The strategy of ESCos in urban redevelopment projects to convince stakeholders to choose for an ESCo approach

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Graduation Thesis

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Contents

Preface

This master thesis is written as completion of the master track Construction Management & Engineering at the Eindhoven University of Technology. This master thesis is established by a cooperation between the Eindhoven University of Technology and Cofely-GDF Suez in the period between February and July 2015.

The inspiration for conducting this research came from an interesting project in Rotterdam, *De Groene Zwembaden*. This project illustrates the potential of successful implementations of energy performance contracts by Energy Service Companies. Energy Service Companies, like Cofely-GDF Suez, confront the problem that ESCo projects in the Netherlands are lagging behind. ESCos want to investigate customer needs, in order to be able to successfully deploy ESCos. Hence, synergy can be realized as both, customers as well as ESCos, can benefit from successful ESCo projects.

During my graduation period I faced many challenges, from finding a proper research question, the development of my research design, finding enough respondents, to writing outcomes and conclusions of the thesis. Conducting research and writing this thesis was not possible without the help of many people. Firstly, I want to show my gratitude to my first supervisor from the Eindhoven University of Technology dr.ir. Brano Glumac. He helped me with successfully setting up my research proposal, and structuring the research according to a proper research design. He helped me with the research methods and the data transition process. Secondly, I want to thank my second supervisor from the university drs. Paul Masselink. He helped me with his experience in sustainable energy applications, and his knowledge from governmental perspective, as he is working as policy officer for the government of the province of Noord-Brabant. He gave me clear insights in practical implementations of potential ESCo projects, and came always up with new innovative ways to implement sustainability. Thirdly, I want to thank my colleagues at Cofely-GDF Suez for their helpfulness. Especially I want to thank my company supervisors Ruud Vleugels and Frank Soons for their support. The company support provided me the opportunity to actually realize research which could positively contribute to the implementation of ESCo projects. As it was one of the main objectives I stated for myself: Conducting research which could immediately and actively contribute to the process of becoming more sustainable by the development of more ESCo projects.

Last but not least I want to thank my friends and family who supported me during this intensive process of graduation. I want to thank them for their help and support. In particular I want to thank Lisanne for her significant support, patience and listening ear.

I hope you, as reader, will enjoy and experience the intensive and pleasant process of this research which resulted in this graduation thesis.

Falco Zeekaf
Eindhoven & Maastricht, July 2015

Management summary

The energy consumption in the Netherlands is rising significantly, on average 1.09 percent year since 1983. Next to this the European Union (EU) set a target to increase the energy efficiency of the EU by 20% in 2020. This means that in spite of an increase in energy demand, the energy efficiency has to increase. Hence, there is a growing need for energy efficiency measures and sustainable energy solutions. One of the possible outcomes for the energy efficiency problem are Energy Service Companies (ESCos) In countries like for instance Germany, the United Kingdom and France there are a lot of ESCo projects. This in contrary to the Dutch ESCo market. The Dutch ESCo market is lacking behind due to distrust, no standardization and the resistance towards outsourcing energy management. ESCo approaches could be applied in the redevelopment of utility buildings. This market could be targeted, as the government obliged the owners of these buildings to invest in energy efficiency measures. Nowadays, still large construction companies win tender procedures, to redevelop utility buildings. Building owners' behavior should experience a transition towards awareness about the benefits of an ESCo approach instead of the traditional process. This transition can be done by investigating the decision criteria of the customers, in order to set up a proper strategy to manage the stakeholders. Next to this, suggestions have to be made to ESCos an how to expose and proposition their self on the market.

Process of contractor selection in ESCo tendering

The main purpose of public procurement is to stimulate competition and safeguard equal treatment off all potential bidders. Relationship and integration between the customer and the contractor appear to be critical components to achieve the objectives of a construction project. The selection of the contractor by the customer is one of the most challenging decision-making stages of a construction project. The process of tendering can be subdivided into two streams; (1) the strategy of contractors on how to approach the tender procedure and (2) the strategy of the customer on how to select the winning bid.

Basically, the bidding party has two different possibilities on how to enter a tender procedure. Bidders can enter the procedure with a traditional approach or an ESCo approach. Especially in the Netherlands, traditional energy efficiency projects are implemented which had left little space for the implementation of ESCos. ESCo projects compete for scarce capital with traditional projects. This means that ESCos can enter the tender procedure with a traditional- or ESCo approach.

The customer, in general, has two alternative methods for supplier selection. First, the lowest price bid and second the most economically advantageous tender (MEAT). In the EU lowest price is used less frequently and instead the MEAT approach is used more often.

Procurement criteria in ESCo tendering

The process of contractor selection, which is divided in a bidding process and a contractor selection process, is linked by procurement criteria. The procurement criteria form the link between both processes. Customers predefine a list of procurement criteria on which the bidding contractors will be evaluated. The choice of one contractor over another is largely dependent on the customer's

preferences in terms of the procurement criteria. In state of the art literature 46 procurement criteria are distinguished, divided among 11 categories. In this research this initial list of procurement criteria is rated and validated which results in a list of 23 criteria, divided among 6 categories.

Impact of procurement criteria on game outcomes and preference of game outcomes

The two possible strategies of the customer as well as the ESCo result in four different possible game outcomes. The 23 validated criteria all have their impact on the game outcomes. The impact of criteria per game outcome differ per player. The differences in evaluation of impact levels of both players is determined. Game outcome A, *Lowest Price procurement – Traditional approach* is regarded as the traditional process. The technical consultants, which act as customer, as well as the ESCo have the same evaluations about the impact levels of the procurement criteria. In Game outcome B, *Lowest Price procurement – ESCo approach* consultants assign higher impact levels to the procurement criteria than the ESCo experts do. Game outcome C, *MEAT procurement – Traditional approach* is a process of frequent occurrence. Hence, the evaluations of impact levels by both players is not in balance as it is in game outcome A. Game outcome D, *MEAT procurement – ESCo approach* provides the best opportunities to employ successful ESCo projects. In this game outcome the procurement criteria are evaluated as having the highest impacts, in contrary to the other game outcomes. Both parties agree that the total costs of ownership analysis is one of the most important procurement criteria. Nevertheless, consultants want to expand the financial statement by providing a solid financial plan, cost control and rationality of estimates. Next to this, financing opportunities are evaluated as having a moderate to high impact by the consultants. The delivered energy performance and user comfort has been evaluated as having the highest impact by the consultants. ESCos should invest more effort in the business case in order to convince consultants of the ESCo approach. Next to that ESCo should pay attention to a clear and pleasant communication style, as consultants evaluate it as moderate to high impact in contrary to ESCo who think it has moderate to low impact.

Next to impact levels, the preference of both players towards the game outcomes is evaluated. Both players have the highest preference to game outcome D, *MEAT procurement – ESCo approach*, which provides opportunities to employ ESCos. Next to that the payoff generated via the evaluated impact levels also leads to the sub game perfect Nash equilibrium of game outcome D.

Decision support tool

The customer as well as the ESCos can independently decide to include or exclude criteria in a tender procedure. The 23 validated criteria can independently be included or excluded in the tender procedure. This process is translated to a decision support tool (DSS), wherein both players independently can decide to include or exclude criteria. The objective of the DSS is two sided. First of all it can contribute to the decision making process of ESCos, as they can evaluate the consequences of in- or excluding criteria. Namely, they can immediately derive the new estimated payoff due to the inclusion or exclusion. Secondly, ESCos can proactively approach consultants and customers, and illustrate that the payoff will rise if the customer decides to include other criteria.

Management samenvatting

Het energieverbruik in Nederland stijgt jaarlijks met gemiddeld 1,09 procent sinds 1983. Daarnaast heeft de Europese Unie (EU) als doel gesteld om de energie efficiëntie met 20% te verbeteren tot aan 2020. Dit betekent dat ondanks een toename in de energievraag, de energie efficiëntie moet verbeteren. Dit betekent dat er een groeiende behoefte is naar energiebesparende maatregelen en duurzame energieoplossingen. Eén van de mogelijke uitkomsten voor dit vraagstuk zijn Energy Service Companies (ESCo's). In landen zoals bijvoorbeeld Duitsland, het Verenigd Koninkrijk en Frankrijk zijn er reeds talloze ESCo projecten uitgerold. Dit in tegenstelling tot de Nederlandse ESCo markt. De Nederlandse ESCo markt blijft achter vanwege wantrouwen, geen standaardisatie en weerstand tegen het uitbesteden van energie beheer. ESCo aanpakken kunnen worden toegepast in herontwikkelingstrajecten van utiliteitsgebouwen. Men kan zich op deze markt focussen, aangezien de overheid gebouweigenaren binnen deze sector heeft verplicht om te investeren in energie verduurzamende maatregelen. Hedendaags, zijn het nog altijd de grote bouwbedrijven die de herontwikkeling van utiliteitsgebouwen binnen halen via aanbestedingsprocedures. Gebouweigenaren zouden een verandering in denkwijze moeten ondergaan omtrent de voordelen die ESCo aanpakken kunnen leveren ten opzichte van het traditionele proces. Deze verandering kan worden bewerkstelligd door de beslissingscriteria van de opdrachtgevers te onderzoeken. Vanuit dit beginpunt kunnen strategieën worden ontwikkeld om stakeholders te managen. Daarnaast kunnen aanbevelingen worden gedaan naar ESCo's, op welke wijze zij zich dienen te positioneren op de markt.

Proces van gunning in ESCo aanbestedingen

Het voornaamste doel in openbare aanbestedingen is het stimuleren van marktwerking, en het bewaken van een gelijke behandeling van alle inschrijvende partijen. Relatie en integratie tussen opdrachtgever en opdrachtnemer blijken kritische componenten te zijn om de gestelde doelen bij een bouwproject te bereiken. Het kiezen van een opdrachtnemer door de opdrachtgever is de meest uitdagende beslissing in de fases van een bouwproject. Het aanbestedingsproces bestaat uit twee delen; (1) de strategie van opdrachtnemers op de wijze van aanbesteden en (2) de strategie van de opdrachtgever op welke wijze de winnende inschrijving wordt bepaald.

In theorie heeft de inschrijvende partij twee verschillende mogelijkheden om in te schrijven op de aanbestedingsprocedure. Er kan worden ingeschreven met een traditionele aanpak of een ESCo aanpak. In Nederland worden voornamelijk traditionele energie besparende projecten geïmplementeerd, welke de mogelijkheden voor ESCo projecten verkleinen. ESCo projecten strijden voor beperkt kapitaal tezamen met traditionele projecten. Kortom ESCo's kunnen inschrijven middels een traditionele- of ESCo aanpak.

De klant heeft in het algemeen twee mogelijkheden binnen het aanbestedingsproces. Ten eerste kan men gunnen op basis van laagste prijs. Ten tweede kan men gunnen op basis van EMVI, oftewel de economisch meest voordelige inschrijving. In de EU wordt laagste prijs gunning steeds minder gebruikt, terwijl EMVI steeds vaker wordt toegepast

Gunningscriteria in ESCo aanbestedingen

Het gunningsproces is opgebouwd uit een aanbesteding- en inschrijvingsproces, en wordt verbonden door de gunningscriteria. De gunningscriteria vormen de schakelen tussen beide processen. Opdrachtgevers stellen een lijst samen van gunningscriteria, waarop de inschrijvende partijen worden gewaardeerd. In recente literatuur zijn 46 gunningscriteria onderscheidden, welke zijn onderverdeeld in 11 categorieën. In dit onderzoek is deze lijst gewaardeerd en gevalideerd, wat resulteert in een lijst van 23 gunningscriteria, onderverdeeld in 6 categorieën.

