of the model to provide a more realistic analysis. Accordingly, the study was intended to identify the CSFs for PPP healthcare projects, model the interrelationships between the factors, derive the relative importance weights (priorities) of the factors, and based on these, develop a performance assessment tool for PPP healthcare projects and provide guidance for private sector construction companies for project performance improvement. In the study, project success is used as a broad term encompassing on-time and on-budget delivery, conformity to quality specifications, profitability, green building performance, conformity to health and safety requirements, functionality, participants' satisfaction, meeting design goals, contribution to project stakeholders' reputation and conformity to users' expectations.

In the first stage of the study, CSFs for the PPP healthcare projects were investigated through a comprehensive literature review and an initial framework was proposed for PPP healthcare project success, consisting of 64 factors organized in eight groups. Utilizing the proposed framework, assistive questionnaire forms were prepared and used in conducting semi-structured and face-to-face interviews with six experts from the private sector, who have experience with PPP healthcare projects delivered/being executed in Turkey. It was intended to make the necessary revisions and enrich the framework with expert opinion, and accordingly, determine the factors to be included in the model to be developed at the subsequent stage of the research. Gathered data was analyzed and the proposed framework was revised accordingly. The final framework consists of 33 factors in six groups, which are: (1) External Environment,

Figure G.1. **Model Structure and Development** presented under the **Help** tab



PPP Healthcare Project Success Factors

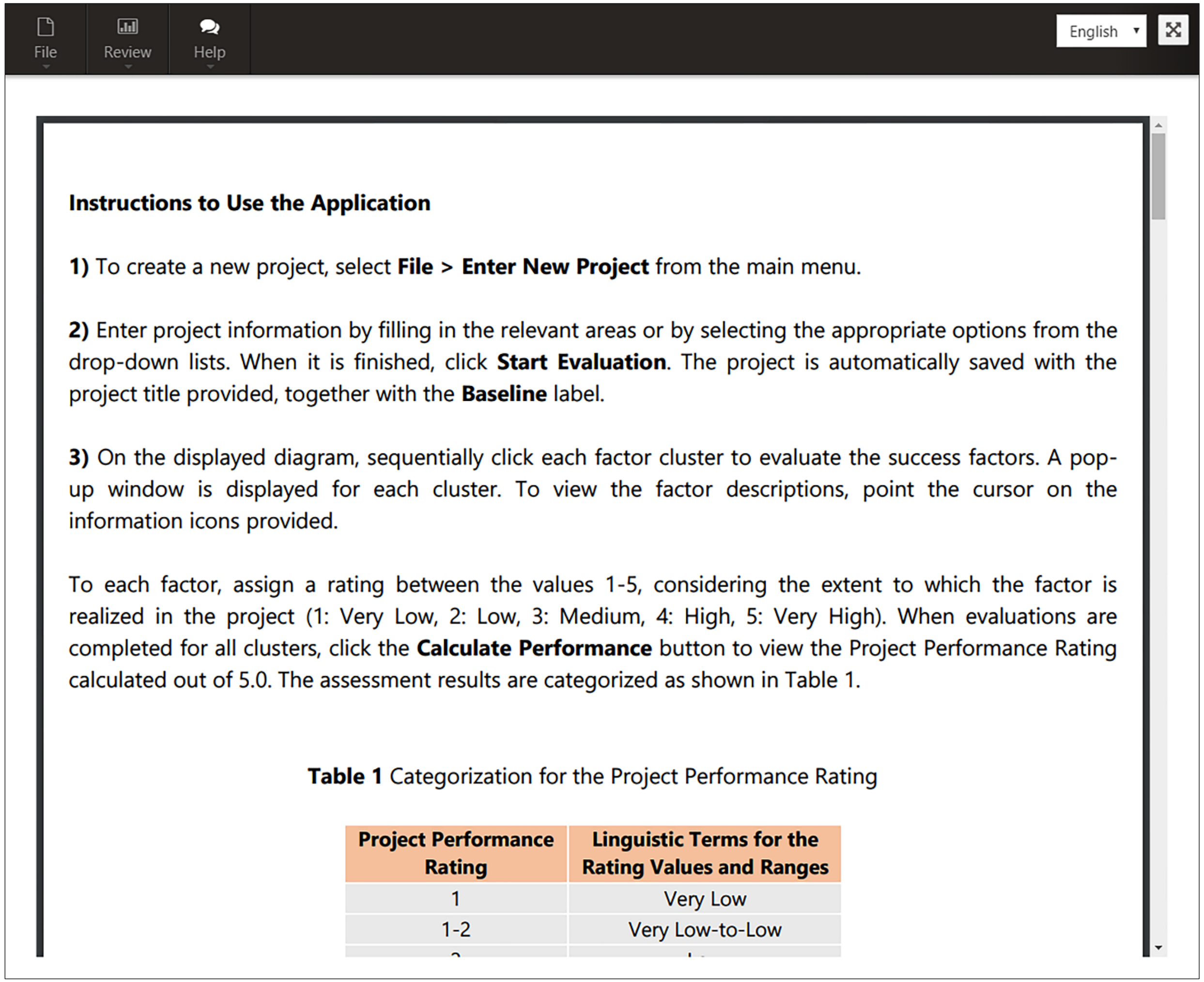
1. External Environment

E1	**A stable political environment and strong government support** • The strength and stability of the government • The significance of the project in terms of government policies, a positive governmental attitude towards private sector cooperation in the project • A favorable global political environment
E2	**Favorable global economic conditions and exchange rates, a strong and stable economic environment in the host country** • A favorable global economic environment • Strong and stable domestic economic conditions and a robust macroeconomic policy • Favorable exchange rates and a predictable level of exchange risk • High credit rating of the host country
E3	**A transparent and mature legal and regulatory framework** • Comprehensive, transparent and well-prepared legislation and regulations for PPP healthcare projects
E4	**Convenient location, favorable weather and site conditions** • Location advantage of the project site • Favorable weather and site conditions in the project area

2. Financial Characteristics

F1	**Favorable financing interest rates and financing costs, the strength and profitability of the project** • Fixed and low interest rate financing and low financial charges • The strength, financial feasibility and sustainability of the project • Sufficient profitability of the project to attract domestic/foreign investors
F2	**Provision of adequate government guarantees** • Provision of government debt guarantee

Figure G.2. **List of Success Factors** presented under the **Help** tab



Instructions to Use the Application

1) To create a new project, select **File > Enter New Project** from the main menu.

2) Enter project information by filling in the relevant areas or by selecting the appropriate options from the drop-down lists. When it is finished, click **Start Evaluation**. The project is automatically saved with the project title provided, together with the **Baseline** label.

3) On the displayed diagram, sequentially click each factor cluster to evaluate the success factors. A pop-up window is displayed for each cluster. To view the factor descriptions, point the cursor on the information icons provided.

To each factor, assign a rating between the values 1-5, considering the extent to which the factor is realized in the project (1: Very Low, 2: Low, 3: Medium, 4: High, 5: Very High). When evaluations are completed for all clusters, click the **Calculate Performance** button to view the Project Performance Rating calculated out of 5.0. The assessment results are categorized as shown in Table 1.

Table 1 Categorization for the Project Performance Rating

Project Performance Rating	Linguistic Terms for the Rating Values and Ranges
1	Very Low
1-2	Very Low-to-Low

Figure G.3. **Instructions to Use the Application** presented under the **Help** tab

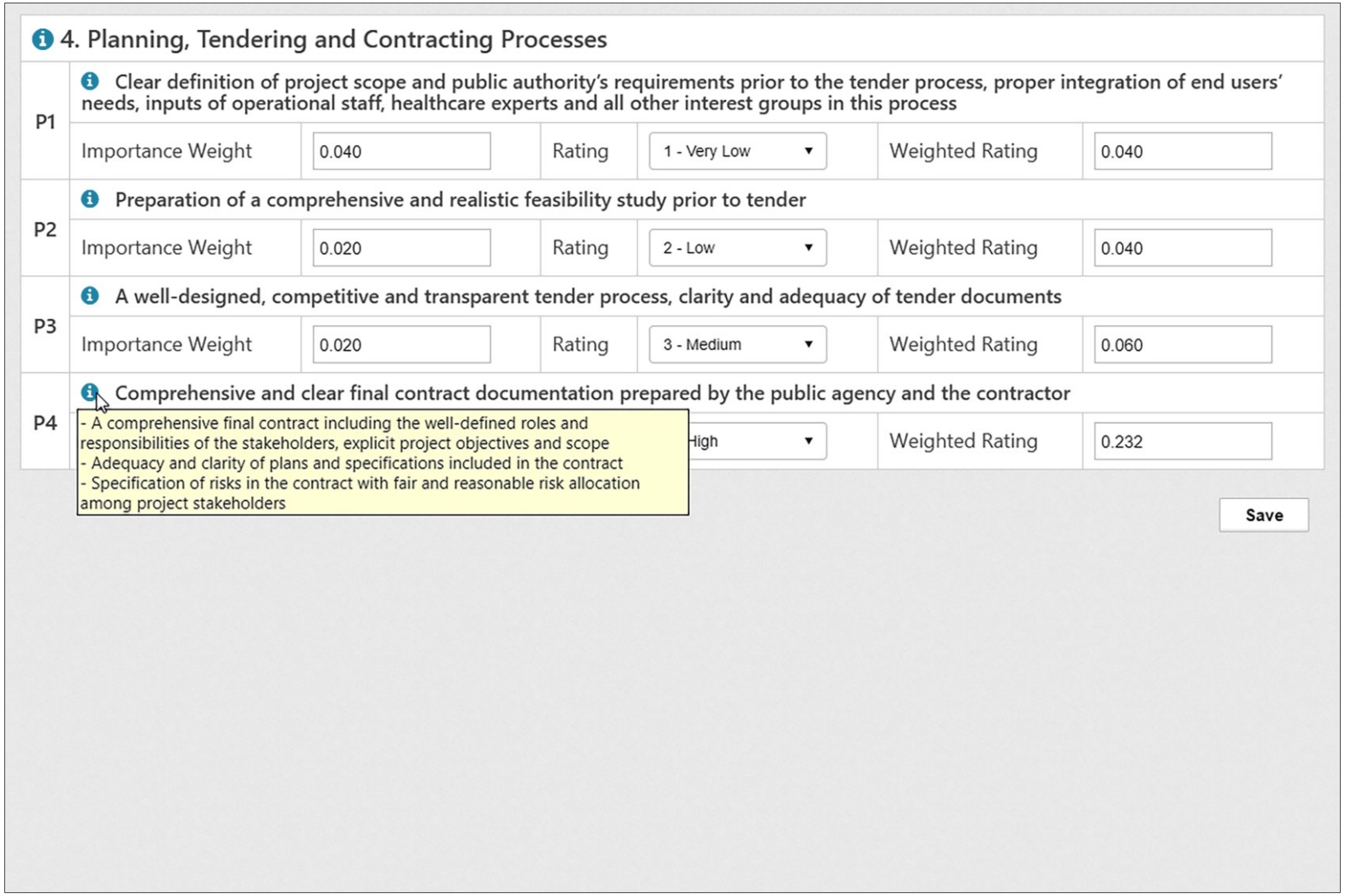
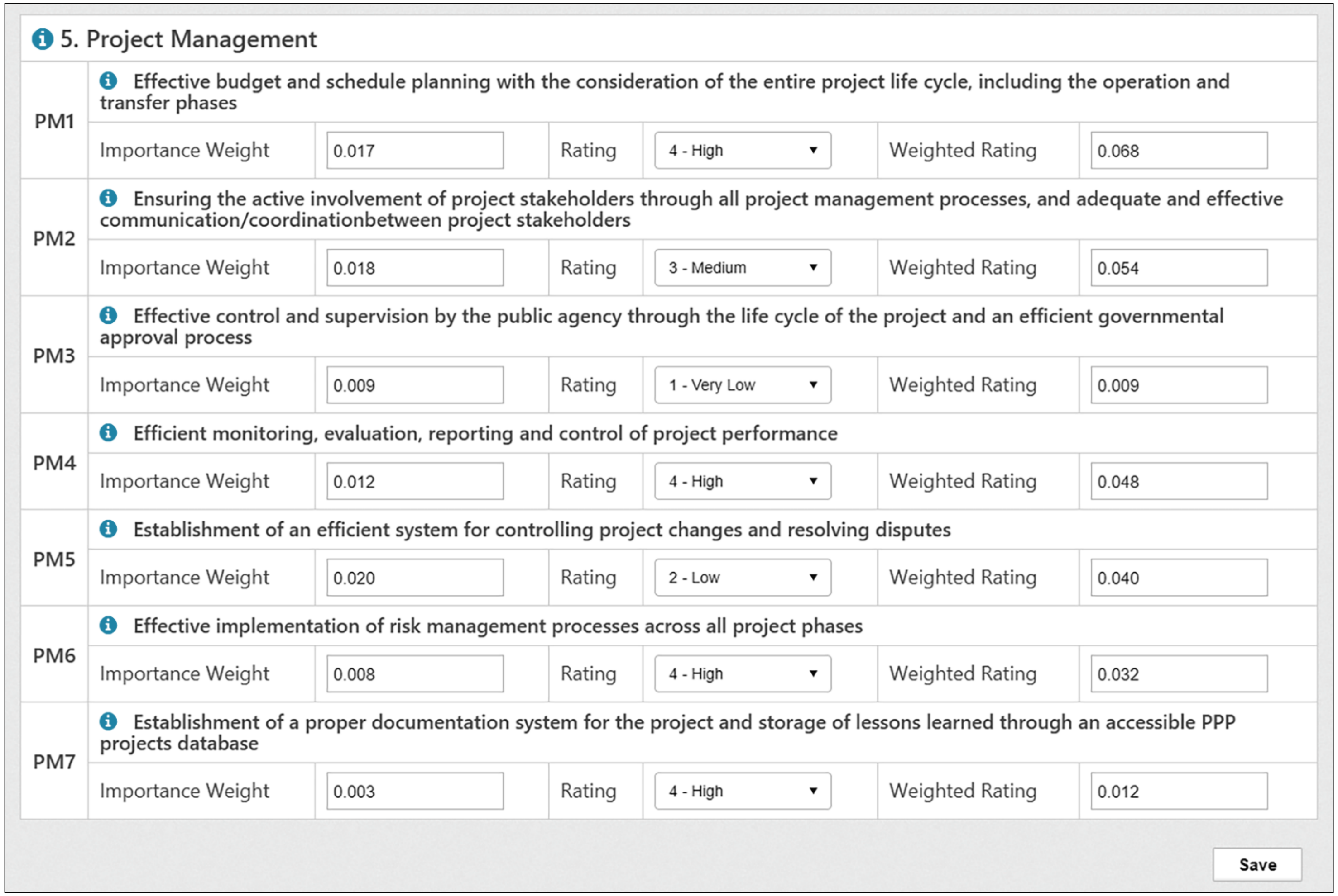


Figure G.4. Demonstration of the tooltip provided to show the factor descriptions in the evaluation screen



5. Project Management

PM1	Effective budget and schedule planning with the consideration of the entire project life cycle, including the operation and transfer phases					
	Importance Weight	0.017	Rating	4 - High	Weighted Rating	0.068
PM2	Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordinationbetween project stakeholders					
	Importance Weight	0.018	Rating	3 - Medium	Weighted Rating	0.054
PM3	Effective control and supervision by the public agency through the life cycle of the project and an efficient governmental approval process					
	Importance Weight	0.009	Rating	1 - Very Low	Weighted Rating	0.009
PM4	Efficient monitoring, evaluation, reporting and control of project performance					
	Importance Weight	0.012	Rating	4 - High	Weighted Rating	0.048
PM5	Establishment of an efficient system for controlling project changes and resolving disputes					
	Importance Weight	0.020	Rating	2 - Low	Weighted Rating	0.040
PM6	Effective implementation of risk management processes across all project phases					
	Importance Weight	0.008	Rating	4 - High	Weighted Rating	0.032
PM7	Establishment of a proper documentation system for the project and storage of lessons learned through an accessible PPP projects database					
	Importance Weight	0.003	Rating	4 - High	Weighted Rating	0.012