Impact van gunningscriteria op uitkomsten en voorkeur ten aanzien van deze uitkomsten

De twee mogelijke strategieën van de opdrachtgever en de ESCo resulteren in vier verschillende mogelijke uitkomsten. De 23 gevalideerde criteria hebben allemaal impact op deze uitkomst. Echter, de impact verschilt per partij. De verschillen in impact niveaus per partij is bepaald. Uitkomst A, *Laagste prijs gunning – Traditionele inschrijving* wordt gezien als het traditionele proces. De technische adviseurs, welke fungeren als opdrachtgever, en de ESCo hebben dezelfde mening over de impact niveaus van de gunningscriteria. In uitkomst B, *Laagste prijs gunning – ESCo aanpak*, kennen adviseurs hogere impact niveaus toe aan de criteria dan de ESCo experts. Uitkomst C, *EMVI gunning – Traditionele inschrijving* komt tegenwoordig steeds vaker voor. Hierdoor, liggen de evaluaties van beide partijen niet op één lijn zoals in uitkomst A. Uitkomst D, *EMVI gunning – ESCo aanpak* levert de beste mogelijkheden om ESCo projecten uit te rollen. De criteria hebben in deze uitkomst de hoogste impact. De total costs of ownership analyse wordt gezien als een van de meest belangrijkste gunningscriteria door beide partijen. Echter, adviseurs willen dat deze analyse wordt uitgebreid met een duidelijk financieel plan, kostenbeheersing en rationele aannames. Daarnaast worden financieringsmogelijkheden gezien als een gemiddeld tot hoge impact door de adviseurs. De geleverde energieprestaties en het gebruikscomfort wordt door de adviseurs als belangrijkste geacht. ESCos dienen meer energie te investeren in een solide business case om zo de adviseurs te overtuigen van de ESCo aanpak. Daarnaast dient er helder en prettig gecommuniceerd te worden, aangezien adviseurs dit een gemiddeld tot hoge impact geven.

Naast de impact niveaus, is de respondenten gevraagd naar de voorkeur van de uitkomsten. Beide partijen hebben de meeste voorkeur voor uitkomst D, EMVI *gunning – ESCo aanpak*, wat mogelijkheden biedt voor ESCo's. Ook via de impact niveaus leidt uitkomst D naar de hoogste payoff, welke is bepaald met de sub game perfect Nash equilibrium methode.

Decision support tool (Beslissing ondersteunend instrument)

De opdrachtgever en de ESCo kunnen onafhankelijk beslissen om criteria mee te nemen of uit te sluiten in een aanbestedingsprocedure, dat geldt voor alle 23 criteria. Dit proces is vertaald naar een decision support tool (DSS), waarin beide partijen onafhankelijk kunnen kiezen om criteria mee te nemen of uit te sluiten. Het DSS dient twee doelen. Allereerst, kan het bijdragen aan het besluitvormingsproces van ESCo's, aangezien de consequenties van criteria kunnen worden bekeken. Er wordt namelijk onmiddellijk een nieuwe payoff berekent wanneer een criterium wordt meegenomen dan wel uitgesloten. Ten tweede kunnen ESCo's proactief opdrachtgevers benaderen, en aantonen dat het resultaat beter wordt wanneer de opdrachtgever kiest voor een ESCo aanpak.

The strategy of ESCos in urban redevelopment projects to convince stakeholders to choose for an ESCo approach

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Abstract

The energy consumption in the Netherlands is rising significantly, on average 1.09 percent year since 1983 (CBS, 2015). Next to this the European Union (EU) set a target to increase the energy efficiency of the EU by 20% in 2020. This means that in spite of an increase in energy demand, the energy efficiency has to increase. One of the possible outcomes for the energy efficiency problem are Energy Service Companies (ESCos). ESCos basically deliver energy services and other energy efficiency improvement measures. However the Dutch ESCo market is lacking behind in contrary to other European counties. ESCo approaches could be applied in the redevelopment of utility buildings. Nowadays, still large construction companies win tender procedures, to redevelop utility buildings. Building owners' behavior should experience a transition towards awareness about the benefits of an ESCo approach instead of the traditional process. Therefore this research shall answer the research question: What strategy should ESCos apply under which tender procedure in urban redevelopment projects to increase success chances for an ESCo approach? This research question is answered by combining the research methods Fuzzy Delphi method (FDM) and Game theory. First, a literature review has been conducted to define a list of procurement criteria which are part of ESCo tender procedures. This list has been rated, validated and functioned as input for the FDM questionnaire. Respondents were asked to evaluate the impact of procurement criteria under different game outcomes. Next to this, respondents gave their preferences over the four different game outcomes. The respondents consisted of two homogeneous groups, namely ESCo experts and technical consultants which represent the customers. The results illustrate that both players have the same opinion in the common traditional process, but differentiate in more complex processes. In a most economical attractive tender (MEAT), ESCos should focus on the construction of a solid business case based on energy performance levels and comfort levels for the end-users. The results are captured in a decision support tool. The tool can demonstrate for both parties how the payoff will be react on the in- or exclusion of specific criteria. ESCos can proactively visit customers to illustrate hypothetically the benefits of an ESCo approach.

Keywords: ESCo tendering, procurement-, bidding strategies, Fuzzy Delhi, Game theory, impact levels, preference levels, decision support tool

1 Introduction

This chapter describes the research design of this graduation thesis. First the research problem is defined, which follows into the research questions. In the third subchapter the research design is displayed, together with research objectives and limitations. The fourth subchapter will explain the expected results. Finally a reading guide will be given.

1.1 Problem definition

In the Netherlands the energy consumption between 1973 and 2013 has increased from 2617 PJ to 3256 PJ (Figure 1-1) that is an increase of 24% according to data of the Dutch Central Statistical Office (CBS, 2015). The International Energy Agency expects that the energy consumption will rise with another 18% up to 2020, and 30% until 2030 (Daniëls & van der Maas, 2009).

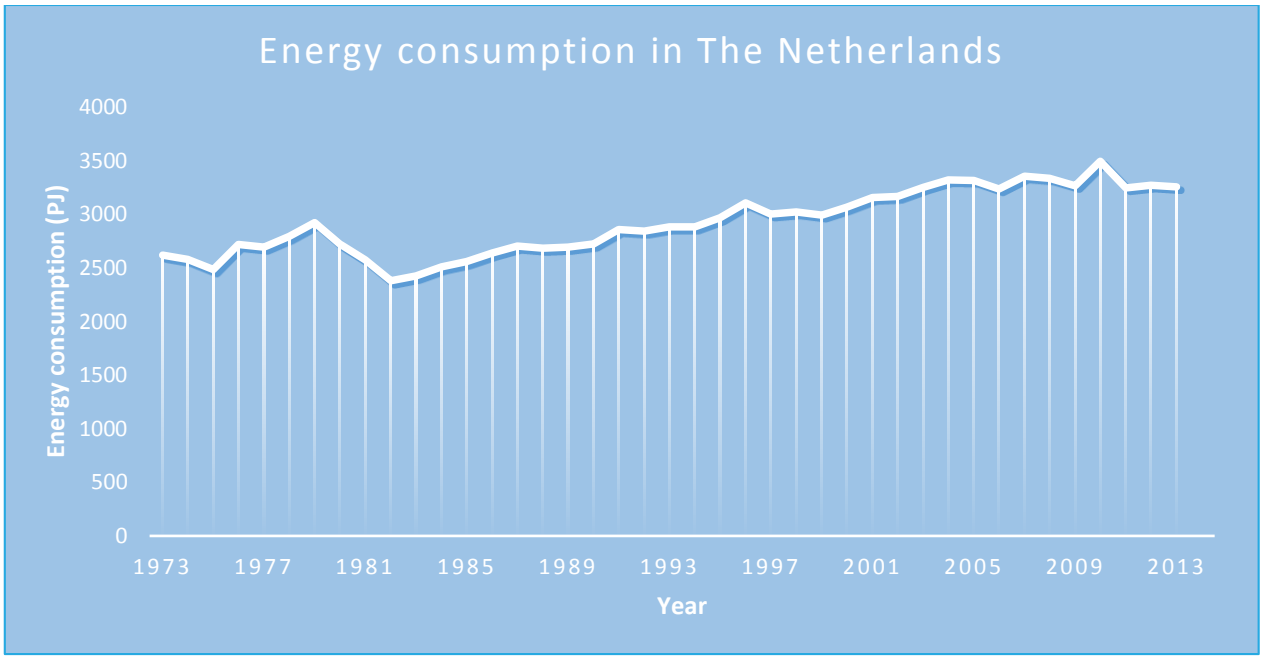


Figure 1-1 Energy consumption in the Netherlands between 1973-2013 (CBS, 2015)

The energy consumption in the Netherlands is rising significantly, on average 1.09 percent year since 1983 (CBS, 2015) (Figure 1-1). Next to this the European Union (EU) set a target to increase the energy efficiency of the EU by 20% in 2020 (ING, 2013). This means that in spite of an increase in energy demand, the energy efficiency has to increase. Hence, there is a growing need for energy efficiency measures and sustainable energy solutions.

One of the possible outcomes for the energy efficiency problem are Energy Service Companies (ESCos). ESCos basically deliver energy services and other energy efficiency improvement measures. In Chapter 2 the concept of ESCos will be elucidated clearly. In countries like for instance Germany, the United Kingdom and France there are a lot of ESCo projects. This in contrary to the Dutch ESCo market. The market size of the German ESCo market is €3.5-5.0 billion,

with a potential of €20-30 billion per year. The market potential of the Dutch ESCo market is €30 million per year (Bertoldi, Boza-Kiss, Panev, & Labanca, 2014). One could not absolutely compare these market figures because of the scale differences between both countries, however the differences in market size and potential are significant. The Dutch ESCo market is lacking behind due to distrust, no standardization and the resistance towards outsourcing energy management (Marino, Bertoldi, & Rezessy, 2010).

In September 2013 the Dutch government released its report on the sustainable growth of the nation. This report is called the "Energieakkoord", which means energy agreement in English (EIB, 2013). An example of an aspect of the agreement is about the Environmental Protection Act. Utility buildings are obliged to invest in energy efficiency measures, when the payback period is less than five years. If companies ignore this, they risk a financial penalty of 1.5-2 times the energy efficiency investment (van den Tempel, 2009).

Energieonderzoek Centrum Nederland (ECN) investigated the energy savings potential in the Dutch utility buildings. They investigated the potential on gas consumption, and the potential on energy savings on lighting. The potential gas consumption savings is 37%. The potential of energy savings on lighting systems is 65%. Lighting is responsible for 35% of the total amount of electricity consumption of buildings, which means there are, next to lighting, even more energy saving possibilities. This means that the savings potential in utility buildings has significant size (Sipma, 2014).

ESCo approaches could be applied in the redevelopment of utility buildings. This market could be targeted, as the government obliged the owners of these buildings to invest in energy efficiency measures. Nowadays, still large construction companies win tender procedures, to redevelop utility buildings. Building owners' behavior should experience a transition towards awareness about the benefits of an ESCo approach instead of the traditional process. This transition can be done by investigating the decision criteria of the customers, in order to set up a proper strategy to manage the stakeholders. Next to this, suggestions have to be made to ESCos an how to expose and proposition their self on the market.

1.2 Research question

In order to successfully deploy strategies for ESCos on how to approach customers and win tender procedures. As well as to provide customers guidance on how to involve ESCo in their tender procedures, a main research question has been stated. The main research question is:

- What strategy should ESCos apply under which tender procedure in urban redevelopment projects to increase success chances for an ESCo approach?

In order to give an answer on the main research question, the following sub questions have been formulated:

1. What are Energy Service Companies? (Literature Study)
2. Which types of partnerships do exist? (Literature Study/ Case Studies/ SWOT Analysis)

3. Which types of tender do exist? (Literature Study/ Case Studies/ Interviews/ SWOT Analysis)
4. Which stakeholders are involved in the decision making process in the tender procedure of urban redevelopment projects? (Literature Study/ Case Studies/ Interviews/ Stakeholder Analysis Tools)
5. Why do private parties make use of tender procedures? (Literature Study/ Case Studies)
6. What are the decision criteria of the contracting authority to select the winning tender, and what are their impact levels? (Literature Study/ Case Studies/ Interviews/ Fuzzy Delphi Method)
7. What are the decision criteria of ESCos when constructing the tender, and what are their impact levels? (Literature Study/ Case Studies/ Interviews/ Fuzzy Delphi Method)
8. How are the tender procedures stated, and can the outcomes be influenced? (Literature Study/ Case Studies/ Interviews/ Fuzzy Delphi Method/ Auction Game Theory)

1.3 Research design

The research has to contribute to the development of the Dutch ESCo market. The Dutch ESCo market has a large potential, but the developments do not run smoothly. One of the potential target markets of ESCos is the redevelopment of the utility buildings. Nowadays, large construction companies win the tender procedure instead of ESCos. The objective of this research is to create a new strategy for ESCos about how to convince stakeholders to choose for an ESCo approach. Next to this recommendations will be given towards customers, on how to involve ESCos in tender procedures. The development of the Dutch ESCo market will positively contribute to the sustainability goals stated by the government (ING, 2013).