Save

Figure G.5. Evaluation screen provided for the **Project Management** cluster

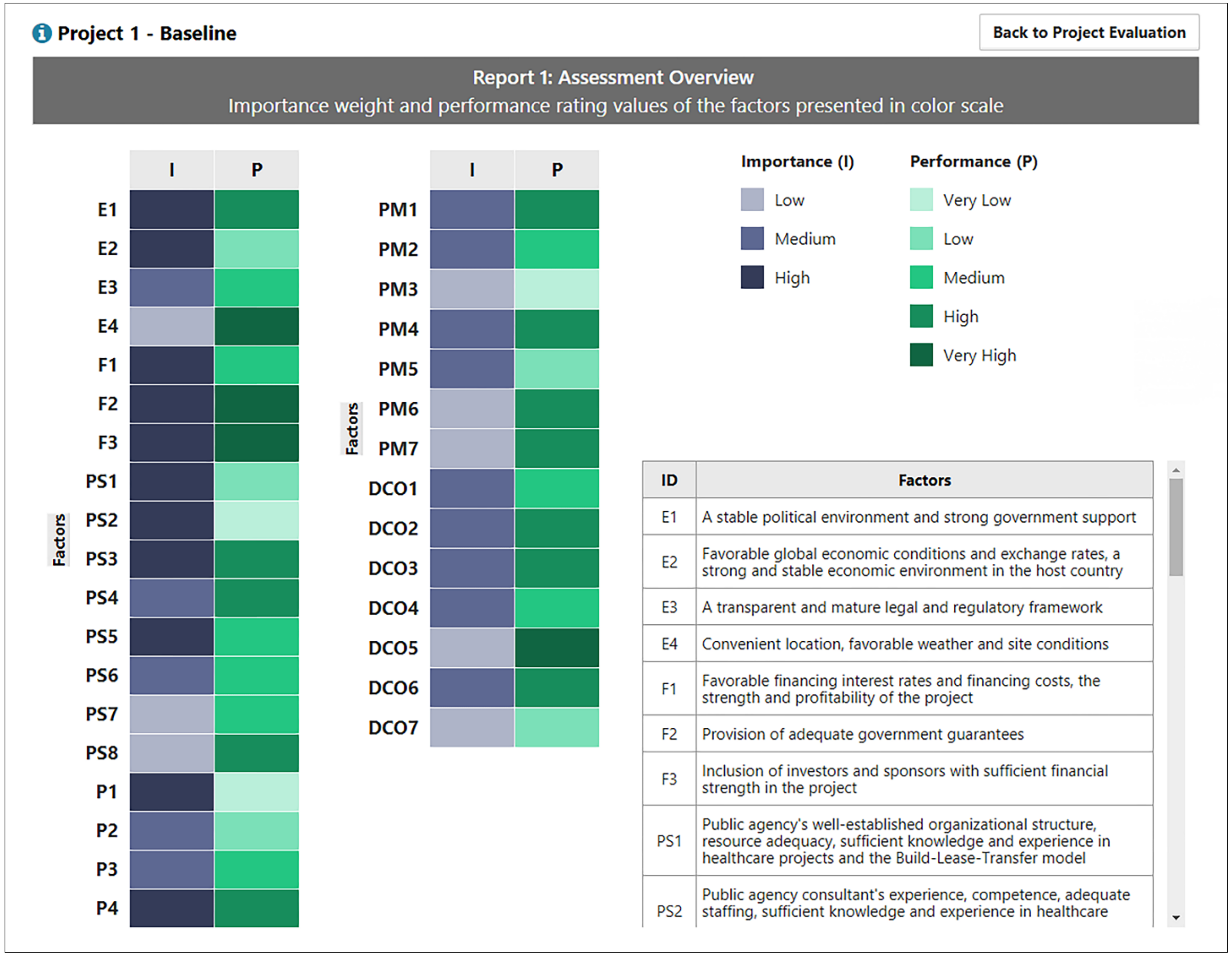


Figure G.6. A screenshot of Report 1

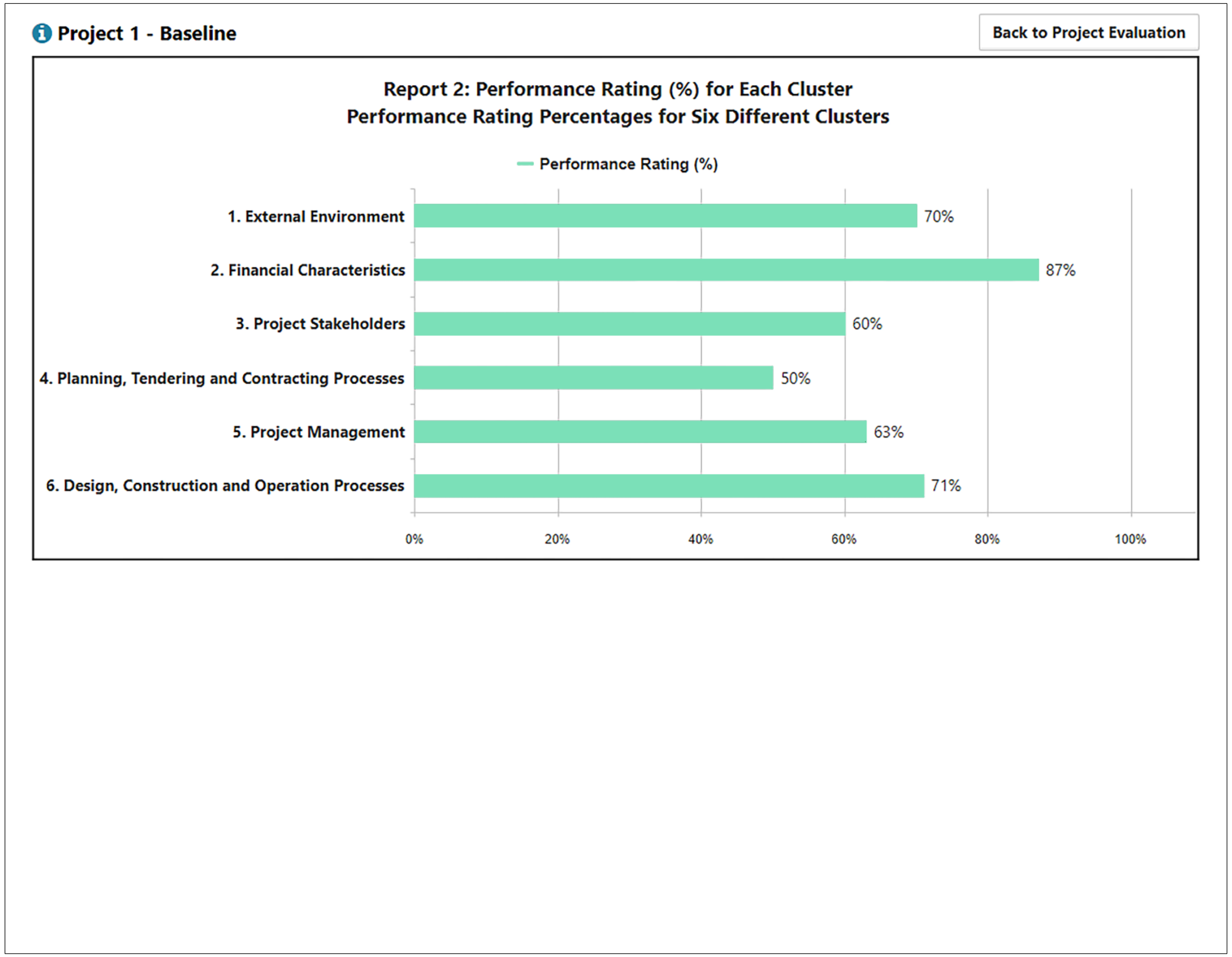


Figure G.7. A screenshot of Report 2

Project 1 - Baseline

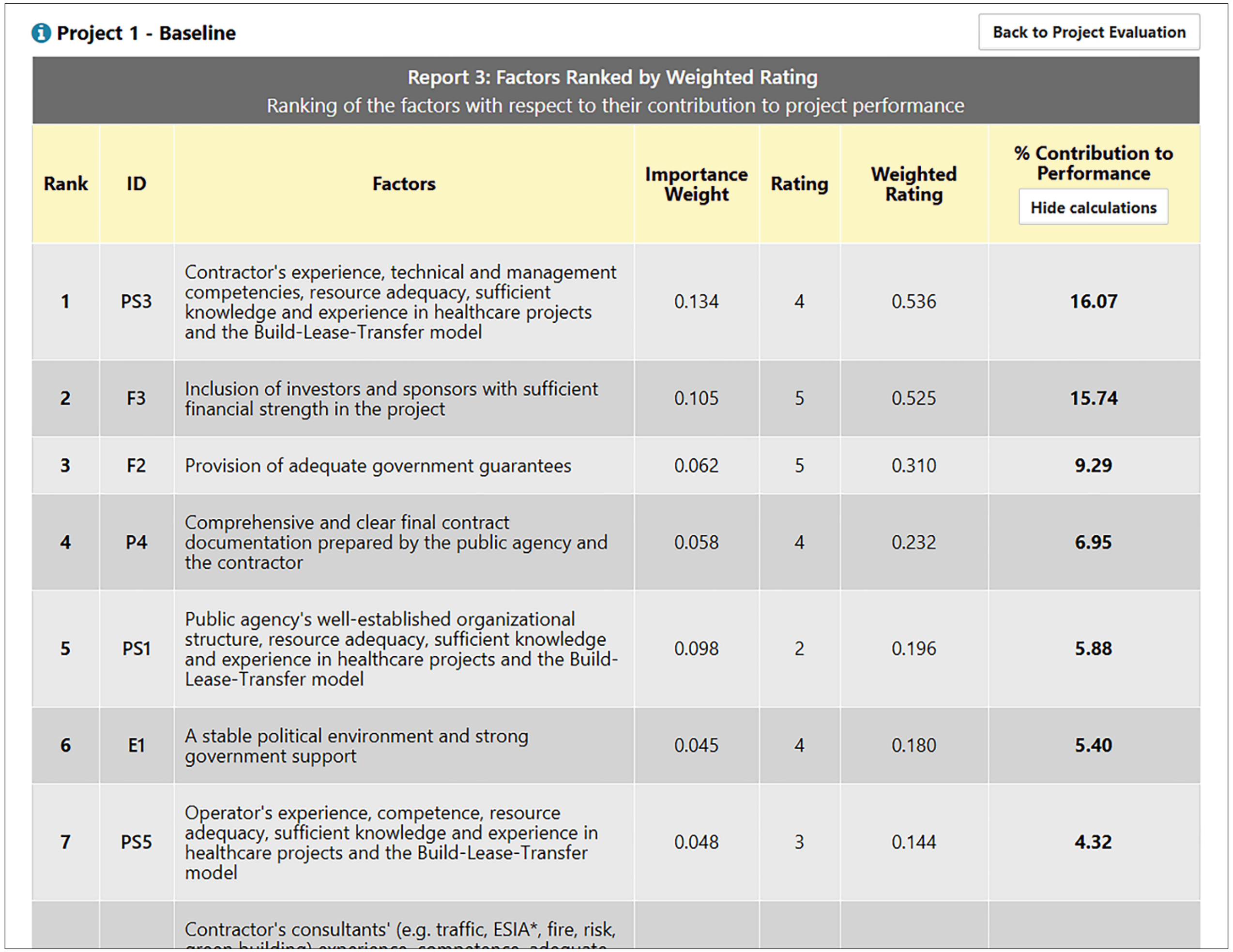
Back to Project Evaluation

Report 3: Factors Ranked by Weighted Rating

Ranking of the factors with respect to their contribution to project performance

Rank	ID	Factors	% Contribution to Performance Show calculations
1	PS3	Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model	16.07
2	F3	Inclusion of investors and sponsors with sufficient financial strength in the project	15.74
3	F2	Provision of adequate government guarantees	9.29
4	P4	Comprehensive and clear final contract documentation prepared by the public agency and the contractor	6.95
5	PS1	Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model	5.88
6	E1	A stable political environment and strong government support	5.40
7	PS5	Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model	4.32
8	PS4	Contractor's consultants' (e.g. traffic, ESIA*, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model * Environmental and Social Impact Assessment	3.12
9	F1	Favorable financing interest rates and financing costs, the strength and profitability of the project	2.97
[illegible]	[illegible]	Favorable global economic conditions and exchange rates, a strong and stable economic	[illegible]

Figure G.8. List option of Report 3



Project 1 - Baseline

Back to Project Evaluation

Report 3: Factors Ranked by Weighted Rating

Ranking of the factors with respect to their contribution to project performance

Rank	ID	Factors	Importance Weight	Rating	Weighted Rating	% Contribution to Performance (Hide calculations)
1	**PS3**	Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model	0.134	4	0.536	**16.07**
2	**F3**	Inclusion of investors and sponsors with sufficient financial strength in the project	0.105	5	0.525	**15.74**
3	**F2**	Provision of adequate government guarantees	0.062	5	0.310	**9.29**
4	**P4**	Comprehensive and clear final contract documentation prepared by the public agency and the contractor	0.058	4	0.232	**6.95**
5	**PS1**	Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model	0.098	2	0.196	**5.88**
6	**E1**	A stable political environment and strong government support	0.045	4	0.180	**5.40**
7	**PS5**	Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model	0.048	3	0.144	**4.32**
		Contractor's consultants' (e.g. traffic, ESIA*, fire, risk,				

Figure G.9. List option of Report 3 demonstrating the **Show Calculations** option

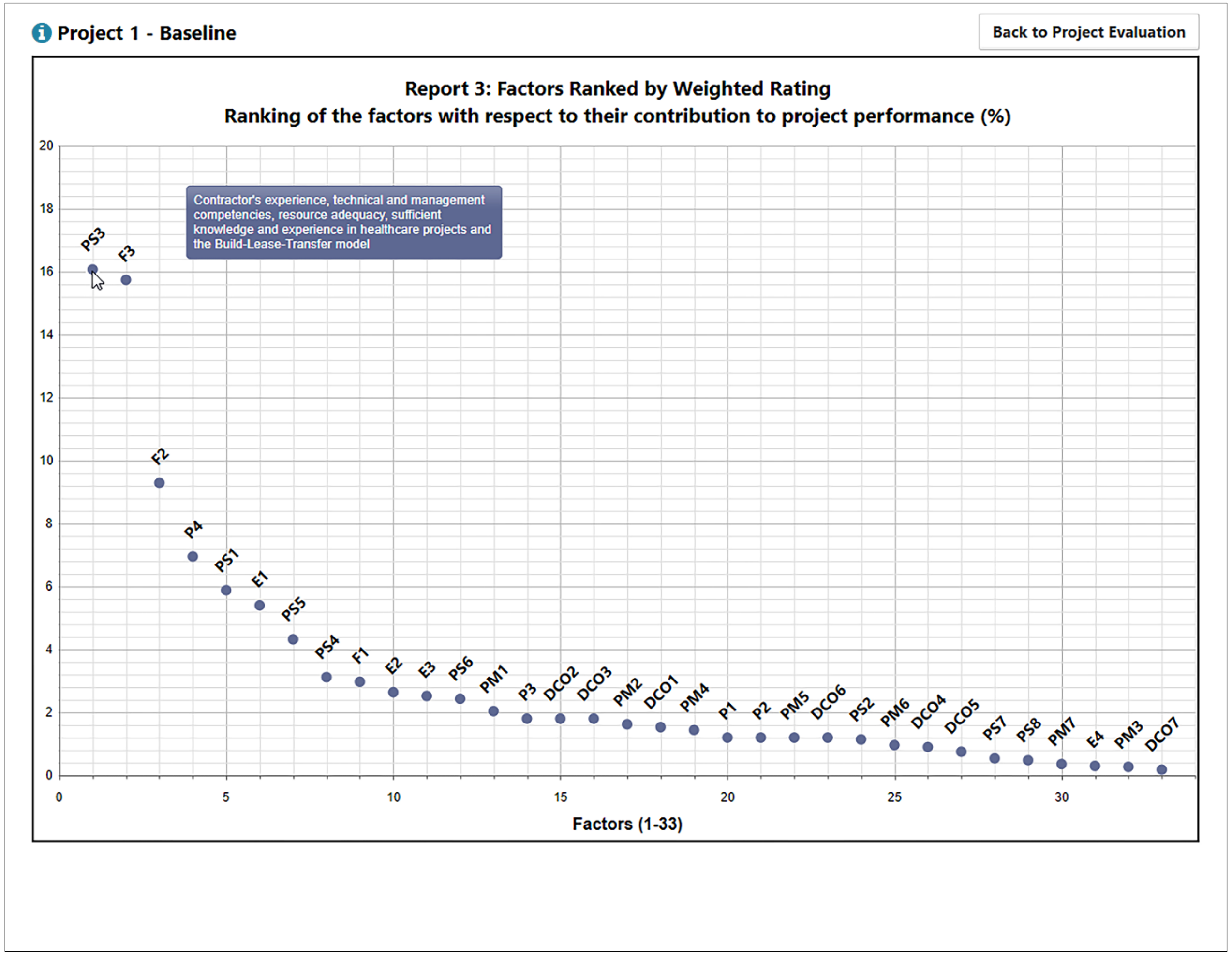


Figure G.10. Graph option of Report 3

Project 1 - Baseline

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Report 4: Factors Ranked by Weighted Rating (Grouped by Clusters)