In order to make sure the research can be conducted within a duration of five months, limitations had to be set. The following research boundaries are set:

- The research has to contribute to the development of the Dutch ESCo market. Therefore the research is focused on the Netherlands. The focus is on Dutch legislation and regulations.
- The focus is on the redevelopment of the utility buildings in the Netherlands, this is a so-called building ESCo which will be further elaborated in 2.1.2 ESCo types.
- In the Netherlands there are several different options to tender, in this research the focus is on standardized processes. Customized tender procedures are not taken into account.

In order to successfully answer the research question stated in 1.2 Research question, a proper research design is constructed (Figure 1-2). This research design starts with a problem identification in state of the art literature. After this problem has been identified, the actual research will begin. The research design will consists of Fuzzy Delphi method and Game theory. The complete research design is divided into smaller steps. These steps will be discussed later on in the report (subchapter 4.2.3).

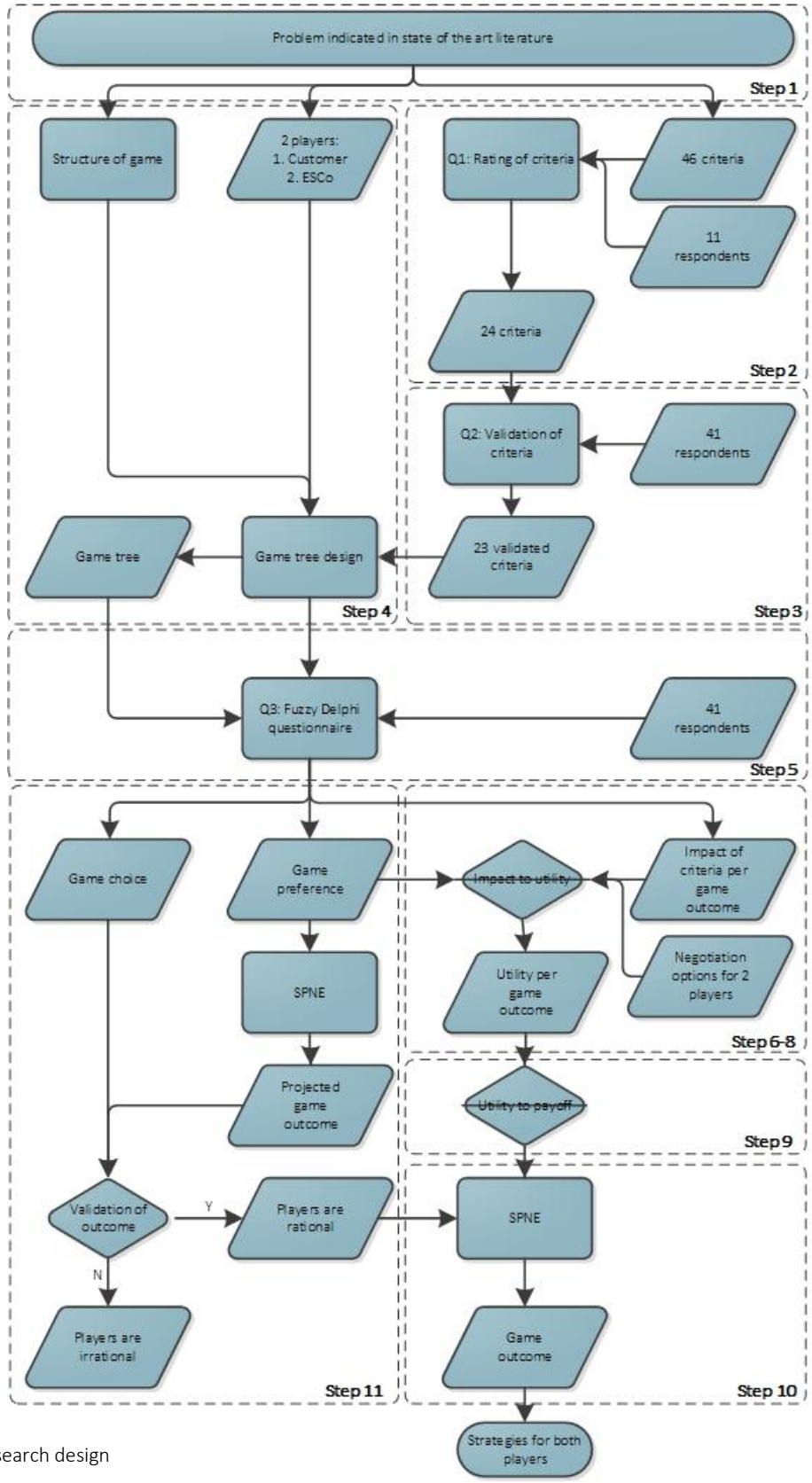


Figure 1-2 Research design

1.4 Expected results

This research should contribute to the development of new ESCo projects. The results will consist of evaluations of impact levels of procurement criteria. By analyzing state of the art literature a list of procurement criteria will be composed. This list of procurement criteria will be evaluated by technical consultants as well as ESCos. Hence, a comparison can be made about the differences in evaluations. These evaluations will take place under four different game outcomes. So for each game outcome, recommendations can be made for ESCos as well as technical consultants on how to approach the tender procedure in order to create a successful ESCo project.

Next to that both parties will express their preference regarding the four different outcomes. One would expect that the game outcome, which provides the best circumstances for ESCo projects will be preferred the most. This preference would generate opportunities for ESCo projects, as there will be scientific research that identified that both players prefer an ESCo approach over a traditional approach.

The preference of game outcomes, together with the impact levels of the individual criteria will be combined to a decision support tool. This tool will visually demonstrate the consequences of including or excluding specific procurement criteria. Next to this, it will help ESCos when proactively visiting potential customers. ESCos can hypothetically show potential customers, the consequences of each of the four different approaches. As it will be expected, that ESCo project have the highest preference, the decision support tool will demonstrate that ESCo projects will generate the highest payoff to customers as well as to the ESCo itself.

1.5 Reading Guide

This graduation thesis is subdivided into four different parts. Chapter 2 Glossary represents a summary of the most important definitions, notions and classifications. It will elaborate on the principle of ESCos, followed up by potential ways of partnering in ESCo projects. Chapter 2 will end with an elaboration of potential tender procedures in the Dutch construction industry.

Chapter 3 will consist of a literature review. This literature review will be about ESCo tendering in urban redevelopment. First an introduction will be given, to be followed by the process of contractor selection in ESCo tendering. Next the identified potential procurement criteria will be discussed. Chapter 3 will finish with methods to evaluate bids, which are based on the procurement criteria.

Chapter 4 will be about the construction of the decision support tool for procurement and bidding strategies in ESCo tendering. First of all the methodologies together with the research design will be discussed. Next, the results will be illustrated which function as input for the decision support tool. At the end a conclusion and discussion section will be given, wherein recommendations are made for ESCos as well as technical consultants on how to approach the tender procedures.

The last chapter, chapter 5, will be a conclusion of the research. It will discuss the societal, scientific and beneficiary relevance of the conducted research. Chapter 5 will be followed up by a reference list, and with the appendixes.

As a reader one can decide to read the complete thesis, but this is not necessary. If the reader is looking for background information about the principle of ESCo tendering in urban redevelopment, and all its attributes, chapter 2 is sufficient. Chapter 3 is independently structured as a scientific literature review article. Chapter 4 is structured as a scientific article about the conducted research. In short, one could decide to read the whole thesis, of just one of the chapters.

2 Glossary

ESCo projects are relatively scarce on the Dutch market. In order to create a solid base for this research, first a summary of the most important terms, principles and processes will be represented. This chapter is subdivided into three different segments. First the concept of ESCos will be elucidated. Next the different possibilities about partnerships will be given. The third part will be about different tender procedures which are possible in the Dutch construction sector.

2.1 Energy Service Companies

2.1.1 Definition of the term ESCo

The lack of a common definition has been quoted as one of the main barriers to the wider implementation of Energy Service Companies (ESCos) in Europe. This, because it resulted in a lack of trust which lead to a limitation in ESCo project demand (Marino, Bertoldi, & Rezessy, 2010).

The Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on Energy End-use Efficiency and Energy Services (Energy Services Directive) define the term ESCo as follows (Marino et al., 2011):

''A natural or legal person that delivers energy services and/or other energy efficiency improvement measures in a user's facility or premises, and accepts some degree of financial risk in so doing. The payment for the services delivered is based (either wholly or in part) on the achievement of energy efficiency improvements and on the meeting of the other agreed performance criteria''.

The focus of this report is on the development of the Dutch ESCo market. Therefore, the definition of the term ESCo stated by the Dutch government should be given. The Ministry of Interior and Kingdom Relations defines an ESCo as a company which takes measures to realize an amount of energy savings. A key role in this concept is performance contracting. This is a contractual agreement between the ESCo and the customer wherein agreements are recorded, among them the determined energy savings. When the contractual agreements are not met, the ESCo is liable. When the energy savings exceed the predetermined goal, the revenues will be split among the ESCo and the customer. Next to energy savings, the energy performance contract also contains other targets. Hereby, one has to think for instance about a specific amount of light output (Agentschap NL, 2012).

The definition of the term ESCo in this report is as follows (Agentschap NL, 2012; Bertoldi, Rezessy, & Vine, 2006):

An ESCo is an organization that delivers energy services and/or other energy efficiency improvement measures in a user's facility, and accepts some degree of financial risk in so doing. As their remuneration is directly tied to the energy performances. A contractual agreement is constructed wherein performance criteria are incorporated. This contractual agreement is based on a predetermined fixed time duration.

2.1.2 ESCo types

Next to variety in definitions of the term ESCo, there are also several different ESCo approaches. In general there are four different forms (ESCoNetwerk.nl, 2015):

1. ESCo Light: The ESCo Light primary focusses on the implementation of energy monitoring. Based on the results of this energy management, energy efficiency measures will be realized.
2. Product ESCo: The product ESCo focusses on the implementation of one specific energy measure.
3. Installation ESCo: This form focusses on more substantial energy measures.
4. Building ESCo: This version of an ESCo approach, next to above mentioned aspects, focusses also on measures in the façade of buildings.

2.1.3 Contracting

The establishment of an ESCo depends on the signing of the contractual agreement. This contractual agreement includes the energy services and/or other energy efficiency improvement measures, which will be implemented. Next to this, the performance criteria and the contract period will be mentioned. There are three different ways of contracting (EU ESCo, 2015; Würtenberger, Bleyl, Menkveld, Vethman, & Tilburg, 2012):

- Energy Supply Contracting (ESC)
- Energy Performance Contracting (EPC)
- Integrated Energy-Contracting (IEC)

All contracting approaches will be elaborated in the following subsections.

2.1.3.1 Energy Supply Contracting

ESC is the efficient supply of energy by the ESCo. The output of this supply is measured in Megawatt hours delivered. The duration period of ESC is typically 10-15 years. This duration period depends on the technical lifetime of the installations (Würtenberger et al., 2012). Often ESCos offer complete service packages. These packages include all aspects from engineering to maintenance activities. The ESC business model can be seen in Figure 2-1.

The benefits of ESC are efficiency increases, optimized operational costs and increased quality of technical systems. The customer no longer needs to worry about the energy supply. The focus of ESC is on efficiency of energy supply, this will result in higher environmental performance levels (EU ESCo, 2015).