Ranking of the factors with respect to their contribution to project performance

Cluster	Rank	ID	Factors	% Contribution to Performance (Show calculations)
1. External Environment	1	E1	A stable political environment and strong government support	5.40
	2	E2	Favorable global economic conditions and exchange rates, a strong and stable economic environment in the host country	2.64
	3	E3	A transparent and mature legal and regulatory framework	2.52
	4	E4	Convenient location, favorable weather and site conditions	0.30
2. Financial Characteristics	1	F3	Inclusion of investors and sponsors with sufficient financial strength in the project	15.74
	2	F2	Provision of adequate government guarantees	9.29
	3	F1	Favorable financing interest rates and financing costs, the strength and profitability of the project	2.97
	1	PS3	Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model	16.07
	2	PS1	Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model	5.88
	3	PS5	Operator's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the Build-Lease-	4.32

Figure G.11. List option of Report 4

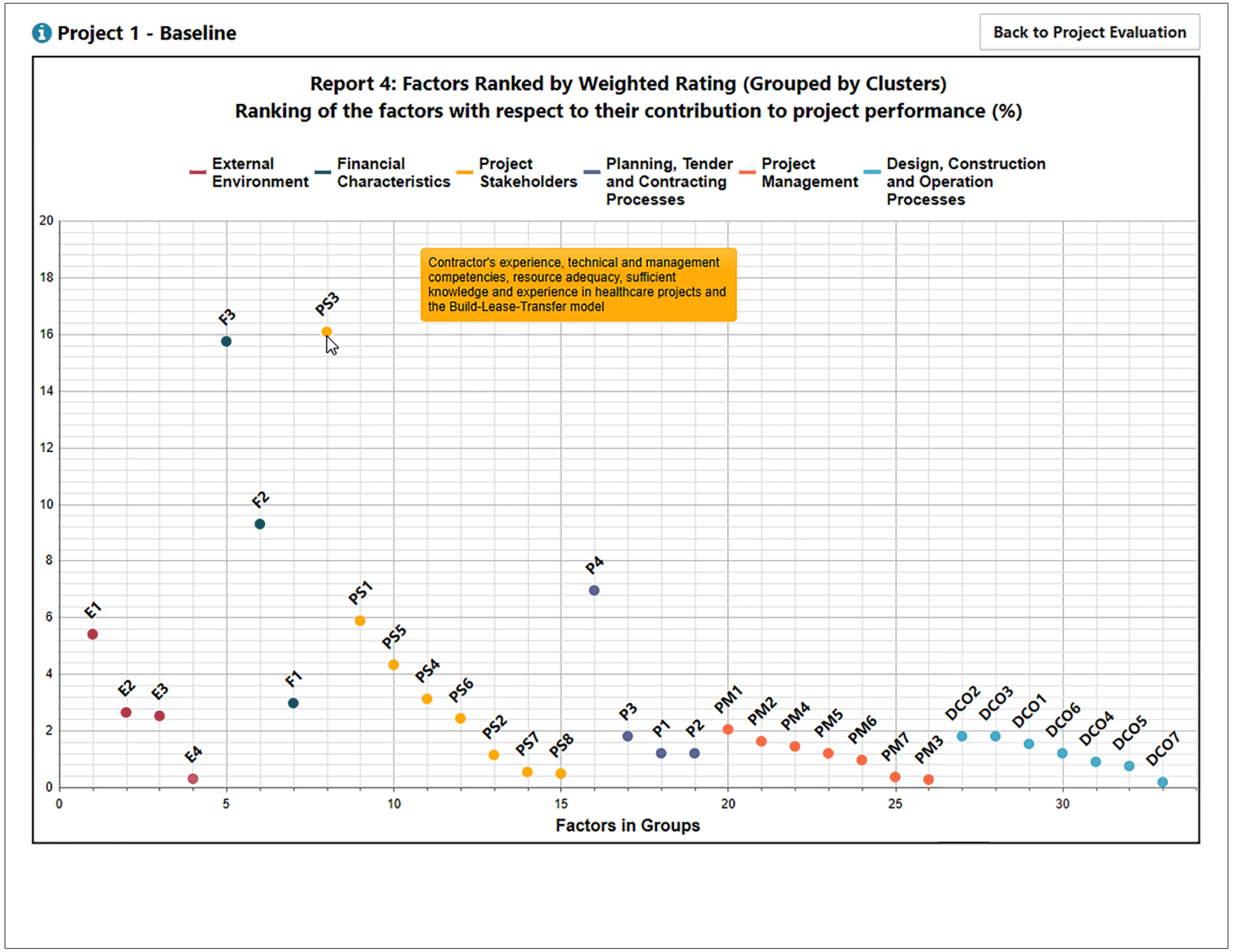
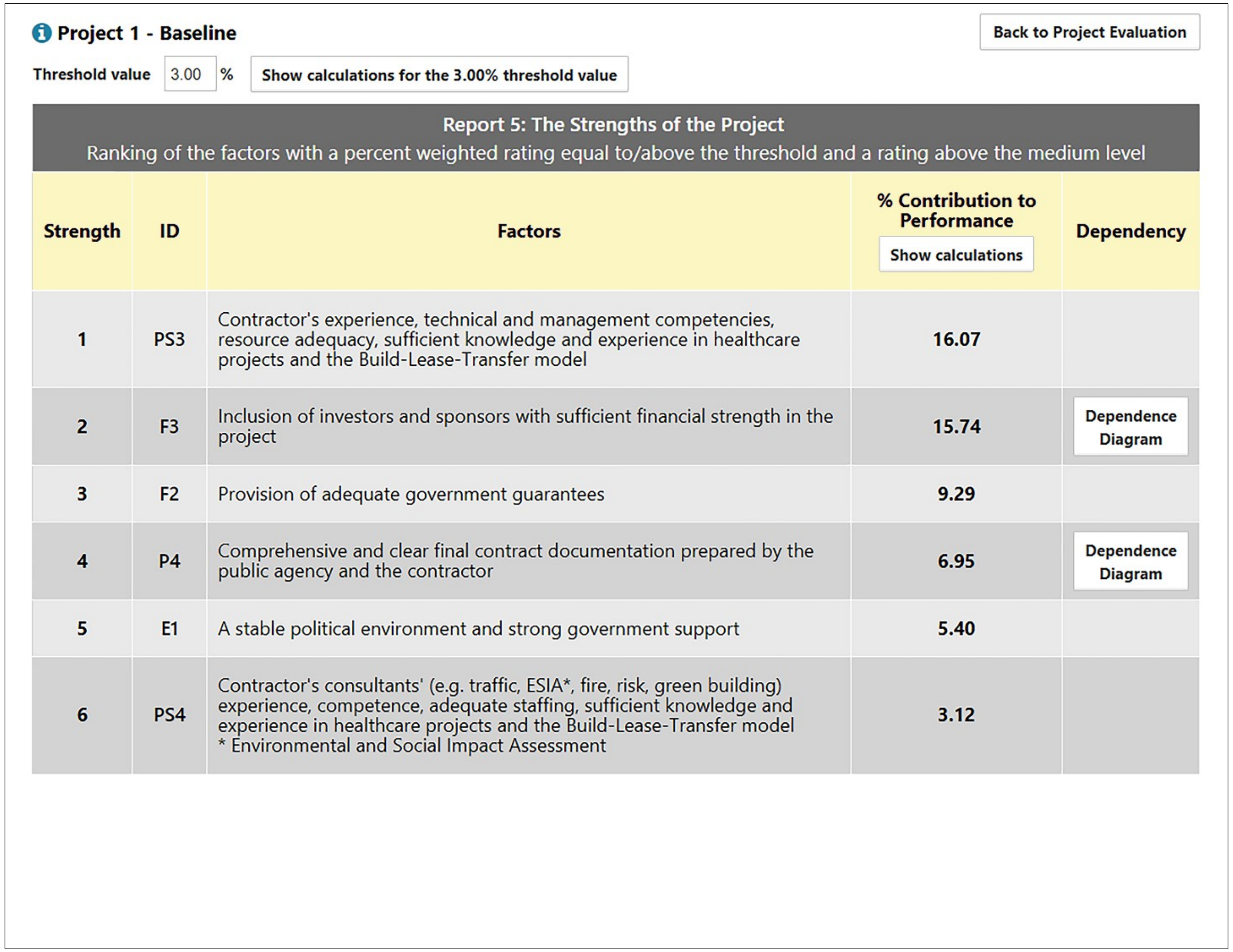


Figure G.12. Graph option of Report 4


Project 1 - Baseline

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Threshold value 3.00 %

Show calculations for the 3.00% threshold value

Report 5: The Strengths of the Project Ranking of the factors with a percent weighted rating equal to/above the threshold and a rating above the medium level				
Strength	**ID**	**Factors**	**% Contribution to Performance** Show calculations	**Dependency**
1	**PS3**	Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model	**16.07**	
2	**F3**	Inclusion of investors and sponsors with sufficient financial strength in the project	**15.74**	Dependence Diagram
3	**F2**	Provision of adequate government guarantees	**9.29**	
4	**P4**	Comprehensive and clear final contract documentation prepared by the public agency and the contractor	**6.95**	Dependence Diagram
5	**E1**	A stable political environment and strong government support	**5.40**	
6	**PS4**	Contractor's consultants' (e.g. traffic, ESIA*, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model * Environmental and Social Impact Assessment	**3.12**	

Figure G.13. List option of Report 5

Project 1 - Baseline

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Threshold value 3.00 % Hide calculations

Average importance weight	=	1 / 33 = 0.03
Average factor rating	=	3
Threshold value	=	0.03 x 3 = 0.09
Normalized threshold value (%)	=	(0.09 / 3) x 100 = 3.00

Report 5: The Strengths of the Project

Ranking of the factors with a percent weighted rating equal to/above the threshold and a rating above the medium level

Strength	ID	Factors	Importance Weight	Rating	Weighted Rating	% Contribution to Performance (Hide calculations)
1	PS3	Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model	0.134	4	0.536	**16.07**
2	F3	Inclusion of investors and sponsors with sufficient financial strength in the project	0.105	5	0.525	**15.74**
3	F2	Provision of adequate government guarantees	0.062	5	0.310	**9.29**
4	P4	Comprehensive and clear final contract documentation prepared by the public agency and the contractor	0.058	4	0.232	**6.95**
5	E1	A stable political environment and strong government support	0.045	4	0.180	**5.40**
6	PS4	Contractor's consultants' (e.g. traffic, ESIA*, fire, risk, green building) experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model * Environmental and Social Impact Assessment	0.026	4	0.104	**3.12**

Figure G.14. The calculation details for the 3.00% threshold value in Report 5

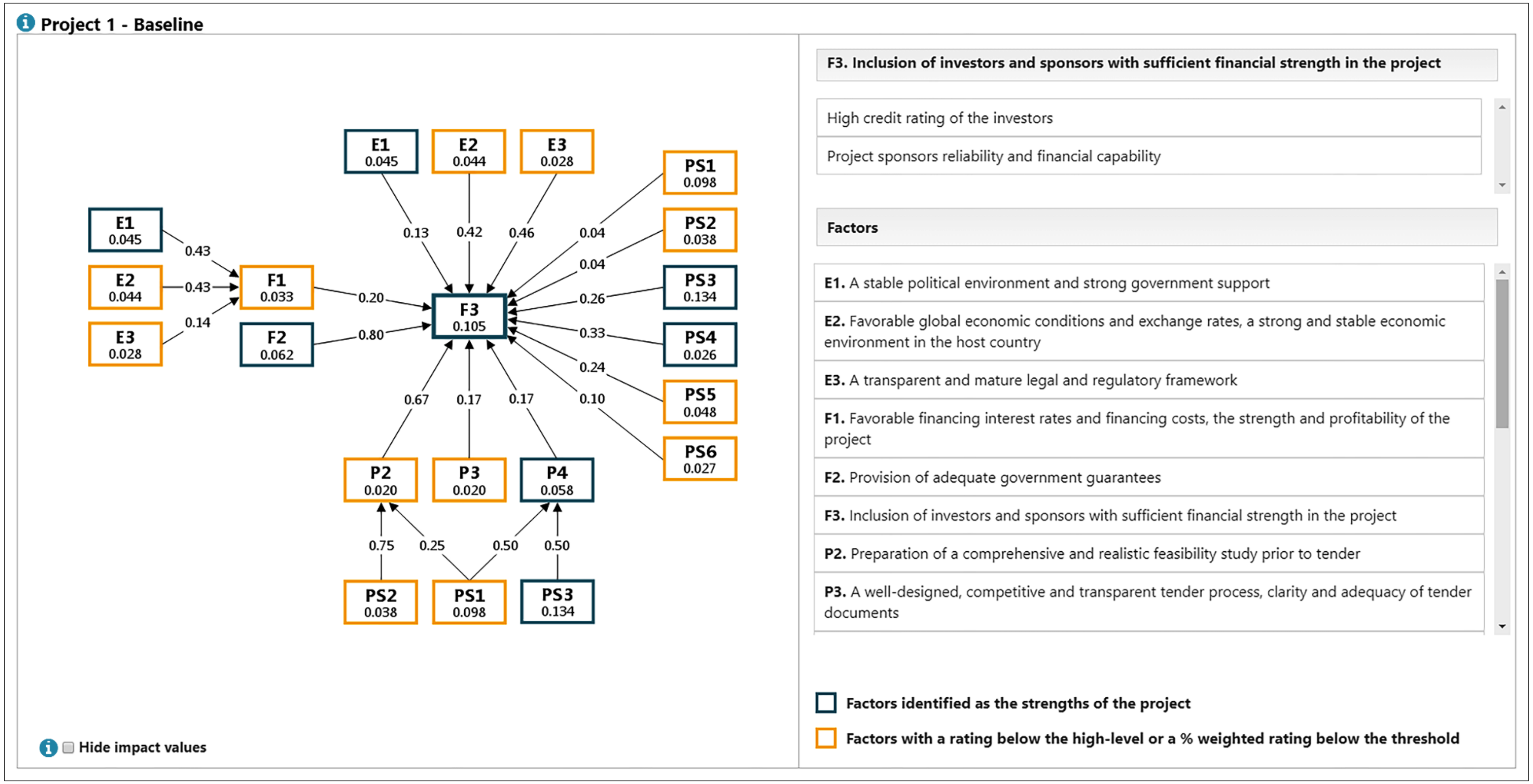


Figure G.15. **Dependence diagram** of the factor **F3** presented in Report 5

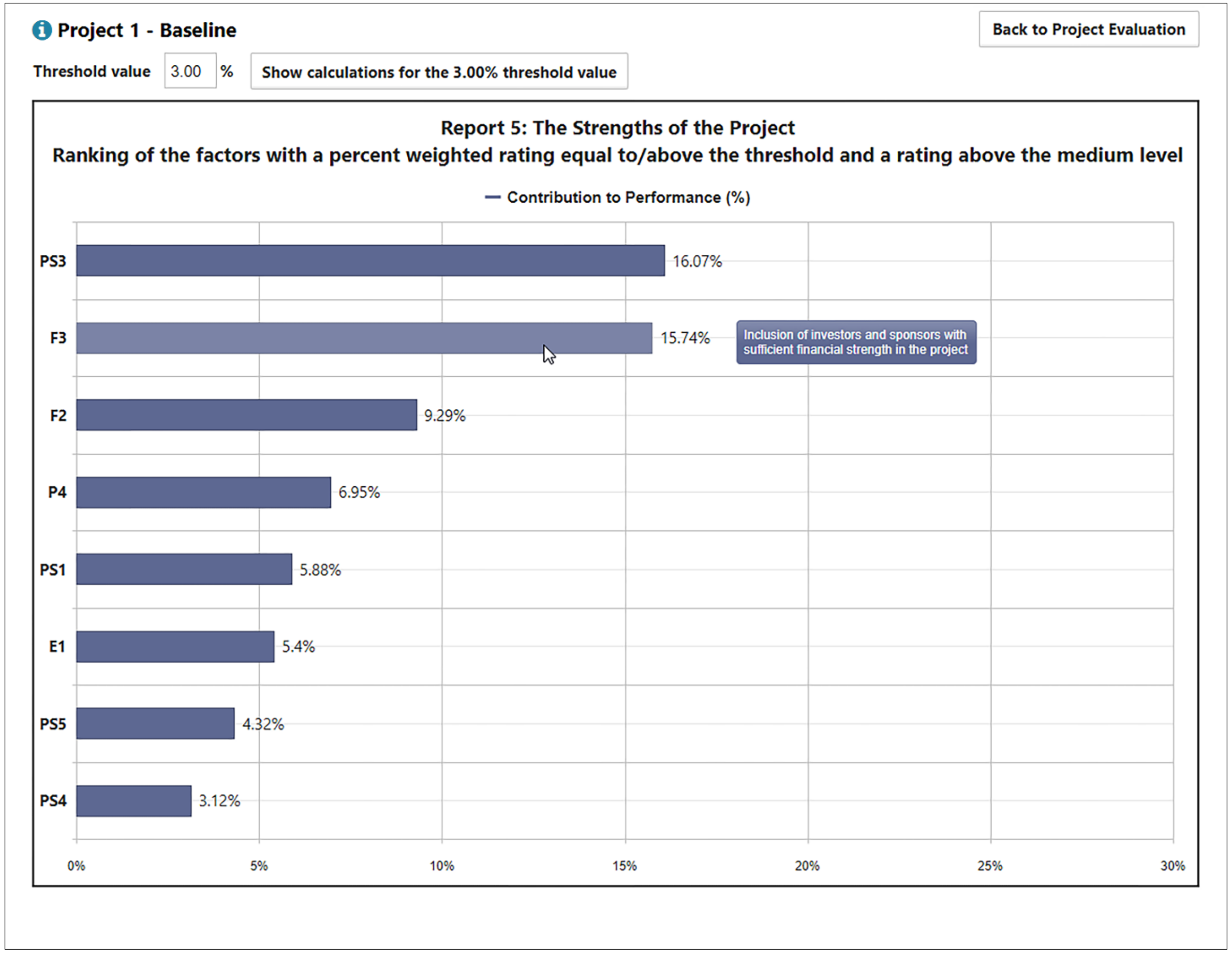
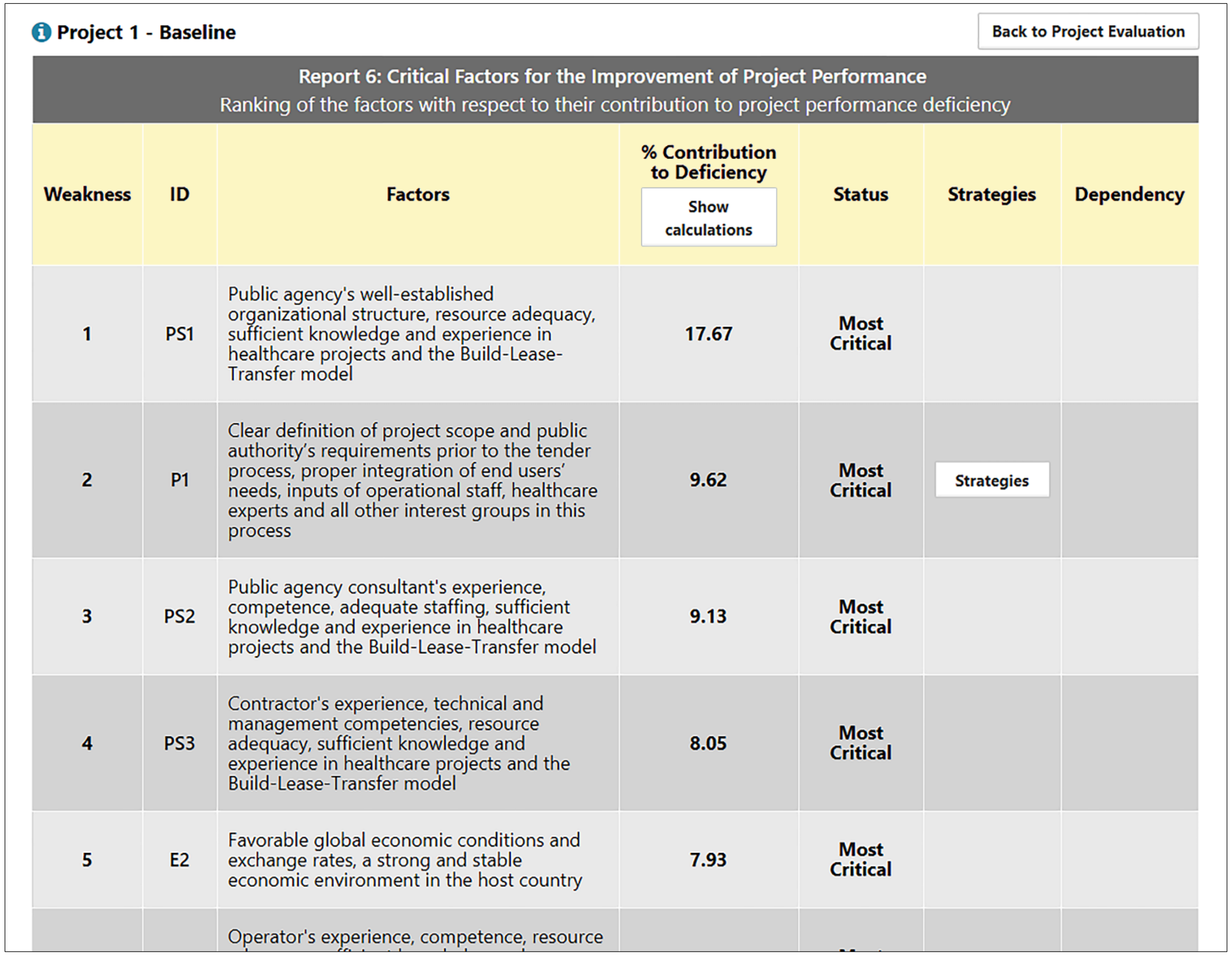


Figure G.16. Graph option of Report 5



Project 1 - Baseline

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Report 6: Critical Factors for the Improvement of Project Performance

Ranking of the factors with respect to their contribution to project performance deficiency

Weakness	ID	Factors	% Contribution to Deficiency (Show calculations)	Status	Strategies	Dependency
1	PS1	Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model	17.67	Most Critical		
2	P1	Clear definition of project scope and public authority's requirements prior to the tender process, proper integration of end users' needs, inputs of operational staff, healthcare experts and all other interest groups in this process	9.62	Most Critical	Strategies	
3	PS2	Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model	9.13	Most Critical		
4	PS3	Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model	8.05	Most Critical		
5	E2	Favorable global economic conditions and exchange rates, a strong and stable economic environment in the host country	7.93	Most Critical		
		Operator's experience, competence, resource				

Figure G.17. List option of Report 6

Project 1 - Baseline Back to Project Evaluation

Report 6: Critical Factors for the Improvement of Project Performance
Ranking of the factors with respect to their contribution to project performance deficiency

Weakness	ID	Factors	Importance Weight	Rating	Deficient Points	% Contribution to Deficiency (Hide calculations)	Status
1	PS1	Public agency's well-established organizational structure, resource adequacy, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model	0.098	2	0.294	**17.67**	**Most Critical**
2	P1	Clear definition of project scope and public authority's requirements prior to the tender process, proper integration of end users' needs, inputs of operational staff, healthcare experts and all other interest groups in this process	0.040	1	0.160	**9.62**	**Most Critical**
3	PS2	Public agency consultant's experience, competence, adequate staffing, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model	0.038	1	0.152	**9.13**	**Most Critical**
4	PS3	Contractor's experience, technical and management competencies, resource adequacy, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model	0.134	4	0.134	**8.05**	**Most Critical**
5	E2	Favorable global economic conditions and exchange rates, a strong and stable economic environment in the host country	0.044	2	0.132	**7.93**	**Most Critical**

Figure G.18. List option of Report 6 demonstrating the **Show Calculations** option

7	F1	Favorable financing interest rates and financing costs, the strength and profitability of the project	**3.97**	**Most Critical**	Strategies	Dependence Diagram
8	P2	Preparation of a comprehensive and realistic feasibility study prior to tender	**3.61**	**Critical**	Strategies	Dependence Diagram
9	PM5	Establishment of an efficient system for controlling project changes and resolving disputes	**3.61**	**Critical**	Strategies	Dependence Diagram
10	P4	Comprehensive and clear final contract documentation prepared by the public agency and the contractor	**3.49**	**Critical**	Strategies	Dependence Diagram
11	E3	A transparent and mature legal and regulatory framework	**3.37**	**Critical**		
12	PS6	Design firm's experience, competence, resource adequacy, sufficient knowledge and experience in healthcare projects and the Build-Lease-Transfer model	**3.25**	**Critical**		
13	E1	A stable political environment and strong government support	**2.70**	**Critical**		
14	P3	A well-designed, competitive and transparent tender process, clarity and adequacy of tender documents	**2.40**	**Critical**	Strategies	
15	PM2	Ensuring the active involvement of project stakeholders through all project management processes, and adequate and effective communication/coordination between project stakeholders	**2.16**	**Critical**	Strategies	Dependence Diagram