2.1.3.2 Energy Performance Contracting

The business model of ESC is based on guaranteed energy supply (Figure 2-1). EPC (Figure 2-2) is based on energy savings (EU ESCo, 2015). In the EPC the ESCo guarantees a minimum energy savings level, hereby the ESCo takes on a performance risk. The financial risk is for the party that finances the project. In some cases the ESCos finance the project itself. The financial part will be elaborated in 2.1.4 Financing structure.

An ESCo takes measures to deliver energy efficiency, or to install sustainable solutions. The investment in energy saving measures, will be repaid by the energy savings. In contrary to ESC, EPC is based on performance. The contract duration is generally around 10-15 years (Würtenberger et al., 2012).

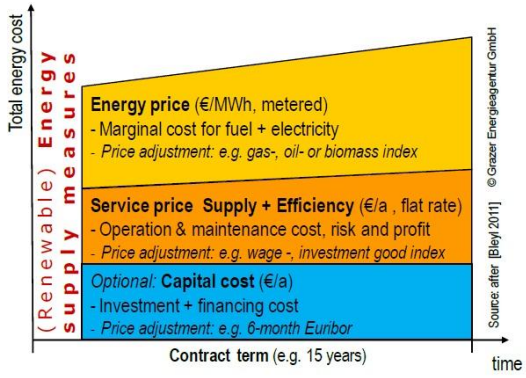


Figure 2-1 Business model ESC (Würtenberger et al., 2012)

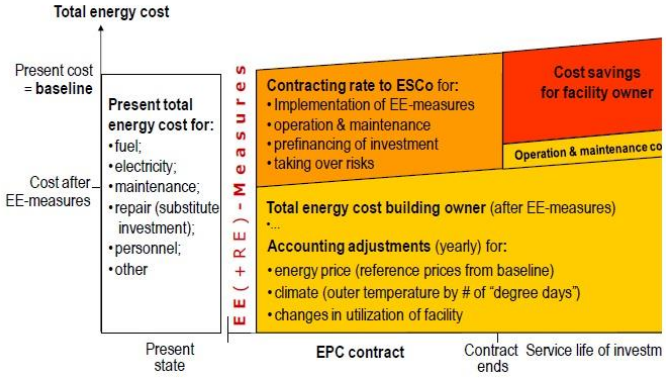


Figure 2-2 Business model EPC (Würtenberger et al., 2012)

2.1.3.3 Integrated Energy-Contracting

IEC is a hybrid form of ESC and EPC, and combines two objectives (Würtenberger et al., 2012):

- Reduction of energy demand
- Efficient supply of the remaining energy demand

One can state that IEC is an ESC, wherein energy savings criteria are incorporated. In this contracting type the ESCo is responsible for the complete energy package. Since the ESCo is completely responsible, the process of implementation can be accelerated. Next to this transaction costs will be lowered (Würtenberger et al., 2012).

2.1.4 Financing structure

In general there are three financing options for financing energy efficiency improvements (Bertoldi et al., 2006):

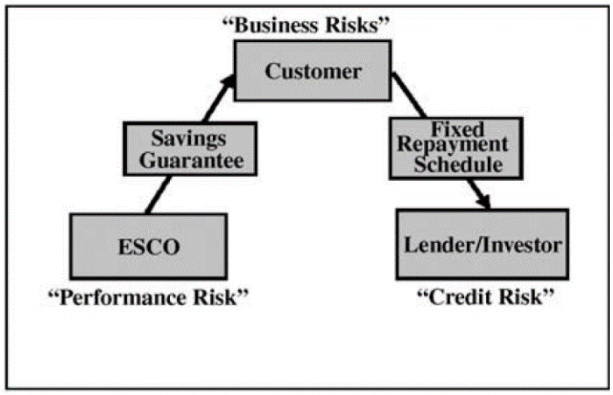
- ESCo financing
- Third party financing (TPF)
- Energy-user/ Customer financing

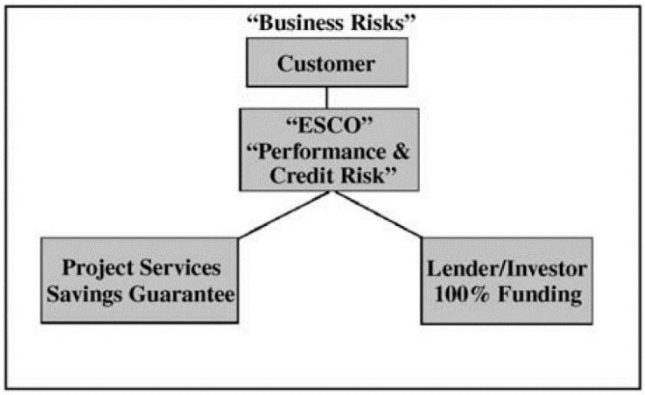
ESCo financing refers to financing with internal funds of the ESCo. This can involve own capital or equipment lease. TPF refers solely to debt financing. Nevertheless there are two options with TPF. This depends on which party borrows the money; the ESCo or the customer. Energy-user/ Customer financing refers to financing with internal funds of the customer (Bertoldi et al., 2006).

In TPF when the customer borrows the money, the ESCo provides an energy savings guarantee. A model wherein the ESCo guarantees a certain level of energy savings is called guaranteed savings, as has been stated in Bertoldi et al. (2006). This guarantee will demonstrate the financial institution, which will provide the credit, that the debt repayment will be covered. An

important benefit from TPF is that the ESCo is safeguarded from the financial risk, and only is responsible for the technical performance. ESCos prefer TPF to ESCo financing as its own risk is smaller. This means that the size of the investment can be broadened (Bertoldi et al., 2006).

In a model of guaranteed savings it is unlikely that the ESCo will finance the project, as it already takes over the entire performance risk. As a consequence in a guaranteed savings model the customer will take the credit risk (Figure 2-3). Another possibility is the shared savings model. In this case the cost savings are split according to a predetermined length of time and percentage (European Commission, 2014). The customer takes over some performance risk, therefore it will try to avoid to also assume credit risks. For this reason the shared savings model (Figure 2-4) regularly makes use of TPF. An important difference between both approaches is that in a guaranteed savings structure the focus is on the level of energy saved, whereas shared savings focusses at the cost of energy saved (European Commission, 2014).





Left: Figure 2-3 Guaranteed savings structure (European Commission, 2014)
Right: Figure 2-4 Shared savings structure (European Commission, 2014)

2.2 Partnerships

Lately, the construction industry has been changing rapidly with an emphasis on partnering. This is a result of fragmentation, companies are differentiating at specific activities. Akintoye & Main (2007) stated that this is a consequence due to an increase in competition, higher research and development costs, higher demand of innovative projects, technological developments and the higher demand in internationalization of the industries. Partnering involves commitment by the organizations involved to achieve the specified objectives (Rahman, et al., 2014).

The European Directive 2010/31/EU stated that from 2020 all buildings should be (re)developed on an energy neutral base. This target requires a transition within the construction industry (Agentschap NL, 2013). The redevelopment of buildings cannot be done by ESCos solely. An ESCo has to find partners to redevelop the buildings completely. The ESCo will be responsible for the building services. Next to this a construction company will be held responsible for the structural requirements. There will be even more companies involved to redevelop the building, but the two major aspects are the building services and the structural requirements. Both parties have to enter in a partnership to successfully redevelop the urban environment. Formerly, the

construction companies acted as general contractors. Nowadays, particularly in ESCo projects, the contribution of construction companies and ESCos is in balance. The project database of ESCoNetwerk.nl (2015) illustrates a trend that ESCos are going to operate as main contractor.

ESCos often have the ability to execute electrical and mechanical engineering activities, but structural engineering does not belong to their portfolios. The component of structural engineering will be done by a construction firm. To offer a complete product-service combination ESCos have to find a construction firm as partner. There are different approaches on how to cooperate with this company. The possible different approaches will be elaborated and evaluated in the following sections.

2.2.1 Contracting approach

The most common approach is by using contracts. A contract is defined as "a legally binding agreement made between two or more parties, by which rights are acquired by one or more to acts of forbearances on the part of the other or others" (Ashworth, 2012, p. 20). For every new project, a new contract has to be created by a notary. There are a lot of basic contracts, whereby the specific project contract can be set up relatively easy (Ashworth, 2012). This contract will illustrate the conditions under which the partnership will be established.

The contract is nothing more than a legally binding agreement between two or more parties. The partnership will not function as an individual nor legal entity (Nozeman, 2010). This means that the companies itself are liable. Another disadvantage of the contracting approach is the fact that no trademark can be applied. Contracts between parties are often major sources of conflicts and mistrust (Dewulf & Kadefors, 2012).

Nevertheless the high flexibility of contracts offer opportunities to new developments. Since the contract has to be newly constructed per project, innovative solutions can be incorporated instantly. Besides that, every project a new partner can be selected. A contract is no strategic alliance, as it will end after the project duration. This means that for every project a different partner can be chosen which is most suitable (Ashworth, 2012). In Table 2-1 a SWOT analysis on the contracting approach is displayed, herein the above mentioned aspects are given.

2.2.2 General Partnership

A complete different approach from the contracting method is by making use of a general partnership (GP). In Dutch this approach is called "vennootschap onder firma (vof)". A GF is a partnership between two or more parties, which will be practiced under a shared trademark (Nozeman, 2010). This means that the trademark can be used as a medium of communication towards potential customers. A GP is an individual entity, but is not a legal entity. This means that the parent companies are financially liable. The basic principle of a GP is based on a contractual agreement between the parties involved (Belastingdienst, 2015).

The GP forms a strategic alliance between different parties. This alliance will be constructed in a standardized framework. Hence, the level of flexibility of the partnership is low. This means, when some projects need a specialized approach the total GP has to be revised. Nowadays, large companies are centralizing their departments. Small companies are being merged into one large entity. When a GP is constructed, this again leads to fragmentation of companies, which is in

contrary to the current policy. Another possible threat is based on the system. The GF forms a new entity, with a specific level of complexity. This might lead to a cumbersome system, which is not able to rapidly adjust itself on innovative developments (Kamer van Koophandel, 2014). In Table 2-1 an overview of the above mentioned aspects is given in a SWOT analysis.

2.2.3 Limited Liability Company

In line with the general partnership, there is the limited liability company (LLC). In Dutch this concept is called "besloten vennootschap (bv)". The GP and a LLC show a lot of similarities, but the main difference is about legal entity. A LLC forms an individual, as well as a legal entity. This means that in no case the parent companies are liable. Since the LLC is an individual entity, a trademark can be applied.

A LLC will be created, like a GP, in a standardized framework. This can lead to a cumbersome system, which is not able to adapt changes rapidly. In contrary to a GP, an LLC will be realized with the help of a notary (Nozeman, 2010). The fragmentation of companies, like has been elucidated with GPs, also counts for LLCs. Next to this disadvantage, LLC has another negative aspect. In history there were a lot of fraud cases concerning LLCs (Het Parool, 2013).This might lead to a negative image of the parent companies. The SWOT analysis on LLCs, shows similarities with the analysis of GPs, nevertheless the SWOT analysis is displayed in Table 2-1.

2.2.4 Special Purpose Vehicle

Special purpose vehicles (SPVs) are individual entities, which are constructed for a specific purpose by a notary. Regularly an SPV is constructed for the project duration, after the project is finished the SPV will be dissolved. SPVs can be designed in such a way that they are legal entities. An SPV can be compared to a LLC, but their main difference is on their lifespan. A SPV will be constructed for a predetermined period of time, a LLC will not be designed for a fixed period (Möhlmann, 2010).

The SPV forms a legal entity, this means no liability for parent companies. Next to that, the partnership can be labeled by a trademark. This means that a product-service can be offered to the customer. SPVs are interesting to potential investors, as it forms an individual as well as a legal entity for a fixed amount of time (Möhlmann, 2010). Like the LLCs, also SPVs were part of fraudulent behavior in the past (Staps, 2006). This might lead to a negative image of the parent companies. The SWOT analysis of the SPV approach is displayed in Table 2-1.