Figure G.19. **Dependence diagram** buttons in the List option of Report 6

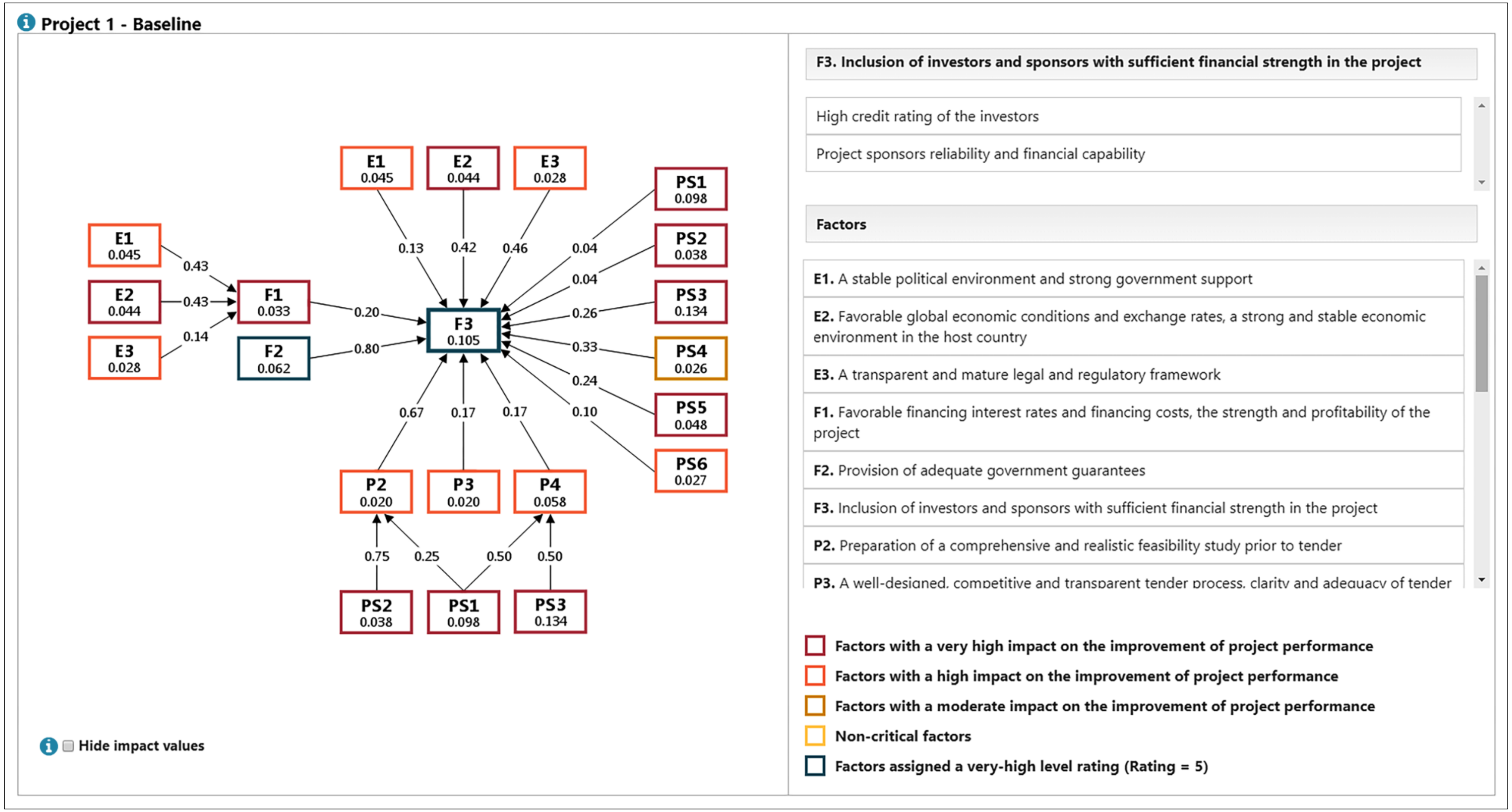

Figure G.20. **Dependence diagram** of the factor **F3** presented in Report 6

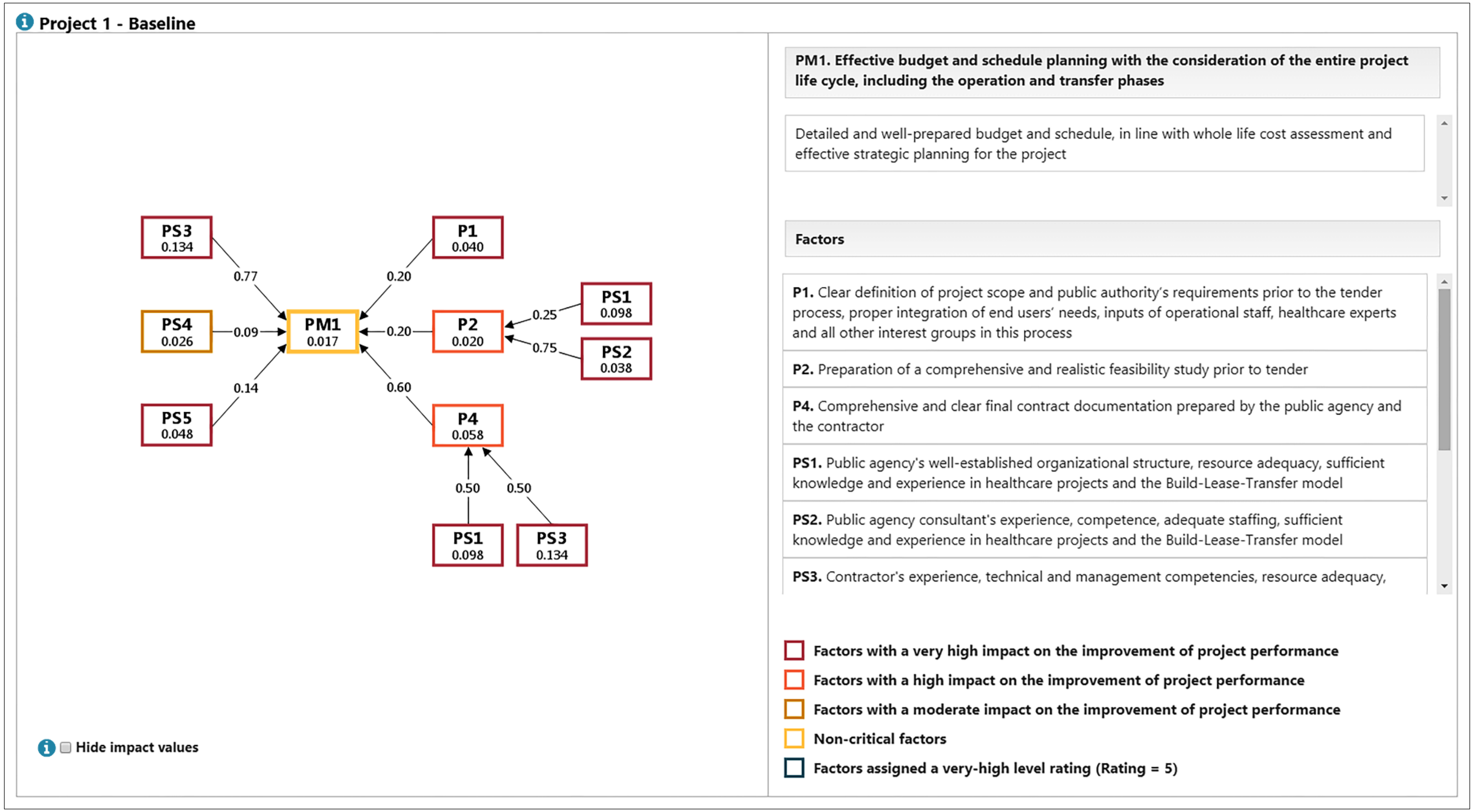

Figure G.21. **Dependence diagram** of the factor **PM1** presented in Report 6

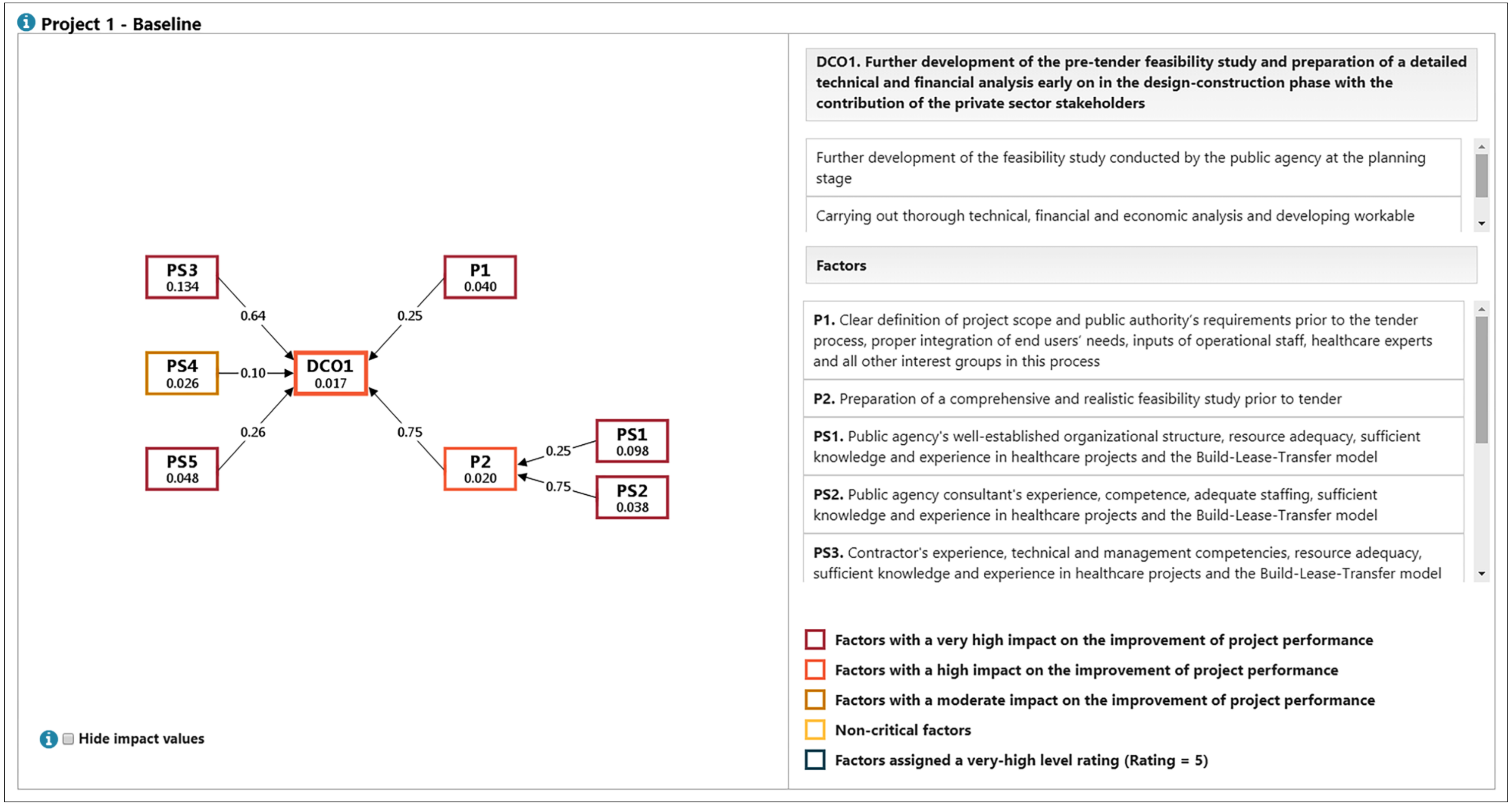

Figure G.22. **Dependence diagram** of the factor **DCO1** presented in Report 6

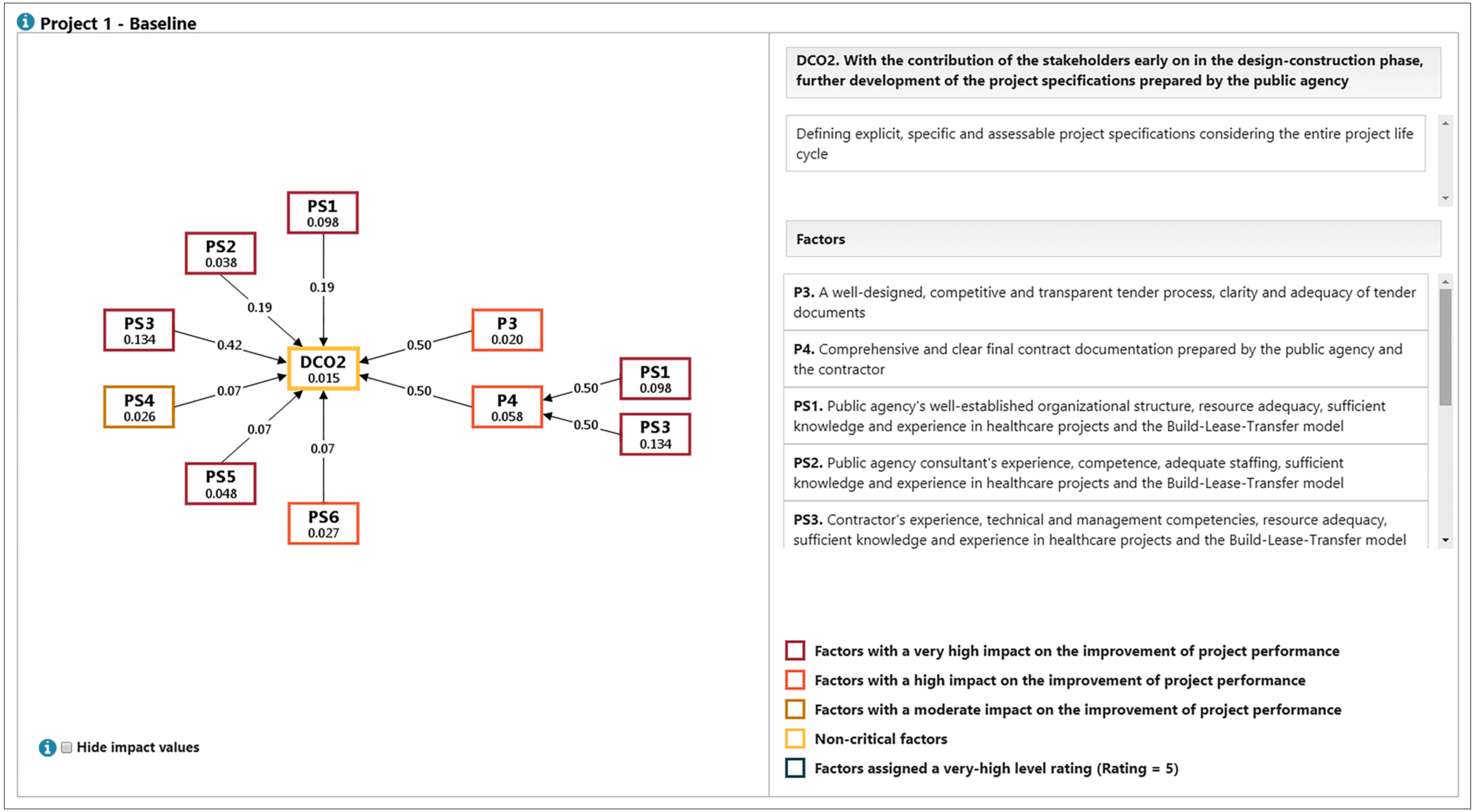

Figure G.23. **Dependence diagram** of the factor **DCO2** presented in Report 6

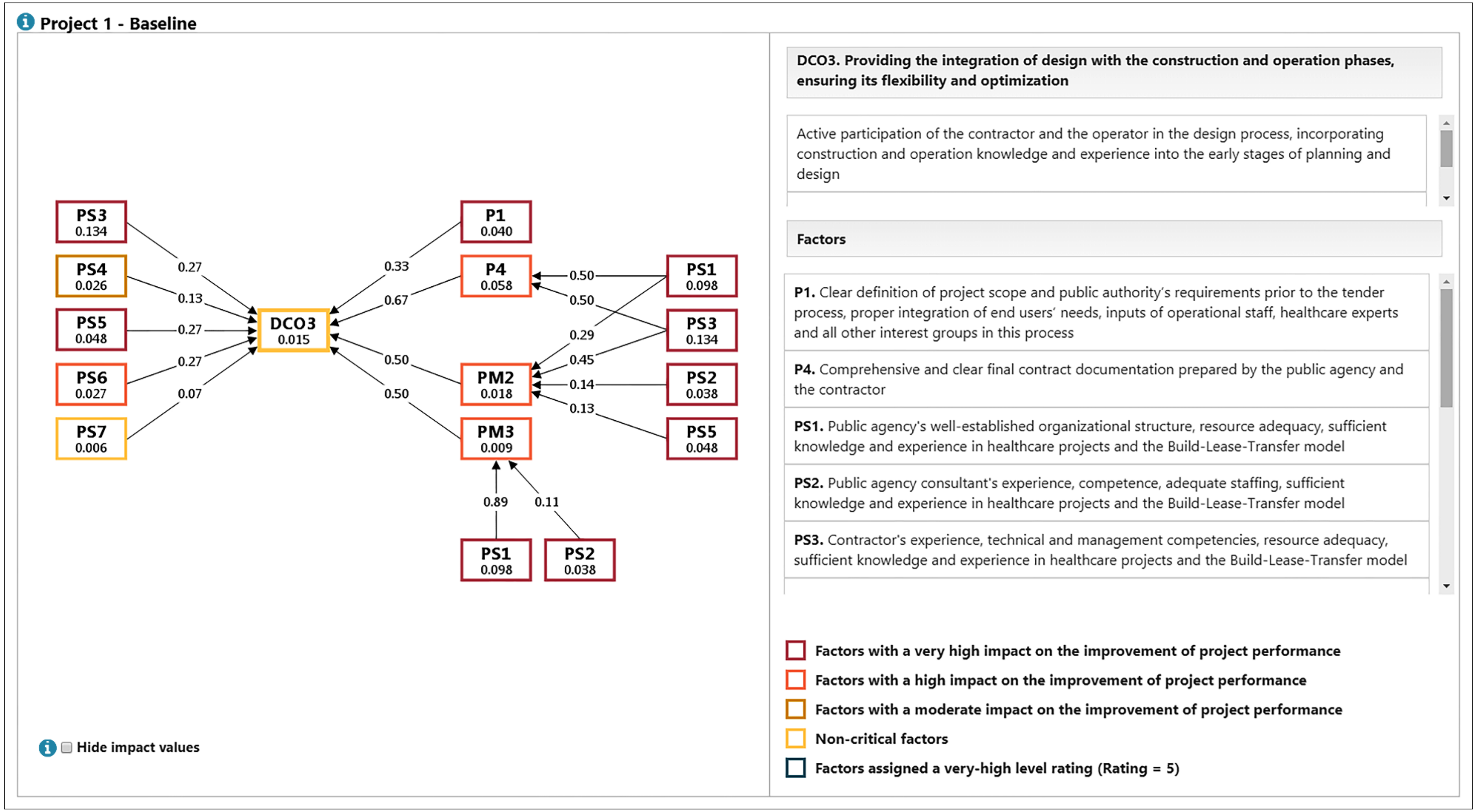

Figure G.24. **Dependence diagram** of the factor **DCO3** presented in Report 6

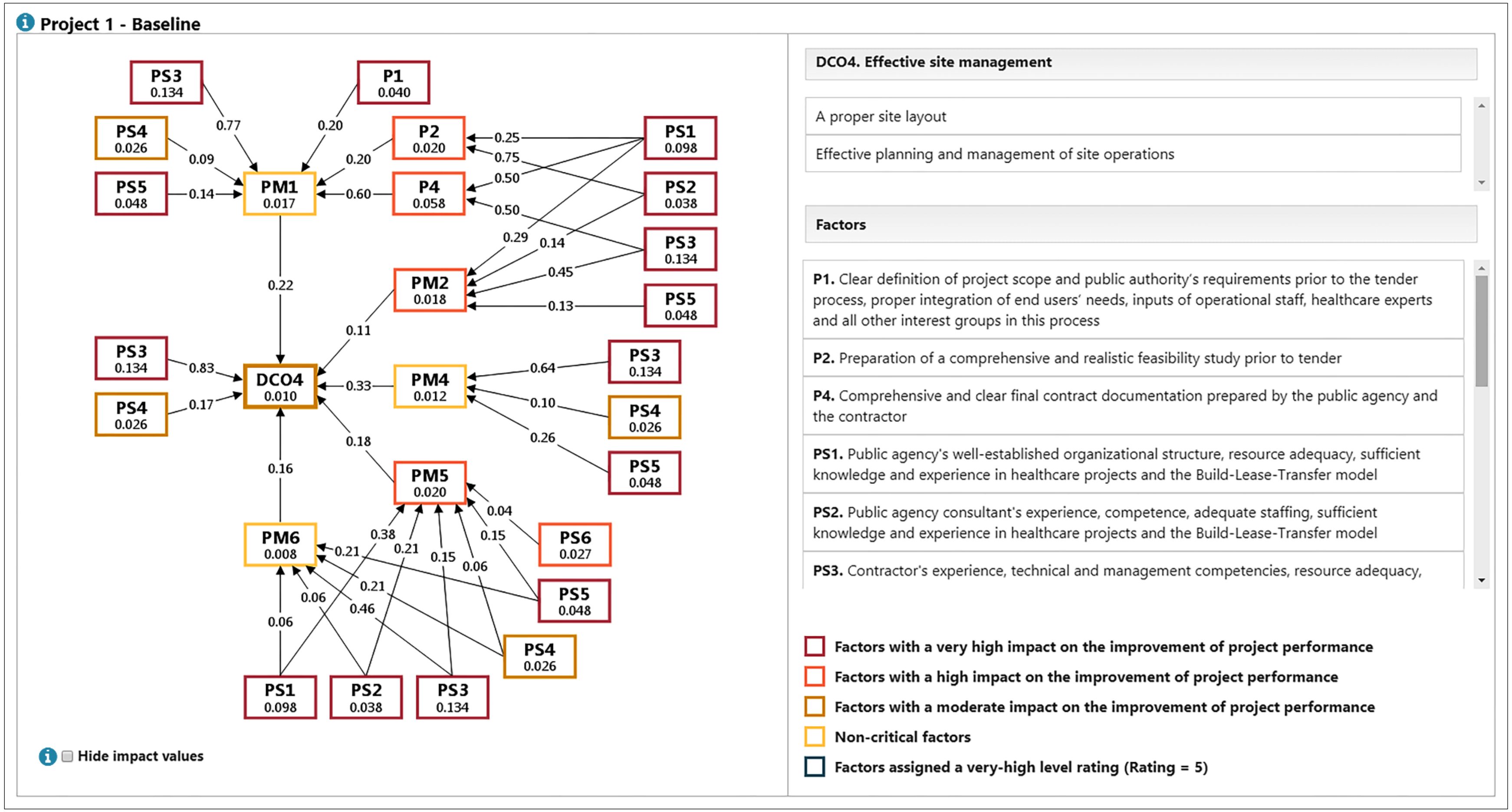

Figure G.25. **Dependence diagram** of the factor **DCO4** presented in Report 6

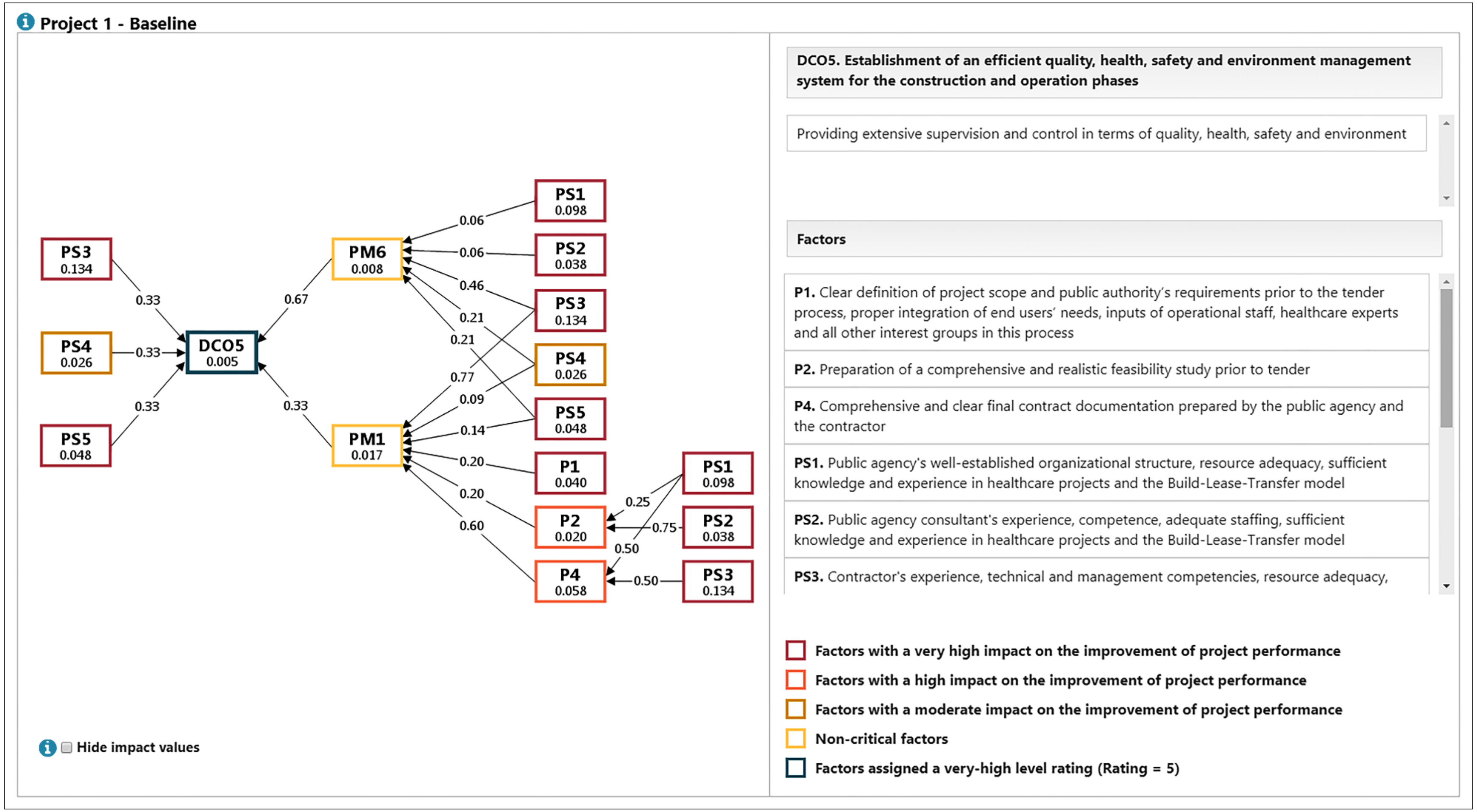

Figure G.26. **Dependence diagram** of the factor **DCO5** presented in Report 6

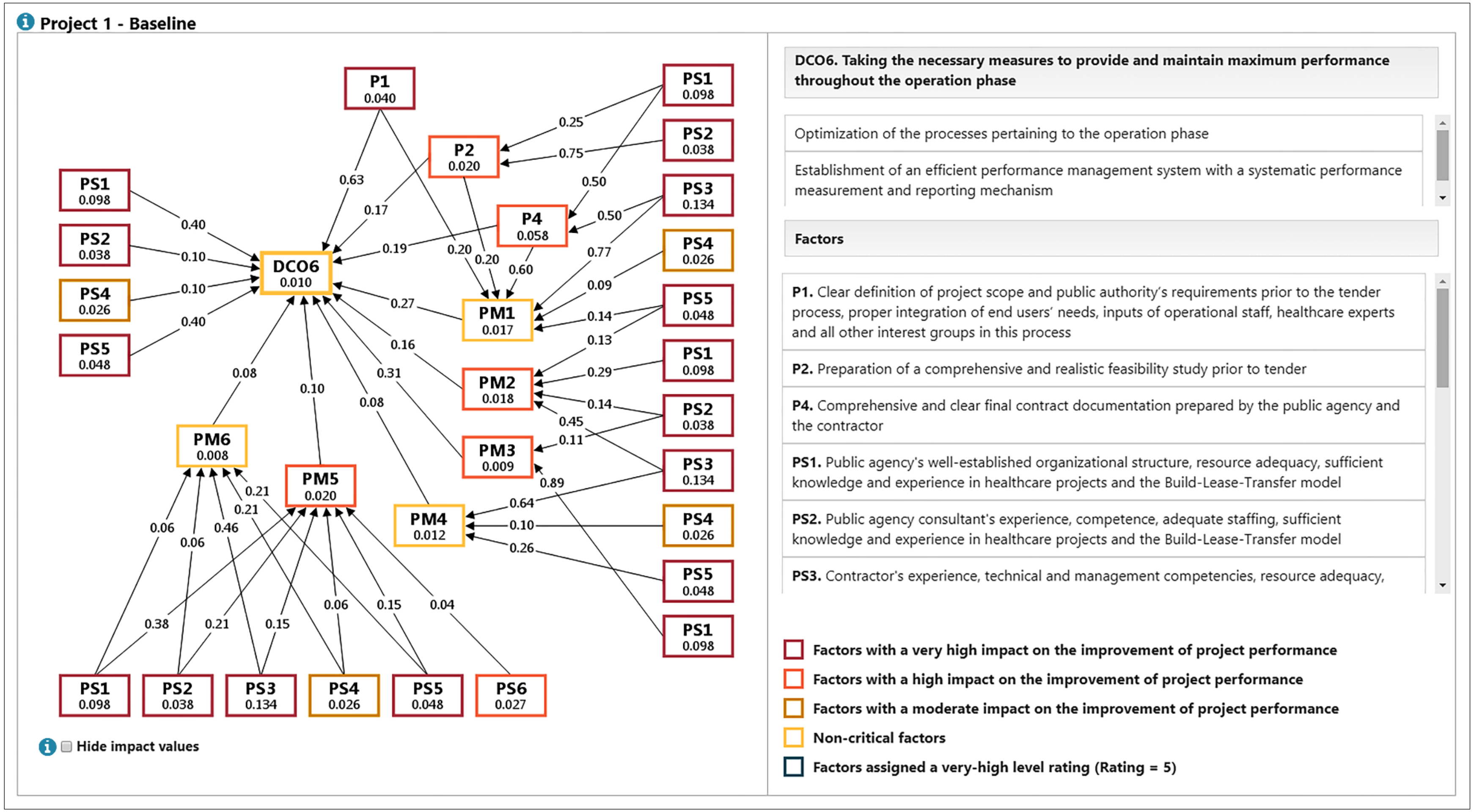

Figure G.27. **Dependence diagram** of the factor **DCO6** presented in Report 6

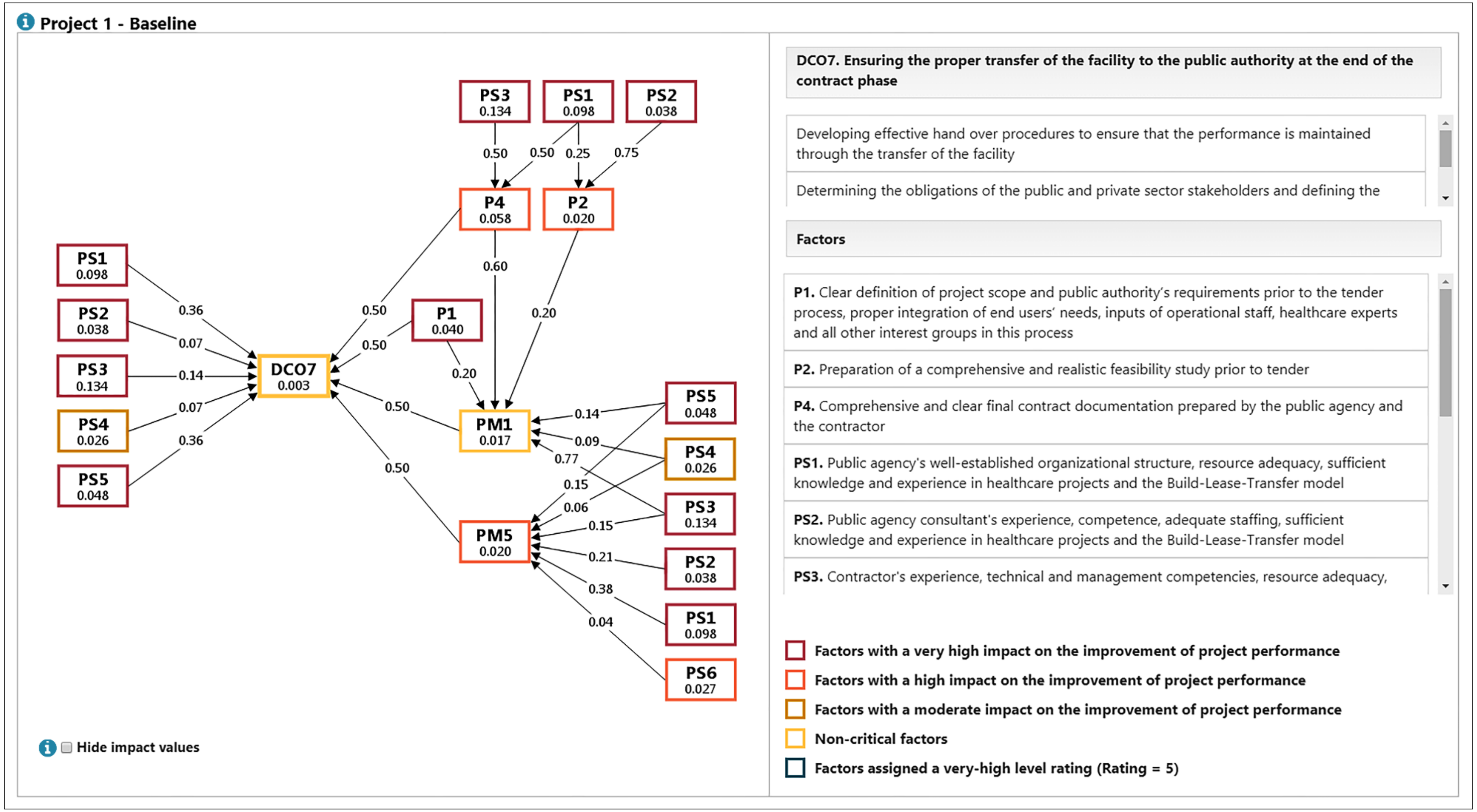

Figure G.28. **Dependence diagram** of the factor **DCO7** presented in Report 6

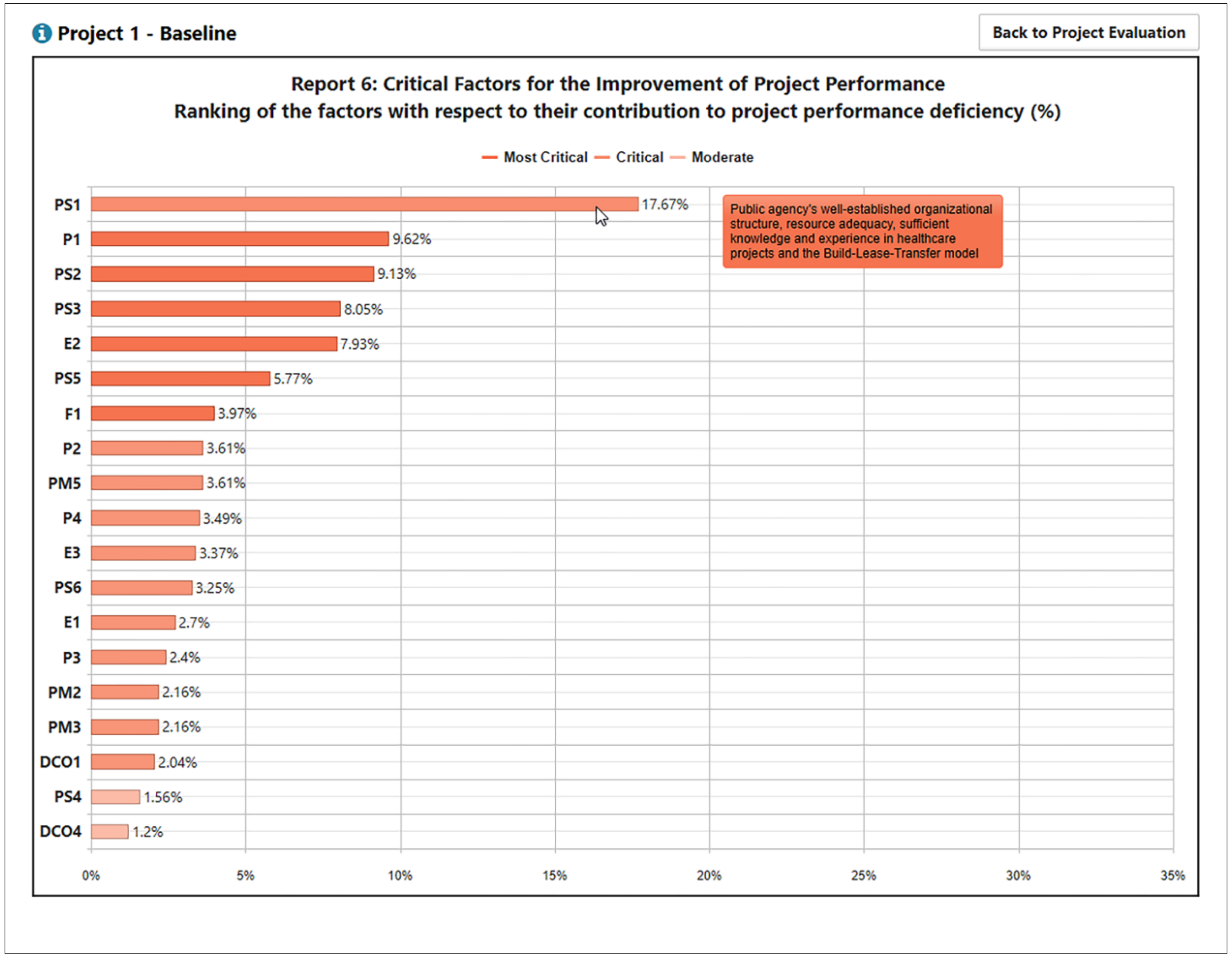

Figure G.29. Graph option of Report 6

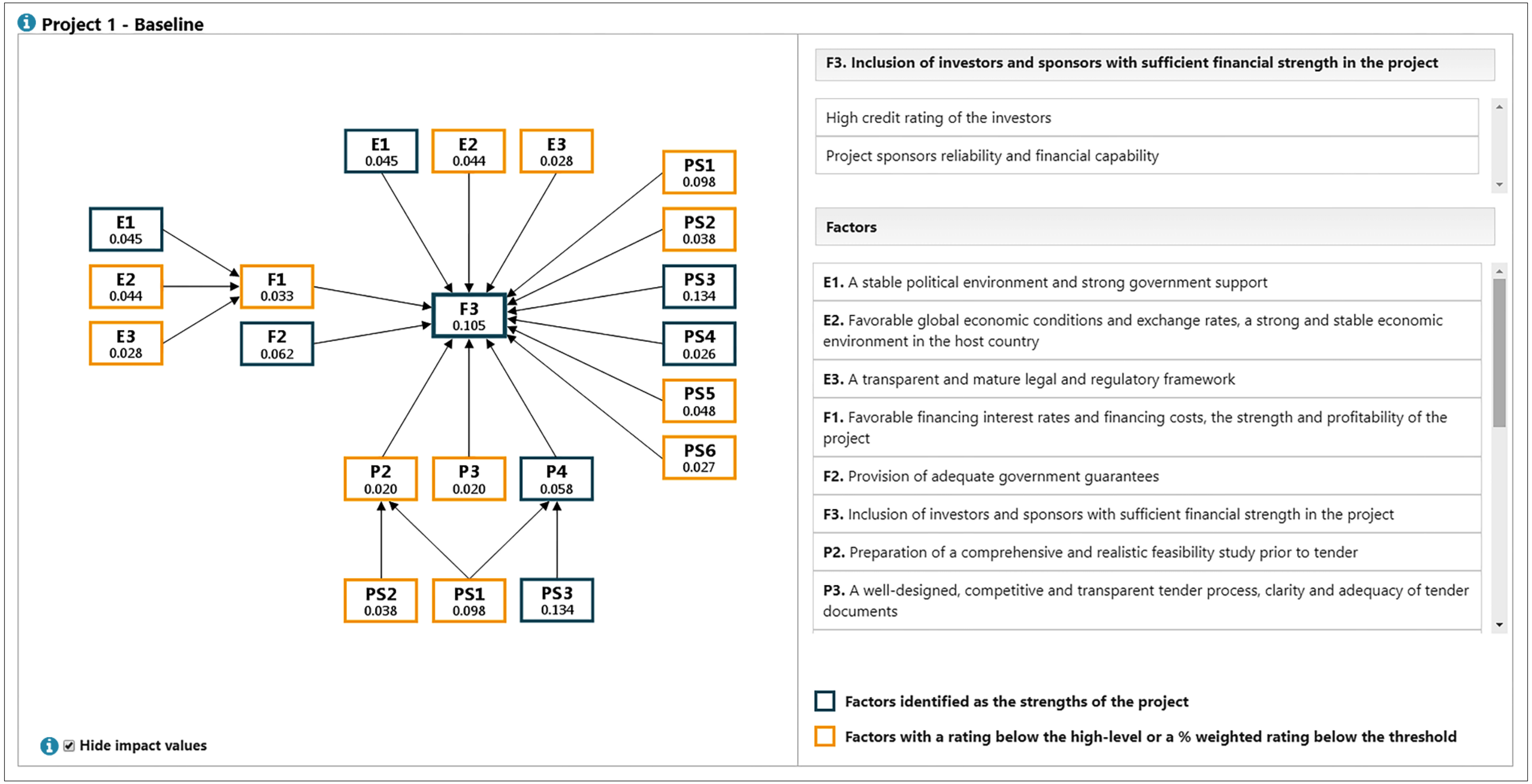