Table 2-1 SWOT analyses different partnership approaches

Contracting approach

	Helpful	Harmful
Internal Origin	**Strengths** - High flexibility, as contract will be constructed per case - Contract can be set up relatively easy	**Weaknesses** - Notary required to construct the contract - Partnership cannot be labeled by a trademark - Partnership does not act as individual nor legal entity - Personal liability for parent company
External Origin	**Opportunities** - High flexibility offers opportunities to new developments - Partner can be selected per individual contract	**Threats** - Contracts are major sources of conflicts and distrust

General partnership

	Helpful	Harmful
Internal Origin	**Strengths** - Partnership acts as individual entity - Partnership can be labeled by a trademark - Partnership can be set up relatively easy	**Weaknesses** - Partnership does not act as a legal entity - Low flexibility due to standardized format - Fragmentation of parent company
External Origin	**Opportunities** - Trademark can function as medium of communication	**Threats** - Personal liability for parent company - Standard format might lead to cumbersome system

Limited liability company

	Helpful	Harmful
Internal Origin	**Strengths** - Partnership acts as individual entity - Partnership acts as legal entity - No personal liability for parent company - Partnership can be labeled by a trademark	**Weaknesses** - Low flexibility due to standardized format - Notary required to construct the LLC - Fragmentation of parent company
External Origin	**Opportunities** - Trademark can function as medium of communication	**Threats** - Possibly undesired image for parent company as a result of LLC - Standard format might lead to cumbersome system

Special purpose vehicle

	Helpful	Harmful
Internal Origin	**Strengths** - Partnership acts as individual entity - Partnership acts as legal entity - No personal liability for parent company - High flexibility - Partnership can be labeled by a trademark - Ends after project	**Weaknesses** - Notary required to construct the SPV - Each case a new SPV has to be constructed
External Origin	**Opportunities** - Attraction to potential investors - Partner can be selected per individual project	**Threats** - Possibly undesired image for parent company as a result of SPV

2.2.5 Conclusion

As a result of the SWOT analyses the SPV approach is most appropriate for a partnership to set up an ESCo. In Table 2-2 an overview table is illustrated. The advantages of GP and LLC are all part of the strengths and opportunities of the SPV. Besides, the disadvantages of GP and LLC are not part of the SPV approach. There is one threat of a possibly undesired image for the parent companies as a result of the SPV. This is due to the Enron case (Staps, 2006). But since then, SPVs are becoming more popular. The structure of SPVs is more transparent. Next to that, ESCos in the United Kingdom nowadays make use of SPVs. Some examples of ESCo projects using the SPV approach are (Hannon & Bolton, 2015):

- Barkantine Heat & Power Company-Tower Hamlets Council
- Birmingham District Energy Company Ltd– Birmingham City Council
- Coventry District Energy Company–Coventry City Council
- Leicester District Energy Company–Leicester City Council

SPVs are used a lot in the banking industry. They use SPVs for complex financing structures. Investors can be attracted with the aid of SPVs. This aspect can also be part of the ESCo approach. When third-party financing is required, investors can make use of the possibilities of SPVs (Möhlmann, 2010). Besides that, SPVs provide opportunities for public-private partnerships as authorities can participate in the partnership (Zheng, Roehrich, & Lewis, 2008). The business model of SPVs is illustrated in Figure 2-5. The figure illustrates than an SPV in this situation will be composed by two parent companies. The SPV will operate as an individual legal entity, but still can make use of the network of partners of the parent companies.

In Table 2-3 the confrontation matrix of the SWOT analysis (Table 2-1) of the SPV approach is displayed. There is a small amount of weaknesses (Table 2-1), and only one potential threat. Nowadays there are a lot of regulations on the construction of SPVs to make sure that no fraud cases are possible anymore (OICV-IOSCO, 2007). The opportunities provided by an SPV approach (Table 2-3), combined with its strengths realize synergy. The only disadvantage is due to the construction of a SPV. When ESCos are able to standardize the process of setting up these partnerships, than this disadvantage will be undone.

The confrontation matrix displayed in Table 2-3 is characterized because of the evaluation of all different attributes. The confrontation matrix (Table 2-4) is a next step concerning Table 2-3. Herein the most important aspects of the four different categories are combined in a strategy. Suggestions are made for the stakeholders on how to construct a SPV in such a way that the negative image will not dominate the strengths and opportunities.

The construction of an SPV could positively contribute to the implementation of ESCos, as it clarifies the operational conditions under which ESCos will function. Nevertheless, ESCos still have to win tender procedures. The process of different tender procedures and their properties will be discussed in the following section.

Table 2-2 Overview of different partnership approaches

	Desirable	Contract	GP	LLC	SPV
Individual entity	✔	✖	✔	✔	✔
Legal entity	✔	✖	✖	✔	✔
Liability parent company	✖	✔	✔	✖	✖
Fragmentation	✖	✖	✔	✔	✖
Effort to construct	●	●●	●●●●	●●●●●	●●●
Attraction to investors	●●●●●	●●	●●●	●●●●	●●●●●
Flexibility	●●●●●	●●●●●	●●	●●	●●●●●

Legend: ✔ Yes | ✖ No | ● → ●●●●● Low → High

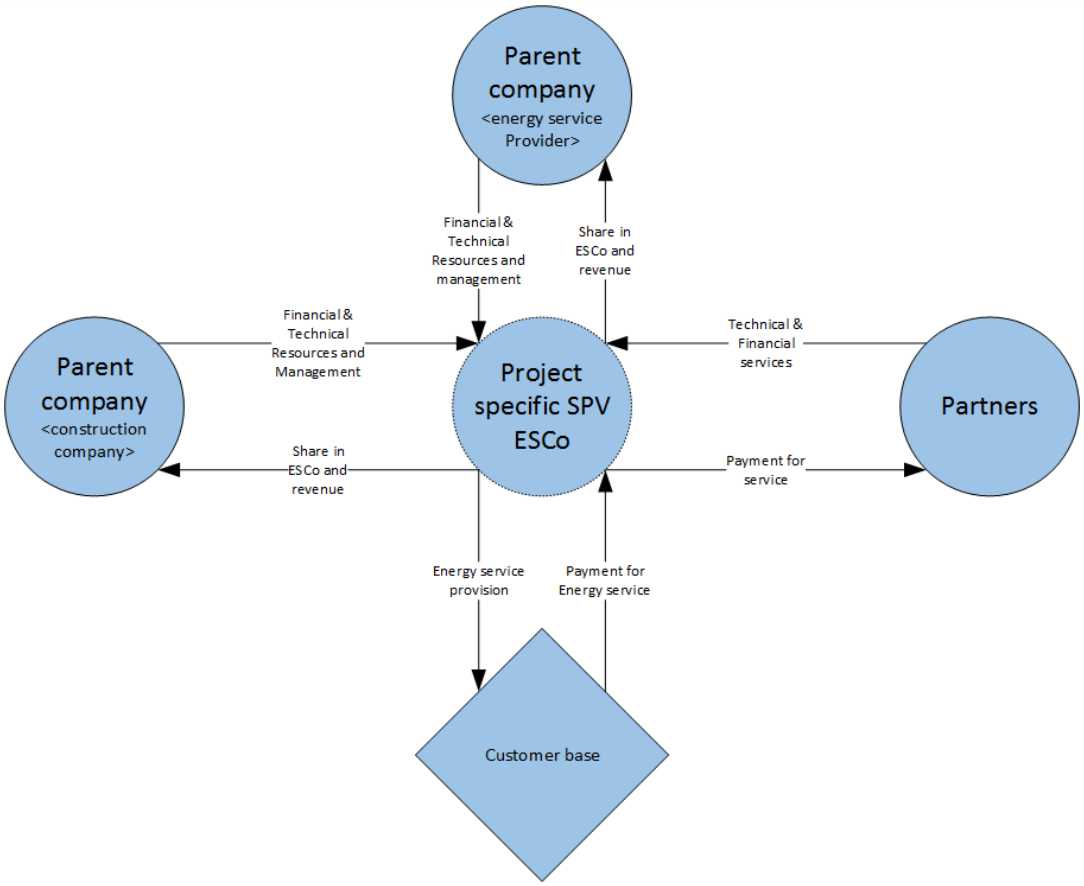


Figure 2-5 Business model SPV

Table 2-3 Confrontation matrix Special Purpose Vehicles

		Strengths				Weaknesses	
		Legal entity	No personal liability	High flexibility	Ends after project	Labor-intensive	Notary required
Opportunities	Attraction to potential investors	✔✔	✔✔	✔	✔	✖	–
	Partner can be selected per project	–	✔✔	✔✔	✔✔	✖✖	✖
Threats							
	Possible undesired image parent company	✖✖	✖✖	–	–	✖✖	✔

Legend: ✔ Positive | ✖ Negative | – No direct relationship

Table 2-4 Confrontation matrix Special Purpose Vehicles (2)

	Opportunities	Threats
Strengths	The SPV forms a seperate legal entity, labeled by a trademark. This leads to recognizition among potential customers and investors. The high degree of flexibility offers new opportunities	The possible undesired image can be counteracted by constructing a transparant SPV, wherein the involved parties all know their liabilities
Weaknesses	A notary has to construct the SPV officially per individual project. This activity can become part of a standardized process	The notary has to construct a transparant SPV, next to that succesfull executed SPV projects will gain trust of the potential customers

SOST
WOWT

2.3 Tender Procedures

Procurement law deals with how governmental bodies select contracting parties. Public parties are obliged to apply procurement law, whereas private parties are in principle at liberty to enter into a contract with anyone (Chao-Duivis, Koning, & Ubink, 2013). The objectives of procurement law are to give everyone a fair chance on the large government market, and next to that to match supply and demand to guarantee that competition functions properly (MKB Servicedesk, 2015). Brackmann (2004) states the definition of a tender procedures as follows: "Tendering is the process of purchasing, whereby the contracting authority offers a tender on a transparent and objective manner to a contractor, who fulfills predetermined restrictions and has the best bid."

Skitmore (1989) stated that only bids derived from detailed cost estimations could be labeled as competitive. Bids submitted to customers therefore can be classified as being either serious or non-serious bids (Skitmore, 1989). Drew et al. (2001) identified that contractor bidding behaviour is depending on; (1) type of customer, (2) type of construction work and (3) size of construction work. Bochenek (2014) elucidated that according to the Directives public procurement should be awarded on the basis of predetermined criteria. This ensures "compliance with transparency non-discrimination, equal treatment, and with guarantee that tenders are evaluated in circumstances of effective competition" (Bochenek, 2014). Therefore there are only two allowed criteria of award (Bochenek, 2014; Uttam & Le Lann Roos, 2015):

- The lowest price
- Most economically advantageous tender (MEAT)

The lowest price is a selection criterion, wherein all demanded aspects are translated to a financial price. Basically the lowest price bid will win the tender (De Bruijn, Groenevel, & Van Zanten, 2008). The MEAT will be composed of several different sub criteria. The options of sub criteria are limitless. These can range, next to price, to term of delivery, life cycle costs, quality, attributes and service (De Bruijn et al., 2008; Pianoo, 2015). The criteria of MEAT will become measurable due to assigning points to sub criteria. The tender with the highest amount of points wins the procedure (Stichting Midden-Brabantse Ontwikkelingsmaatschappij voor Energie en Duurzaamheid, 2014; Daemen & Dohmen, 2015).

There is a trend towards the use of MEAT. Before the criteria lowest price was applied in most of the cases. Bochenek (2014) identified that "the Netherlands show the most significant change in the proportion of selected criteria; during the last four years the price criterion changed from the most frequently used (73.3%/ 26.7% the lowest price/ MEAT in 2010 year), and was outnumbered by MEAT (43.7%/55.3% in 2013 year)".

Procurement law distinguishes several different procedures called tender procedures. Initially there are two basic approaches called the open- and restricted procedure. There are also special tender procedures. The standard tender procedures, which could be of interest for ESCos are as follows (Chao-Duivis et al., 2013; Brackmann, 2004):

- Open procedure
- Restricted procedure
- Negotiated procedure with prior publication of a contract notice
- Negotiated procedure without prior publication of a contract notice

The special tender procedures, which could be of interest for ESCos are as follows (Chao-Duivis et al., 2013; Brackmann, 2004):

- Building team
- Concession procedure
- Design contest
- Framework agreement
- Competitive dialogue

Not all of these procedures will be part of this research. The negotiated procedure with or without prior publication of a contract notice, can only be applied when the open- or restricted procedure is already executed before. Besides that, there are other restrictions to use this procedure (Brackmann, 2004). The building team approach is especially arranged for social housing projects (Brackmann, 2004). The concession approach is constructed for exploitation issues. First of all, the concession approach can be abstracted to an open- or restricted procedure. Next to that, an ESCo goes beyond exploitation. Therefore the concession procedure is not part of this research (Chao-Duivis et al., 2013). The framework agreement is "an agreement between two or more contracting authorities, and or more contractors, the purpose of which is to establish the terms of governing contracts to be awarded during a given period" as has been stated by Chao-Duivis et al. (2013). This is a project customized approach, and therefore not part of this research, as has been stated in 1.3 Research . Altogether four different tender procedures remain:

1. Open procedure
2. Restricted procedure
3. Design contest
4. Competitive dialogue

These four tender procedures are specific for the construction sector. These tender procedures can be researched by making use of auction theory (Klemperer, n.d.). Jin & Yu (2015) identified procurement auction as a market mechanism in which an object, service or a set of objects desired by a buyer is communicated to the bidders". Auction theory will help in the translation of tender procedures to game theoretical procedures, as auctions have been widely discussed in game theory. Therefore in the next section first auction models will be explained. After that the tender procedures will be discussed individually. First of all the open procedure will be explained. After that the restricted procedure will be elucidated, followed by the design contest. The last section will explain the competitive dialogue.

2.3.1 Auction theory

An auction can be defined as a market clearing mechanism, to equate demand and supply. Other market mechanisms are fixed price sales and bargaining (Menezes & Monteiro, 2005). Auctions can be classified according to several different criteria. Some auctions are publicly open, some are not. And auctions can differentiate in whether they are ascending or descending (Klemperer, n.d; Menezes & Monteiro, 2005). Based on those criteria four different auction types can be distinguished (Klemperer, n.d; Menezes & Monteiro, 2005):

- Ascending-bid auction – English auction

- Descending-bid auction – Dutch auction
- First-price sealed bid auction
- Second-price sealed bid action – Vickrey auction

The ascending-bid auction, or English auction is the best-known model. Menezes & Monteiro (2005) state that "the English or ascending-price auction is the best-known format. It is an open auction where an auctioneer (…) starts requesting bids at a low price and bidders bid by meeting the increments proposed by the auctioneer. The auction stops when no bidder is willing to increase his bid above the highest standing bid. The bidder with the highest standing bid wins the auction and pays the highest bid." This auction type is typically applied in the sales of paintings and so on.

The descending-bid auction or Dutch auction works in exactly the opposite way. Klemperer (n.d.) clarified it as follows: "The auctioneer starts at a very high price, and then lowers the price continuously. The first bidder who calls out that she will accept the current price wins the object at that price."

In first- and second-price sealed bid auctions, each bidder submits his or her bid without the knowledge of the bids made by the others. In both cases the winner is the bidder with the highest bid. In a first-price sealed bid auction the bidder will pay the price the bidder bid he or she has bidden. In a second-price sealed bid auction, also called Vickrey auctions, the winner pays the second highest bid (Levin, 2004). All four different auction types are displayed in Table 2-5.

Table 2-5 Auction theory models

	Open - Sealed	Ascending - Descending
Ascending-bid auction	Open	Ascending
Descending-bid auction	Open	Descending
First-price sealed bid auction	Sealed	–
Second-price sealed bid action	Sealed	–

Legend: Open | Sealed | Ascending | Descending

2.3.2 Open procedure

The open procedure is a tender procedure where anyone is permitted to tender. There is no limit on the number of tenderers. The tenders hand in their tender, also called bid, simultaneously (Chao-Duivis et al., 2013). The selection criteria of lowest price and MEAT can both be applied (Pianoo, 2015). The construction bidding system seldom is discussed directly. The system is classified as a type of auction with multiple objectives. Engelbrecht-Wiggans (1980) stated that "the highest price determines the buyer in a first-price sealed bid, whereas the lowest contractor wins the contract in construction bidding. Theoretically, these two systems are equivalent". So therefore this approach can be seen as a first price sealed bid auction in bidding strategies (Levin & Ozdenoren, 2004; Wu & Wang, n.d.). This means that tenderers, also called bidders, do not know the bids of the other bidders (Kamijo, 2013). Next to that the bidder with the highest bid receives the work and pays the price to the contracting authority (Levin & Ozdenoren, 2004).

The open procedure always can be applied (Pianoo, 2015). Bidders do not bid their true values, otherwise no profit would be generalized. Therefore bidders bid somewhat above their values, they add a markup (Levin, 2004). By adding a markup, they potentially make a profit some of the time (Levin , 2004). Ahmad (1990) "proposed a two stage approach, based on multi attribute utility theory, for the decision of whether or not to bid on a project, and then the decision of what markup should be used". Seydel & Olson (1990) proposed a decision support tool using analytical hierarchy process. These tools can positively contribute to the composition of proper strategies on how to win tender procedures. Zhang et al. (2012) proposed a game theoretic model on the strategies on the bid price. They created a gain function, based on the Bayesian Nash Equilibrium (Zhang, Xu, & Zhang, 2012).

The open procedure distinguishes only three phases (Figure 2-6). First the contraction authority publishes the tender. Next, bidders will design their solutions and send in their bids. At the end the contracting authority will assign the work to one of the bidders. This is a clear procedure. Nevertheless there are some restrictions. The procedure is part of the European tender procedures, and therefore standardized (Pianoo, 2015). This standardization only counts for public institutions, private parties are free to set up their tender procedure. This already has been elucidated in 2.3 Tender Procedures. The procedure is free to enter for all parties. This provides opportunities for smaller companies, but on the other hand could lead to high operational costs due to a high amount of bids which have to be evaluated. There is no negotiation phase incorporated (Brackmann, 2004). All these aspects are included in a SWOT analysis (Table 2-6).

2.3.3 Restricted procedure

A variation on the open procedure is the restricted procedure (Figure 2-7). This procedure is also part of the standardized European tender procedures (Pianoo, 2015). During the publication phase, the contracting authority announces that it will publish a concrete tender. Interested contractors will respond to this announcement. Than the contracting authority will select a predetermined amount of contractors to enter the tender procedure. In public procurement minimal five and maximal twenty contractors should be invited (Brackmann, 2004). In this procedure, the lowest price as well as the MEAT approach can be applied in selecting the winning tender (Pianoo, 2015). The restricted procedure can be abstracted to a first-price sealed bid

procedure, as it is equivalent to the open procedure. When the prequalification phase is completed, the process is equal to the open procedure as has been elucidated in the previous section. The bidding strategy of the open procedure also counts for the restricted procedure; first price sealed bid auction (Levin & Ozdenoren, 2004).

In Table 3-6 a SWOT analysis is displayed on the restricted procedure. Initially the procedure is open to enter for everyone, during a prequalification phase a fixed amount of parties will be invited to actually tender (Chao-Duivis et al., 2013). Hereby, the amount of tenders will decrease which will result in lower operational costs as there is a lower amount of bids. Nevertheless, due to the prequalification phase some innovative parties could be excluded of the tender procedure, which could mean that the end result is not the optimum. Although, the prequalification phase will stimulate parties to excel, hence the level of competition will increase (Pianoo, 2015). In public procurement the restricted procedure is tight organized, whereby negotiation is not possible. In private tender procedures, this organization can be constructed differently according to the private parties' objectives (Falagario, Sciancalepore, Constantino, & Pietroforte, 2012).

2.3.4 Design contest

The European Commission (1992) defined a design contest as "a national procedure used by a contracting authority to acquire a plan or design selected by a jury after being put out to competition". The goal of the design contest is to provide the contracting authority a design, which is selected by an independent assessment of a jury (Brackmann, 2004).

This jury will be composed out of independent individuals, wherein at least one member is professionally qualified. The assessment of the tenders will be done anonymously. The jury will not know who is responsible for each design. The jury will independently form their evaluation, based on the predetermined selection criteria (Brackmann, 2004). The procedure may be preceded by a prequalification phase. The difference between the design contest and the open- and restricted procedure is solely about the application of an independent jury. This again means that the auction type of a first-price sealed bid is applicable on the design contest.

The procedure of a design contest (Figure 2-8) is standardized to a lower extent, than the open- and restricted procedure. This level of freedom provides opportunities to adjust the design contest to specific cases, and next to that realizes opportunities for creative bids. On the other hand, this means that a legal framework has to be constructed per case.

It seems hard to find a proper independent jury. Next to that, the contracting authority is not automatically obliged to follow up the jury's advice (Pianoo, 2015). An overview of the strengths, weaknesses, opportunities and threats can be seen in Table 2-6.

2.3.5 Competitive dialogue

The competitive dialogue procedure is especially arranged for highly complex projects. The open- and restricted procedure do not possess the possibility to have consultations with bidders, in contrary to the competitive dialogue (Brackmann, 2004). According to the Official Journal of the European Union (2004), "a public contract is considered to be 'particularly complex', where the contracting authorities are not objectively able to define the technical means (…), capable of