Figure G.30. **Dependence diagram** of the factor **F3** presented in Report 5 with **hide impact values** option checked

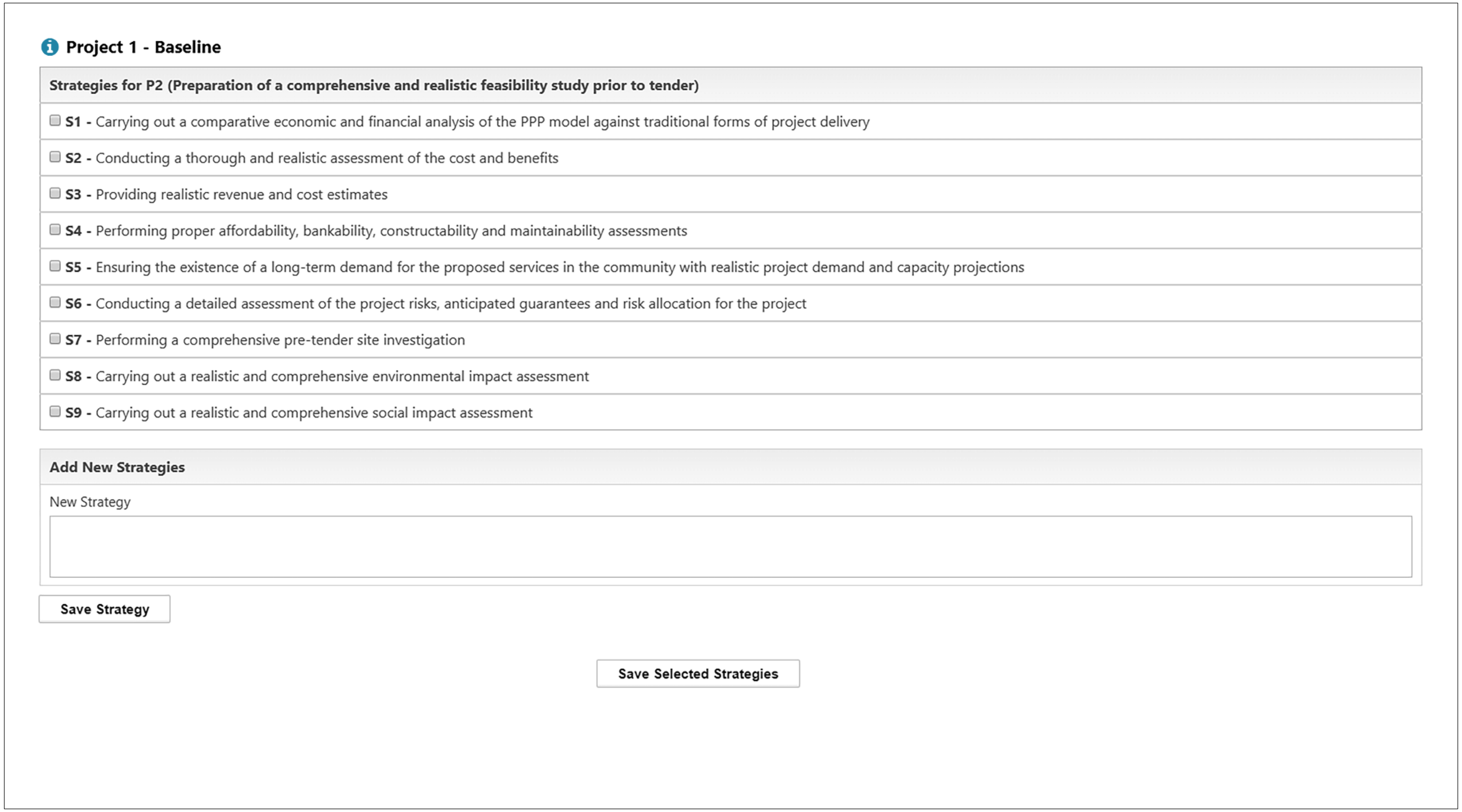

Figure G.31. Example of a **Strategies** pop-up window

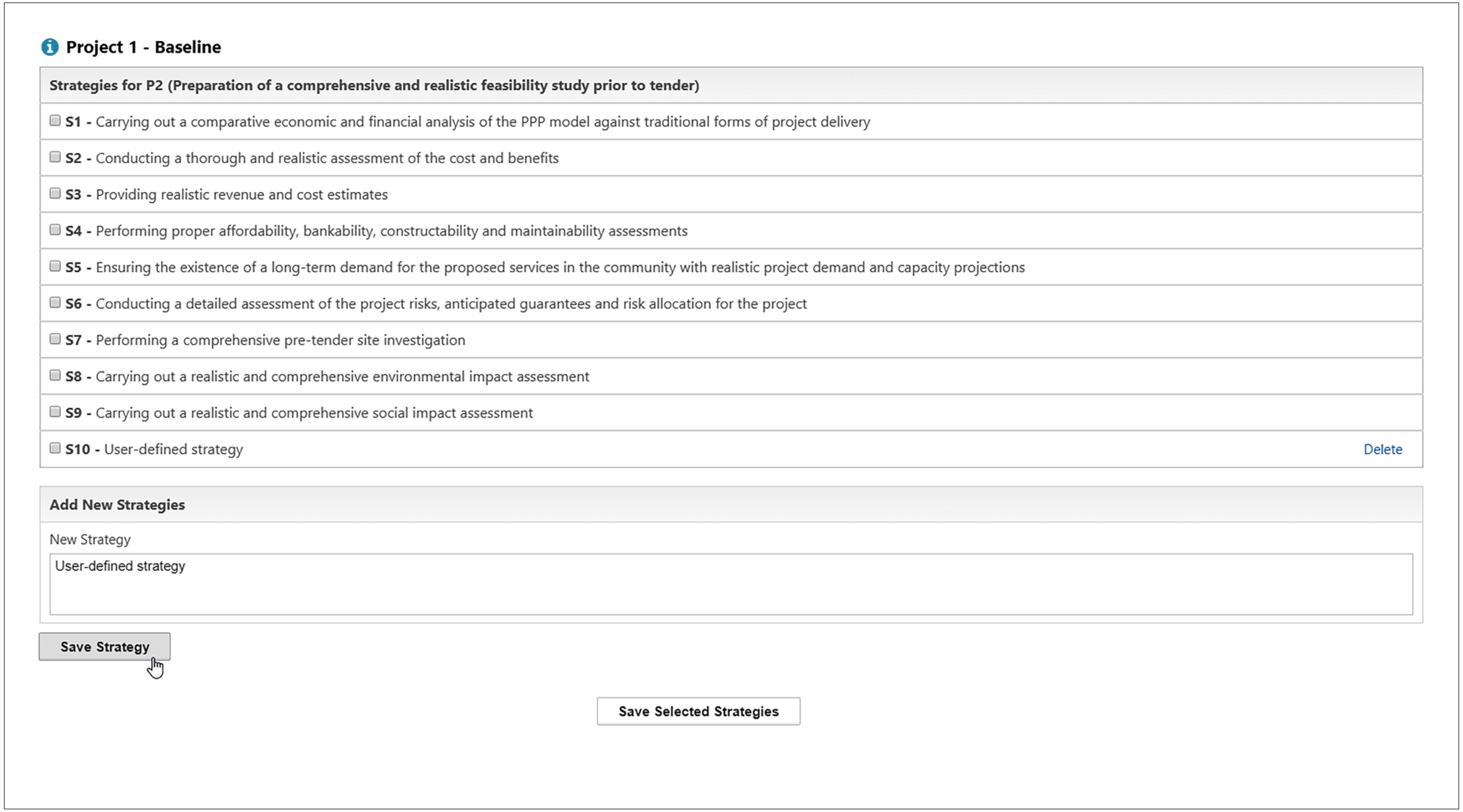

Figure G.32. Entering a new strategy in the **Strategies** pop-up window

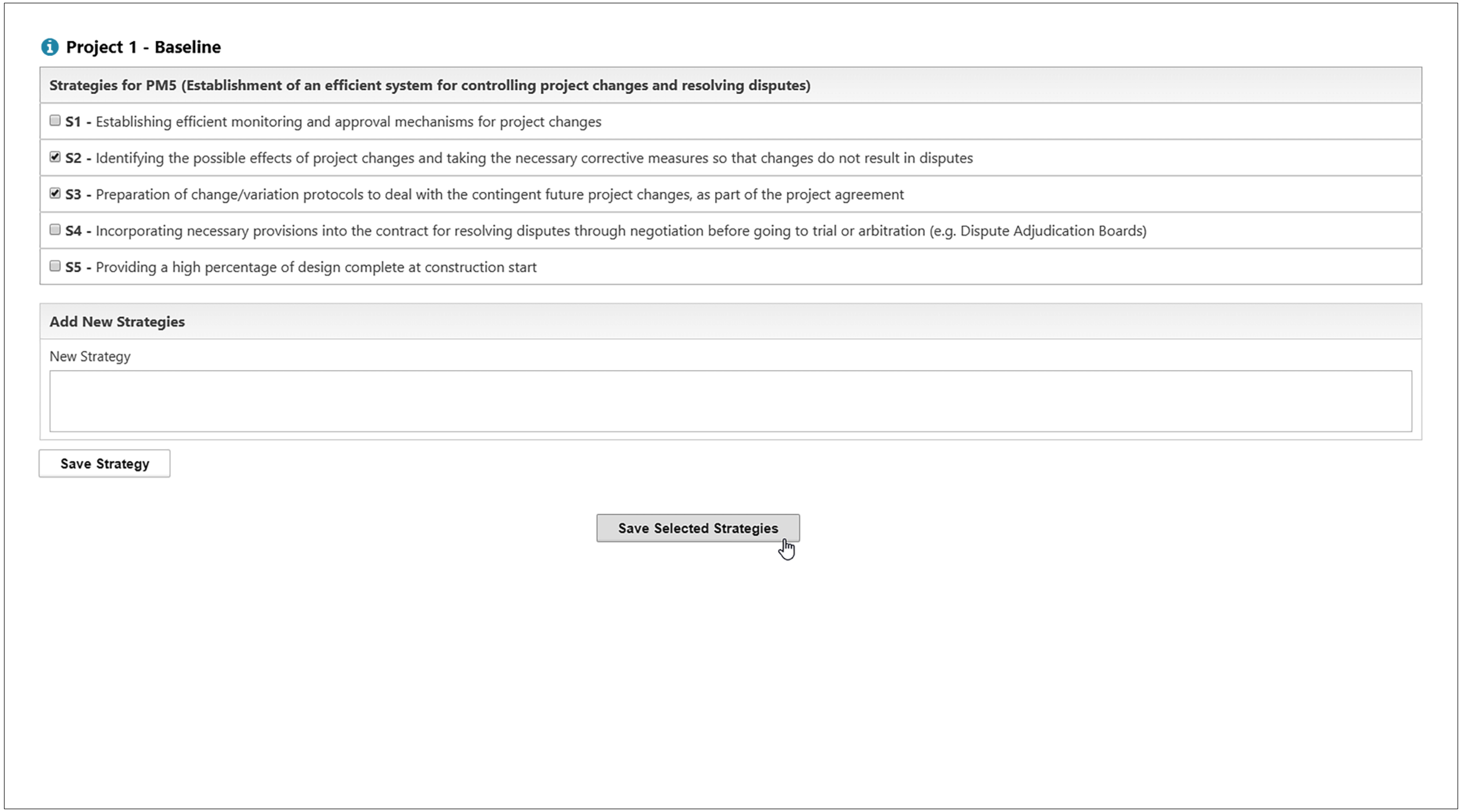

Figure G.33. Selection of the strategies to be used for a scenario

25	DCO6	Taking the necessary measures to provide and maintain maximum performance throughout the operation phase	0.60	Non-Critical	Strategies	Dependence Diagram
26	DCO7	Ensuring the proper transfer of the facility to the public authority at the end of the contract phase	0.54	Non-Critical	Strategies	Dependence Diagram
27	PM6	Effective implementation of risk management processes across all project phases	0.48	Non-Critical	Strategies	Dependence Diagram
28	PS8	Suppliers' experience, competence, commercial strength and long-term accessibility	0.24	Non-Critical		
29	PM7	Establishment of a proper documentation system for the project and storage of lessons learned through an accessible PPP projects database	0.18	Non-Critical	Strategies	Dependence Diagram
30	E4	Convenient location, favorable weather and site conditions	0.00	Rating = 5		
31	F3	Inclusion of investors and sponsors with sufficient financial strength in the project	0.00	Rating = 5	Strategies	Dependence Diagram
32	F2	Provision of adequate government guarantees	0.00	Rating = 5		
33	DCO5	Establishment of an efficient quality, health, safety and environment management system for the construction and operation phases	0.00	Rating = 5	Strategies	Dependence Diagram

Create a Scenario with the Selected Strategies

Figure G.34. Proceeding to create a new scenario upon selecting all of the relevant strategies

Project 1 - Scenario 1

Selected Strategies for Scenario 1			
Relevant Cluster	**Relevant Factor ID**	**Relevant Factor**	**Strategy**
Planning, Tendering and Contracting Processes	P4	Comprehensive and clear final contract documentation prepared by the public agency and the contractor	S12. Including clauses in the contract to enable adopting the changing conditions and demand during the operation period
			S13. Specifying a proper dispute resolution process within the contract
Project Management	PM5	Establishment of an efficient system for controlling project changes and resolving disputes	S2. Identifying the possible effects of project changes and taking the necessary corrective measures so that changes do not result in disputes
			S3. Preparation of change/variation protocols to deal with the contingent future project changes, as part of the project agreement