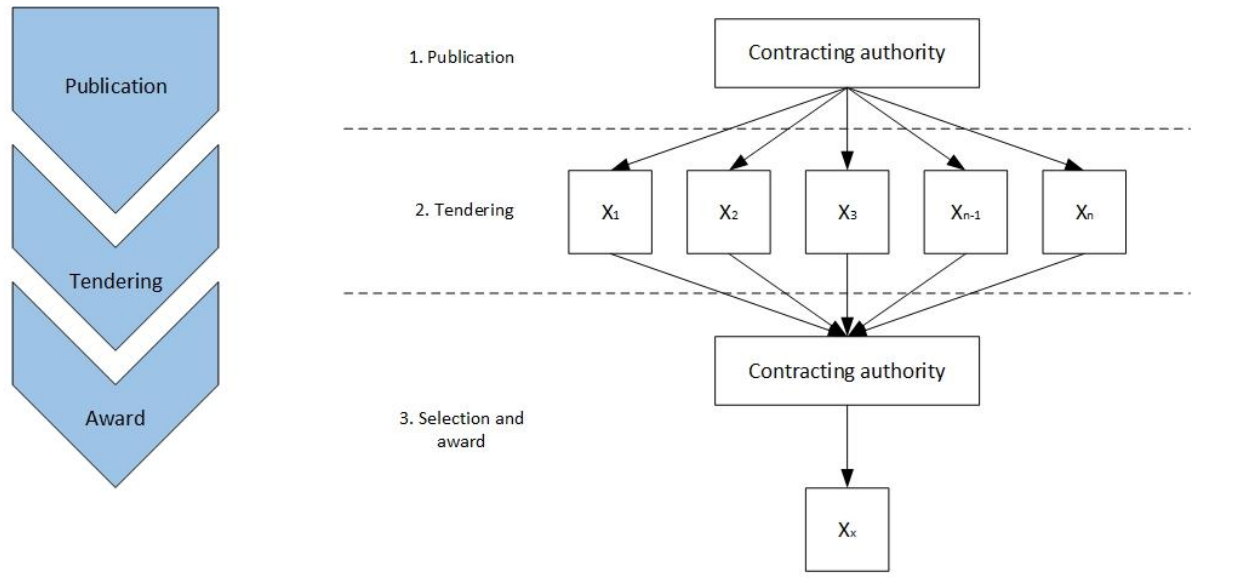


Figure 2-6 Open procedure

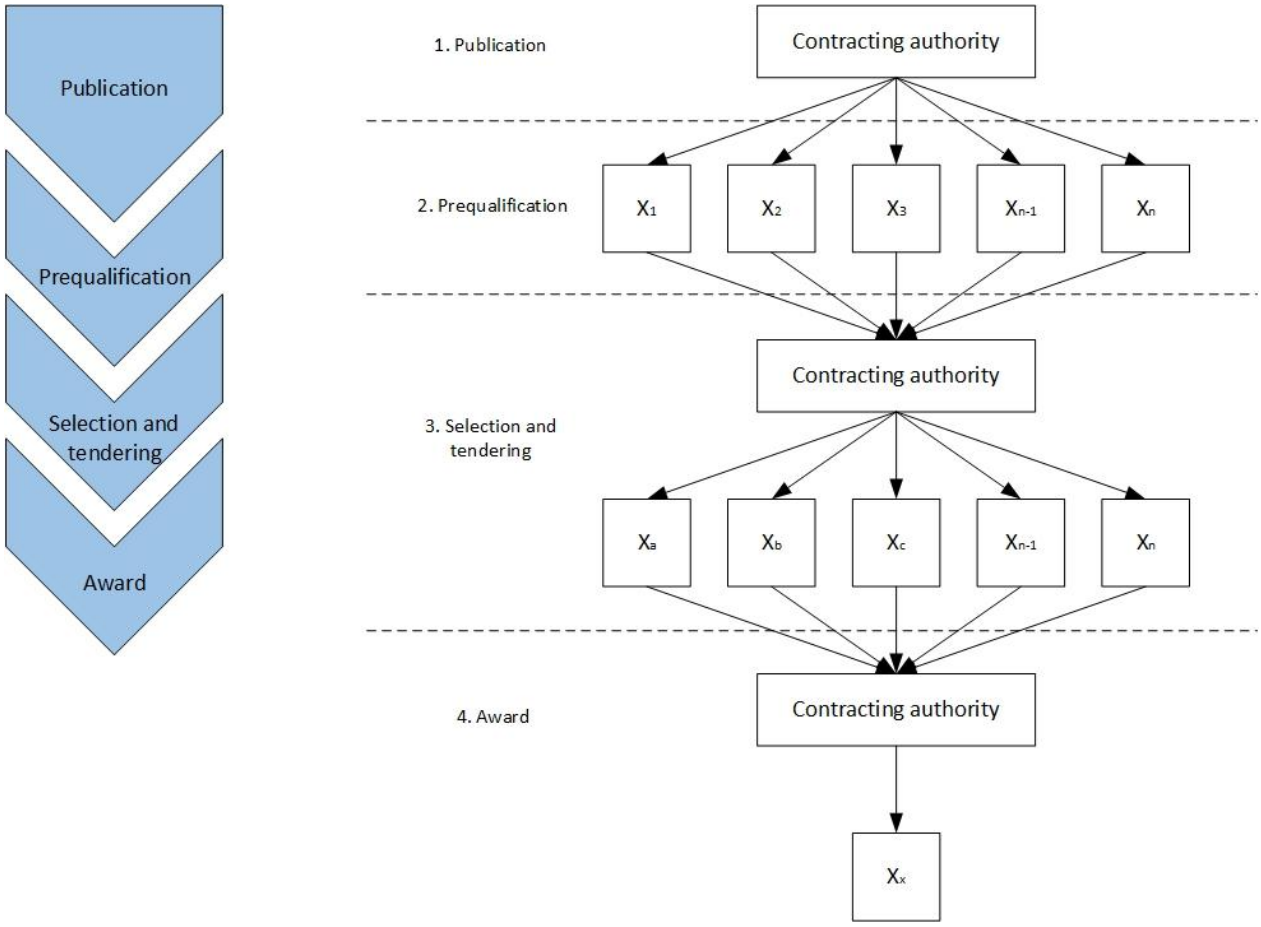


Figure 2-7 Restricted procedure

satisfying their needs or objectives, and/or not able to specify the legal and/or financial make-up of a project". Procurement only can be done by making use of the MEAT approach (Uttam & Le Lann Roos, 2015).

The process of the competitive dialogue procedure (Figure 2-9) starts with the advertisement of the procurement process. Next, like the restricted procedure a prequalification phase will be held (Uttam & Le Lann Roos, 2015; Brackmann, 2004). Next, the actual tendering phase will start combined with dialogues between the contracting authority and the bidders. The dialogues will take place between the contracting authority and each bidder individually and confidentially (Uttam & Le Lann Roos, 2015). After the tenderers submit their bids the contracting authority will award the winner (Brackmann, 2004). The bid with the highest score, according to the MEAT approach, will win the tender procedure (Uttam & Le Lann Roos, 2015). In essence this is comparable to all the other three elucidated tender procedures, and therefore can be labelled as a first-price sealed bid auction.

The high level of interaction between the contracting authority and the bidder provides opportunities for creative bids (Chao-Duivis et al., 2013). Tenderers which possess high competences, can create a unique advantage over competitors as they are able to extract more information from the contracting authority. A weakness of the dialogues is that it will result in a long duration of the tender procedure. The conversations take a lot of effort, and therefore raise the procedure costs. Besides that, all the bids are based on different dialogues which means that they are not based on the same information (Uttam & Le Lann Roos, 2015; Brackmann, 2004; Chao-Duivis et al., 2013). All these aspects are overviewed in the SWOT analysis of Table 2-6.

2.3.6 Conclusion

Basically there are nine different tender procedures, which are reduced to the four above elucidated procedures. This reduction process of the amount of tender procedures is elucidated in 2.3 Tender Procedures. All the four procedures, can be seen as a first-price bidding strategy as they all evaluate their decision on the same strategy. The difference between the tender procedures is based on their process of awarding a winner. Regarding the redevelopment of utility buildings by the aid of an ESCo approach one of these four tender procedures will be applied.

The open procedure is mostly appropriate for low complex projects, wherein procurement is based upon lowest price. The contracting authority will receive a high amount of bids. In low complex projects based upon lowest price procurement, the evaluation of bids can be done relatively quickly. Therefore a high amount of bids can be evaluated in a short duration of time.

The restricted procedure is more appropriate for more complex projects. During the prequalification phase the contracting authority can exclude parties. As a consequence, the level of actual bids will be reduced. This will reduce the evaluation time of the bids, hence bids can be assessed more deeply. The design contest and the competitive dialogue are comparable to the restricted procedure. In a design contest assessment of bids will occur by an independent jury, which will contribute to the level of independency. A competitive dialogue adds a dialogue phase to the process. Parties with a high level of competences, can benefit from these dialogue and improve their bid. The competitive dialogue is especially of interest in high complex projects.

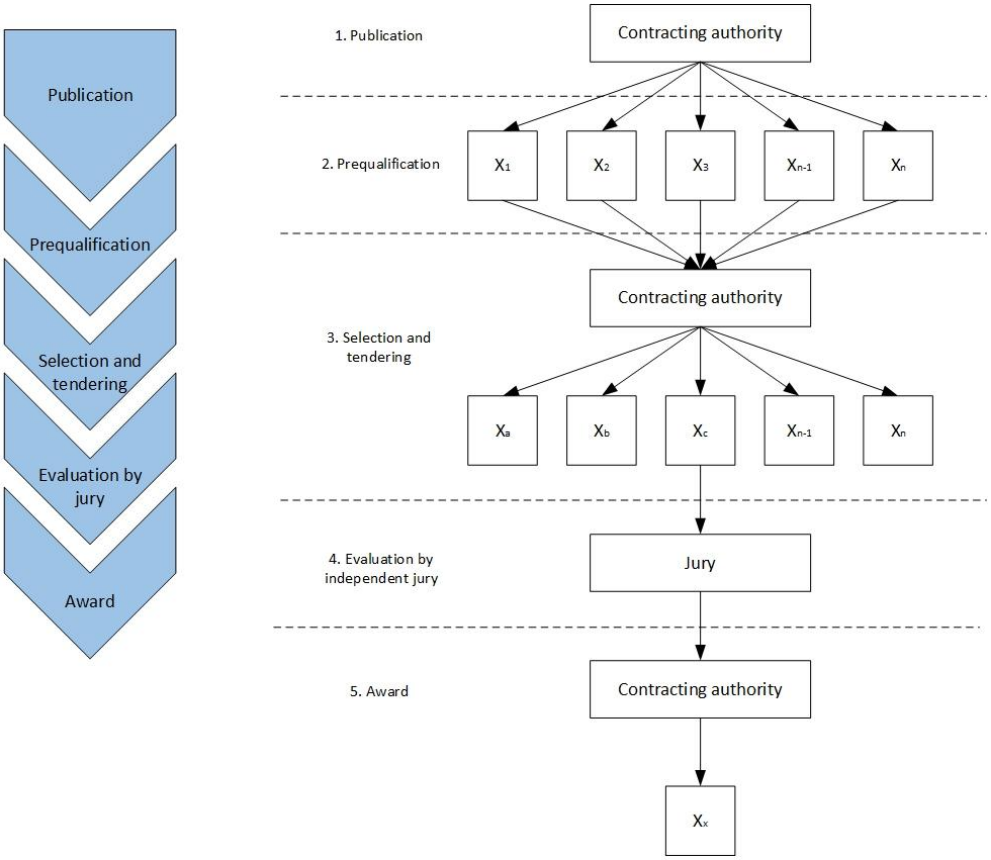


Figure 2-8 Design contest

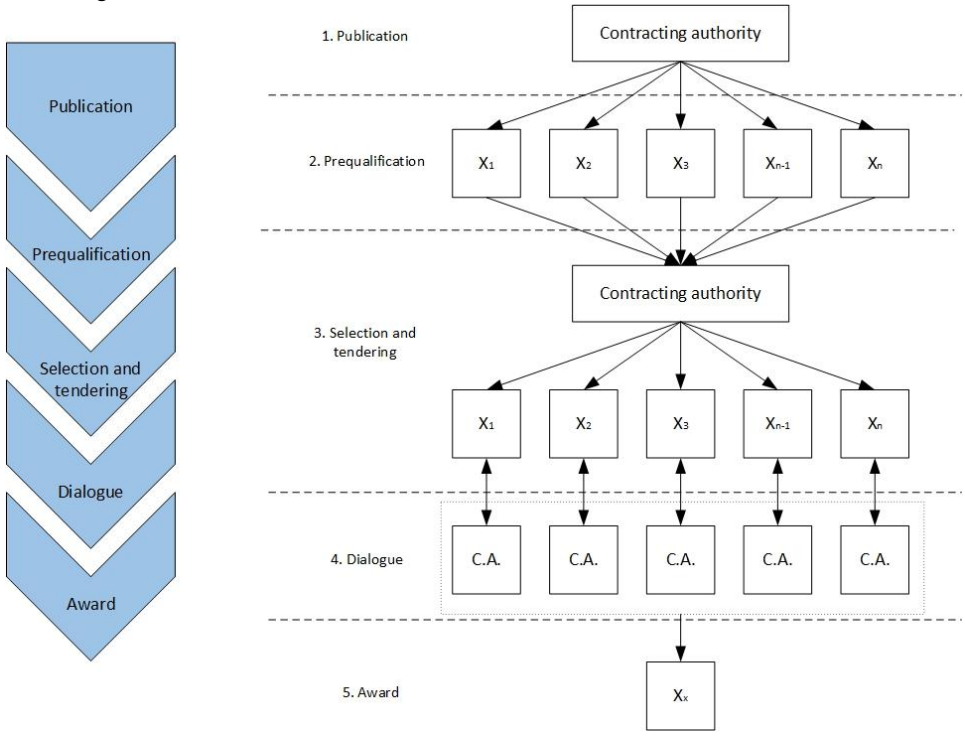


Figure 2-9 Competitive dialogue

Redevelopment of real estate objects by an ESCo approach have a high level of complexity because of the level integrality. A combination of the design contest and a competitive dialogue would substantially contribute to a quality improvement, and therefore are ideal for ESCo projects. First of all the bids will be evaluated by an independent jury, which means that the objectively evaluated highest bid wins. Secondly, the dialogues which are part of the competitive dialogue will help contractors to deeply investigate the customers' demands. This means that contractors are more able to align the bids with needs of the customers. Together with this, the quality of the end results for customers will increase as the bids are more aligned with their demands. Thirdly, ESCo projects are in every case customized projects. In order to realize a well-established ESCo project, customers and bidders have to cooperate closely. So a hybrid form of the design contest and the competitive dialogue helps on the one hand bidders to successfully create a well-personalized design. And on the other hand the end quality for the customer will be increased significantly.