Update Ratings

Figure G.35. A list of the selected strategies for Scenario 1 of Project 1

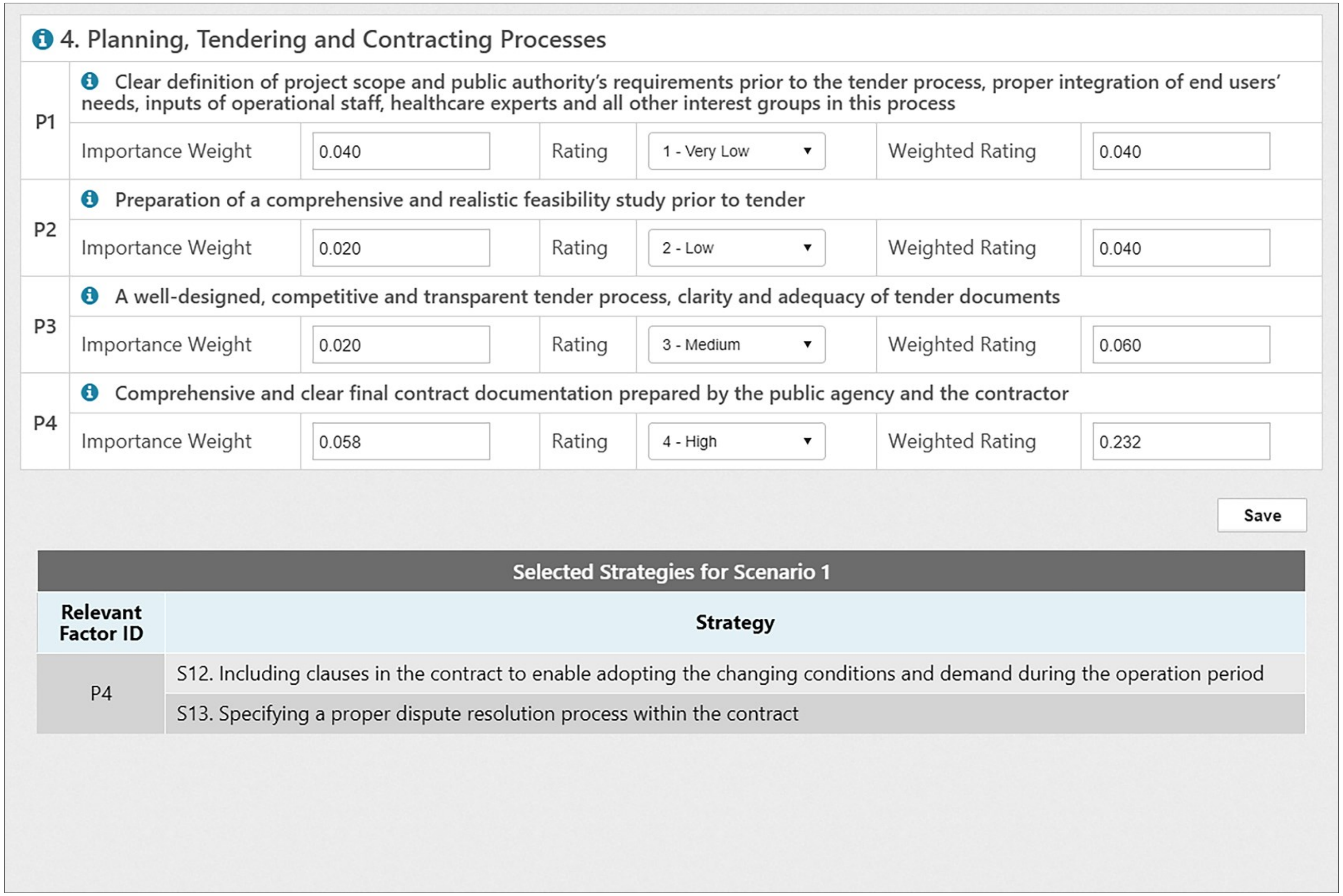

Figure G.36. Updating the ratings of the factors relevant to the selected strategies

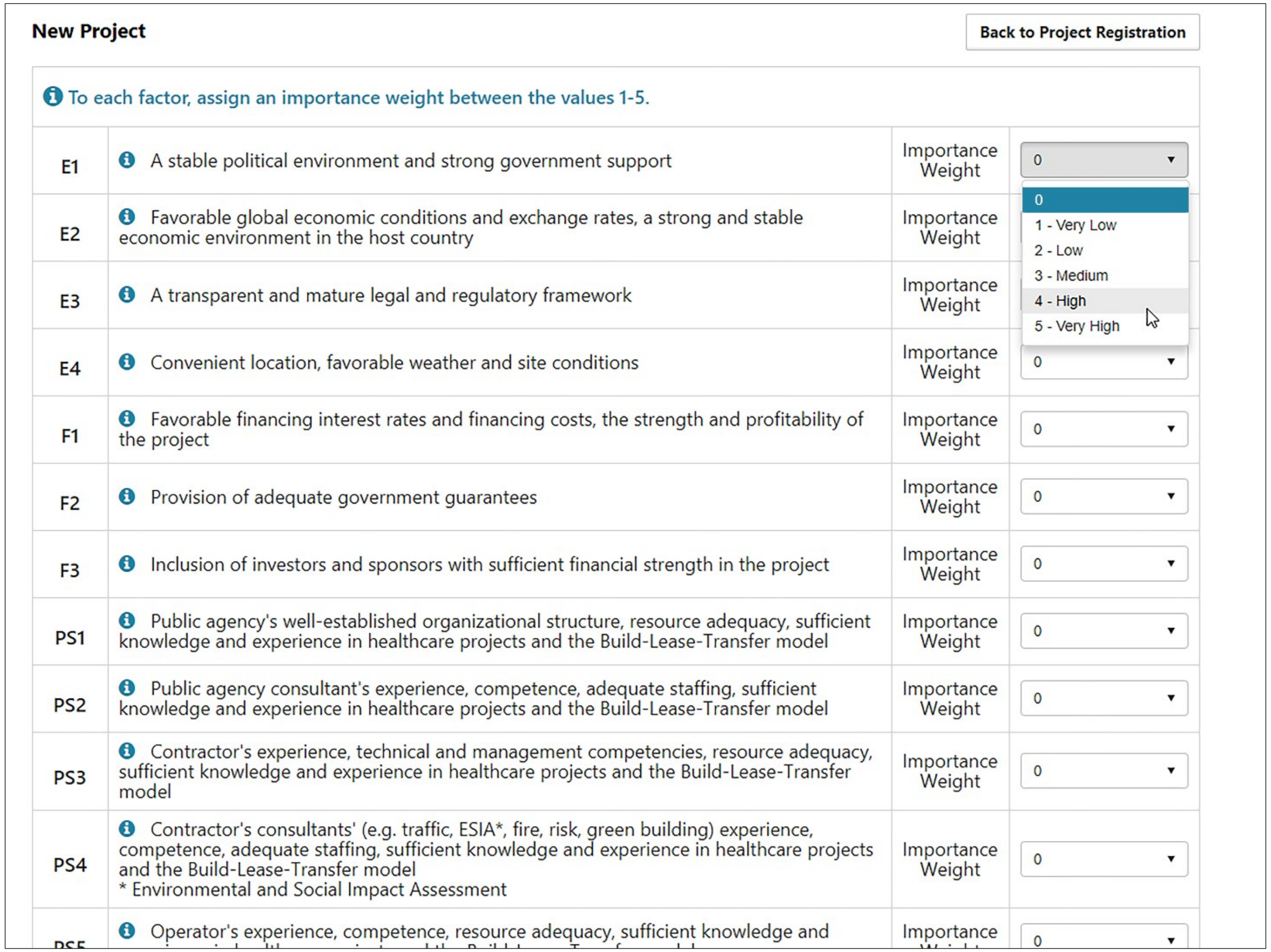

Figure G.37. Assessment with user-defined weights

APPENDIX H

Testing Protocol for the PPP Healthcare Decision Support System

Within the scope of a PhD study conducted in the Building Science Graduate Program of Middle East Technical University, it was aimed to develop a performance assessment model for the healthcare projects delivered by Public-Private Partnerships (PPPs). At the initial step, a conceptual project success framework was proposed by virtue of an extensive literature review. A preliminary study consisting of semi-structured interviews was conducted in May 2017, which was targeted to determine the success factors to be included in the subsequent stage of the research. In light of the obtained results, the conceptual framework was revised. Based on the framework, a discussion session was conducted in December 2017 with the participation of a group of experts for the assessment of the interrelations between the factors and the importance of the factors; and thus, the relative importance weights of the factors were determined. Accordingly, a PPP healthcare project success model was constructed and tested in the session. On the basis of the constructed model, the PPP Healthcare Decision Support System was developed, which is objected to provide guidance to private sector construction companies for project performance improvement, through its use in the pre-tender, planning and execution phases of the relevant projects. The capabilities of the system can be listed as follows:

- Examining project performance on the basis of the pre-determined success factors,
- Designating the importance weights of the factors, which were identified in the former stage of the research, using an algorithm that takes all the factors and their interrelationships into account,
- Revealing a prediction for the project performance rating over 5.00,
- Setting forth the strengths and weaknesses of the project,
- Visualizing the interrelationships between the factors,
- Proposing performance improvement strategies for the project with regards to the relevant factors,
- Enabling the generation of alternative scenarios for the project.

In this way, it was aimed that the system assists project executives in the specification of the most appropriate strategies for project performance improvement, and thus, in determining the necessary precautions and/or corrective actions for the successful planning and delivery of the projects. At the same time, it was intended that the tool contributes to organizational learning for the continuous improvement of the project planning and execution processes in companies.

Any information provided from participators will be kept confidential and will only be used for academic purposes. We would like to thank you for your time and your contribution to our study.

Objective

The objective of this protocol is to assist in the testing and validation of the developed decision support system and in receiving feedback on its contents, functions and improvement.

Project

It is expected from the experts to assess a real project by using the system and give feedback accordingly.

Procedure

The testing procedure is comprised of three major stages:

1. Provision of a set of performance predictions by the experts, regarding the particular phases of the project under consideration
2. Assessment of the project performance using the system
3. Getting remarks on the project performance rating revealed by the tool, comparing it to the prediction provided by the experts at the initial stage of the session and receiving feedback from the experts on the tool's contents, functions, its potential contributions and improvement

Step 1: Anticipation of the Project Performance Rating by the Experts

By considering the factors that may affect the success of the project, make a project performance estimation between 1-5. Evaluate the performance according to your company's point of view (short-term profitability, long-term profitability, *etc.*) and expectations. The corresponding expressions for the points of the scale are given below, whereas decimal values can also be used for the estimation.

1: Very low (Far below expectations)
2: Low (Below expectations)
3: Medium (At a level that meets expectations)
4: High (Above expectations)
5: Very high (Far above expectations)

Estimated Project Performance Rating (The current status of the project)	..… / 5.00

- How confident do you feel when giving the project performance score?

☐	☐	☐	☐	☐
Not sure at all	Not sure	Neutral	Sure	Very sure

- Other evaluations:

What was the opinion you had at the beginning of the project, with respect to performance?	..… / 5.00
Please mention the completion rate of the project.	% ..…
Assess the anticipated performance for the construction completion of the project.	..… / 5.00

Step 2: Assessment of the Project Performance Using the Proposed Tool

The PPP Healthcare Decision Support System includes 33 success factors organized under six groups, which are: (1) External Environment, (2) Financial Characteristics, (3) Project Stakeholders, (4) Planning, Tender and Contracting Processes, (5) Project Management, and (6) Design, Construction and Operation Processes.

The six primary functions of the system are as follows:

1. Project registration, storage and retrieval
2. Listing of the critical success factors for the PPP healthcare projects and assessment of project performance based on these compiled factors
3. Calculation and display of the project performance rating using an algorithm that takes all the factors and their interrelationships into account
4. Through the evaluation reports, displaying an overview of the assessment, the strengths and weaknesses of the project, critical factors for the improvement of project performance and the dependence diagrams for the factors
5. Proposal and display of project performance improvement strategies
6. Creation of alternative project scenarios based on the strategies to be implemented in the project

To perform the testing of the system, the following steps are to be tracked:

- Registration of the project
- Assessment of the success factors
- Reviewing the reports based on the system outputs
- Selection of the performance improvement strategies that can be implemented in the project
- Generation of a scenario with the selected strategies and updating the relevant factor ratings
- Reviewing the comparison of the performance ratings for the baseline and scenario assessments

Step 3: Comparison of the Revealed Rating with Expert Estimates and Providing Feedback

Project Performance Rating	
Estimated by the Experts	**Revealed by the Tool**
….. / 5.00	….. / 5.00

Please share your comments on the following:

- The performance rating revealed by the system, in comparison to the prediction you provided at the initial phase of the session
- The potential benefits of the system for the performance prediction and assessment process
- The observed problems in using the system

Please evaluate the six primary functions of the system using the 1-5 point scale (1: Very low, 2: Low, 3: Medium, 4: High, 5: Very high) and comment on these functions with respect to the following questions:

- How well does the function fulfill its task?
- To what extent can this function improve the project processes?
- How can this function contribute to the processes and to the resolution of the key issues that you have identified at the initial stage of the session?

	Functions	**Performance of the Function (1-5)**	**Contribution of the Function to Project Processes (1-5)**	**Comments**
1	Project registration, storage and retrieval			
2	Listing of the critical success factors and performing the evaluation			
3	Calculation and display of the performance rating using the defined algorithm			
4	Reporting the results of the assessment as well as the strengths and weaknesses			
5	Proposal and display of project performance improvement strategies			
6	Creation of alternative project scenarios			

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EDUCATION

Degree	Institution	Year of Graduation
MS	METU, Department of Architecture (Building Science)	2009
BArch	METU, Department of Architecture	2005
High School	Kdz. Ereğli Anatolian High School, Zonguldak	2001

WORK EXPERIENCE

Year	Place	Enrollment
2013-Present	Ilbank Inc. (Bank of Provinces)	Technical Specialist
2009-2013	METU Research Coordination Office	Research Assistant
2007-2008	METU Research and Implementation Center for Built Environment and Design (RICBED)	Architect (Project-Based)
2005-2006	Worked in a project subcontracted by Prokon Engineering and Consulting Inc.	Architect (Project-Based)

FOREIGN LANGUAGES

English (Advanced), Italian (Intermediate)

PUBLICATIONS

1. Ongel, B., Tanyer, A. M. and Dikmen, I. "Developing a Critical Success Factors Framework for PPP Healthcare Projects", RICS COBRA 2018: The Construction, Building and Real Estate Research Conference of the Royal Institution of Chartered Surveyors, 23-24 April 2018, London, UK (2018).
2. Öngel, B., Tanyer, A. M., Dikmen, İ. "Yüksek Performanslı Yeşil Bina Projelerindeki Kritik Başarı Faktörleri", 4. Proje ve Yapım Yönetimi Kongresi, 3-5 Kasım 2016, Eskişehir, Türkiye (2016).
3. Öngel, B., Tanyer, A. M., Dikmen, İ. "İnşaat Şirketlerinde Risk Yönetim Süreçlerinin Olgunluğunun Değerlendirilmesi", 1. Proje ve Yapım Yönetimi Kongresi, 29 Eylül-1 Ekim 2010, Ankara, Türkiye (2010).
4. Öngel, B. "Assessing Risk Management Maturity: A Framework for the Construction Companies", Unpublished MSc Dissertation, Middle East Technical University, Turkey (2009).
5. Ongel, B., Tanyer, A. M. and Dikmen, I. "Risk Management Maturity Models: A Review and Future Directions for Improvement", Fifth International Conference on Construction in the 21st Century (CITC-V), 20-22 May 2009, Istanbul, Turkey (2009).

CERTIFICATES AND SCHOLARSHIPS

1. Dean's Honor List: 2002-2003 Spring Term; 2004-2005 Spring Term.
2. Dean's High Honor List: 2003-2004 Spring Term; 2004-2005 Fall Term.
3. Special Student with Scholarship, Master of Architecture, Politecnico di Milano, Milan, Italy (One semester of education, 2006-2007 Fall Term).
4. Level Four Certificate from the Italian Cultural Center, Ankara; one semester of education at Il Centro, the Italian Language and Culture Center for Foreigners, Milan.

WORKS PRESENTED

Graduation project exhibited. 22nd World Congress of Architecture: UIA 2005 Istanbul (Cities: Grand Bazaar of Architectures), 3-7 July 2005, Istanbul, Turkey.