Table 2-6 SWOT analyses tender procedures

Open procedure

	Helpful	Harmful
Internal Origin	**Strengths** - Open for all to enter in the tender procedure - Possible high amount of bids, means that bid has to be unique	**Weaknesses** - Tight procedure, as it is a standardized procedure - High operational costs because of high amount of bids - Negotiation is not possible
External Origin	**Opportunities** - Possible high competitive level due to many bidders	**Threats** - Possible too high amount of bids

Restricted procedure

	Helpful	Harmful
Internal Origin	**Strengths** - Initially open for all to enter in the tender procedure - Operational costs lowered due to restricted amount of bids	**Weaknesses** - Tight procedure, as it is a standardized procedure - Negotiation is not possible
External Origin	**Opportunities** - Prequalification stage might lead to higher level of competition	**Threats** - Not all parties are invited to tender, this reduces chances for some parties

Design contest

	Helpful	Harmful
Internal Origin	**Strengths** - Freedom to apply prequalification phase or not - Procedure provides opportunities for creative bids - Evaluation by independent jury	**Weaknesses** - Legal framework has to be constructed per individual case
External Origin	**Opportunities** - High level of freedom to adjust design contest to specific case	**Threats** - It seems difficult to find a proper independent jury - The procedure is not standardized, which means that it is not obliged to automatically follow up the jury's advice

Competitive dialogue

	Helpful	Harmful
Internal Origin	**Strengths** - High level of interaction between contracting authtority and bidder - Procedure provides opportunities for creative bids	**Weaknesses** - Long procedure due to interaction moments - High procedure costs due to the dialogues
External Origin	**Opportunities** - Companies with a high level of criticism can create a competitive advantage	**Threats** - Bids will might not be based on the same information

3 ESCo tendering in urban redevelopment

Abstract

The Netherlands has to realize that 14% of their energy is renewable energy in 2020. The Netherlands has to implement additional measures to meet the targets stated by the Renewable Energy Directive. One of the possible outcomes to this problem are energy service companies, also called Energy Service Companies (ESCos). In the Netherlands the implementation of ESCos is lacking behind in comparison to other European counties. There are several barriers to the implementation of ESCos. Nowadays the image of ESCos is seen as complex, there is a high level of mistrust in the ESCo model and a lack of standardization have been quoted as main barriers of this problem. Nevertheless, there are opportunities to employ ESCo projects. For instance, utility buildings are obliged to invest in energy efficiency measures, when the payback period is less than five years. Next to that ECN identified a high potential in energy reduction savings in the Netherlands. Together with this the promotion of successful examples of EPC and the public sector has to take a leading role in adopting EPC contracts. The ESCo tendering process is a complex process, with several different stakeholders involved. The procurement strategies of customers and the bidding strategies of contractors form the two main processes. These strategies are linked by the procurement criteria. In this literature review, a literature study has been conducted to generate a clear overview of procurement criteria. In total 46 different procurement criteria were derived. The contractor evaluation process is elucidated by several multi criteria decision analysis methods.

Keywords: ESCo, tender process, contractor selection, procurement criteria, stakeholder analysis

3.1 Introduction

The transformation of land worldwide raised global concerns increasing the need to reconsider land use policy and environmental issues (Loures, 2015). Since the mid-1980s policy makers and planners in Europe have been paying significantly more attention to methods to foster sustainable development and to improve quality of life in urban areas (De Sousa, 2003). The reuse of industrial areas is attractive to communities and policymakers for several reasons. One of the most important incentives is that the redevelopment of industrial areas helps to stop the conversion of agricultural- and rural land into urban uses (Alberini, Longo, Tonin, Trombetta, & Turvani, 2005). Altogether it means that there is a growing need to favor the transformation towards greater sustainability (Romero & Ruiz, 2014). However, Ren et al. (2010) stated that "industrial stakeholders generally make their decisions looking for the minimum cost solutions, while environmental issues such as the greenhouse effect and the availability of energy sources should be evaluated as much as the economic aspect of the problem".

In February of 2015 the Kyoto Protocol had its ten-year anniversary (EEA, 2015). Therefore the European Environment Agency (EEA) published a report on the proceedings so far. The Renewable Energy Directive (Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and

subsequently repealing Directives 2001/77/EC and 2003/30/EC) stated binding targets for participants of the Kyoto protocol. The Netherlands has to realize that 14% of their energy is renewable energy in 2020. In 2012 this share was 4.5%, what means that there is still a chasm of 9.5% to cross in approximately 8 years (EEA, 2015). According to the EEA (2015), the Netherlands has to implement additional measures to meet the targets stated by the Renewable Energy Directive. One of the possible outcomes to this problem are energy service companies, also called ESCos. Bertoldi et al. (2006) define ESCos as companies that "(1) guarantee energy savings (as reflected in the contract), (2) they can finance, or via energy savings guarantee assist in arranging finance for, the operation of an energy system, and (3) their remuneration is directly tied to the energy savings achieved. Therefore ESCos accept some degree of risk for the achievement of improved energy efficiency in a user's facility and have their payment for the services delivered based (either in whole are at least in part) on the achievement of those energy efficiency improvements."

In the Netherlands the implementation of ESCos is lacking behind in comparison to other European counties (Marino, Bertoldi, Rezessy, & Boza-Kiss, 2011). One of the hindering factors to ESCo projects is about procurement in tender procedures. Marino et al. (2011) stated that "the focus on initial investment costs instead of life-cycle costs poses a disadvantage to energy performance projects that may have a higher initial investment cost but significantly lower life-cycle cost". Bertoldi et al. (2006) identified that public procurement rules and regulations complicate the tendering procedure for ESCos. Lee et al. (2015) conducted a questionnaire on barriers to ESCos, they stated that "modification of procurement practices to facilitate the use of EPC contracts was viewed as the second most practical measure to enhance the use of EPC". Tender proposals from different ESCos differentiate significantly in key evaluation aspects, such as capital costs, estimated savings and payback period. The inflexible process of public procurement might not be conducive to the evaluation of the different proposals (Lee, Lam, & Lee, 2015).

The focus of this literature review will be on the tendering process in order to stimulate the development of ESCo projects in the urban redevelopment. First of all the main barriers of ESCos will be further elucidated. Next the opportunities of ESCos will be elaborated. The third section will elaborate on tendering, and the different stakeholders which are involved in ESCo tendering. The last section will investigate the different procurement methods and their decision criteria.

3.1.1 Barriers to the implementation of ESCos

Even though the Netherlands has traditionally been among the front-runners in energy efficiency policies, until 2005 there was barely any ESCo activity on the Dutch market (Marino et al., 2010). Cagno et al. (2014) stated that "the Netherlands has a long tradition of voluntary long-term agreements (…), aimed at accomplishing ambitious energy efficiency goals". Bertoldi et al. (2006) specified that in the Netherlands a numerous of energy efficiency activities have been implemented, but at the same time the ESCo activity is low.

In 2013 the European Commission published an ESCo Market Report, wherein they mentioned that until 2013 in the Netherlands the amount of completed ESCo projects is still limited (Bertoldi et al., 2013). The projects, which are completed, focus mainly on new large non-

residential buildings and dwellings. And to some extent to existing buildings. The key customers are the public- and commercial sector. Public administration, healthcare facilities and swimming pools are the most common targets (Bertoldi et al., 2013).

ESCo contracts often have a duration period of 5 to 15 years. This means that customers have to sign a long term contract with an ESCo. Research showed that this forms a barrier to the customer to set up an ESCo contract (de Boer, 2011). Another barrier to the customer is about the investments that go along with energy efficiency measures. Customers have to make a trade-off between investing in their core business activities and in energy efficiency instruments. Mostly, customers decide to invest in their primary activities, as this will lead to direct results (de Boer, 2011). Besides that, customers are interested in initial investment costs. Customers do not take in mind the principle of total costs of ownership. In most countries public procurement rules do not provide a framework for TCO. This could lock out ESCos in public tender procedures (Marino et al, 2010). Since 2008 it became more difficult to arrange external financing due to the financial and economic crisis (Boonekamp & Vethman, 2009), therefore only large institutions with high capital can finance ESCo projects. De Boer (2011) stated that most of the ESCo projects are customer financed, but there is a trend towards ESCo financing. This might functions as an attraction tool to new potential customers. However, the energy tariff shows a high level of volatility (de Boer, 2011; Marino et al., 2010), as a result of energy surpluses (ABN-AMRO, 2013). This means that it is difficult to make clear predictions about the future cash flow, as there is a lot of uncertainty due to the fluctuating energy tariff (de Boer, 2011).

The above mentioned barriers form mainly financial barriers. Besides these barriers there are also others. In the Netherlands outsourcing energy management is often met with resistance from the technical departments (Marino et al., 2011). Next to this, there is a lack of reliable information and examples on the Dutch ESCo market. This results in a deficit of trust and unfamiliarity with ESCos (Bertoldi, Boza-Kiss, Panev, & Labanca, 2014). Nowadays the image of ESCos is seen as complex, hence customers decide to choose for another sustainable alternative like for instance own investments (Bertoldi et al., 2014). There is a high level of mistrust in the ESCo model from customers. The lack of standardization has been quoted as the main driver of this perception (Bertoldi et al., 2010). Because of the lack of standardization AT Osborne designed a standardized energy performance contract (AT Osborne, 2011). Next to this, ESCoNetwerk.nl constructed in cooperation with other private- and public organizations a tendering guideline (ESCoNetwerk.nl, 2014). This means that are ongoing developments about the implementation of ESCo projects, in the following section the opportunities are further elucidated.

3.1.2 Opportunities to employ ESCos

As discussed previously (subchapter 3.1) there are already developments for further implementation of ESCos. Next to these, there also more opportunities. In September 2013 the Dutch government released its report on the sustainable growth of the nation. This report is called the “Energieakkoord”, which means energy agreement in English (EIB, 2013). An example of an aspect of the agreement is about the Environmental Protection Act. Utility buildings are obliged to invest in energy efficiency measures, when the payback period is less than five years. If companies

ignore this, they risk a financial penalty of 1.5-2 times the energy efficiency investment (van den Tempel, 2009).

Energieonderzoek Centrum Nederland (ECN) investigated the energy savings potential in the Dutch utility buildings. They investigated the potential on gas consumption, and the potential on energy savings on lighting. The potential gas consumption savings is 37%. The potential of energy savings on lighting systems is 65%. Lighting is responsible for 35% of the total amount of electricity consumption of buildings, which means there are, next to lighting, even more energy saving possibilities. This means that the savings potential in utility buildings has significant size (Sipma, 2014).

ESCo approaches could be applied to the redevelopment of utility buildings. This market could be targeted, as the government obliged the owners of these buildings to invest in energy efficiency measures. Next to this, the Ministry of Infrastructure and Environment published in 2011 a report on critical development in the Netherlands (Ministerie van Infrastructuur en Milieu, 2011). They stated that short-term thinking should be excluded, the focus of industrial areas should be on quality and sustainability on the long-term (Ministerie van Infrastructuur en Milieu, 2011). The report also stated that industrial areas have to be redeveloped integrally instead of redeveloping individual buildings (Ministerie van Infrastructuur en Milieu, 2011). All public regulations provide new opportunities to ESCos.

Lee et al. (2015) conducted a questionnaire among ESCo respondents to investigate the most important measures to enhance the adoption of EPC in Hong Kong. They identified that the promotion of successful examples of EPC and the public sector has to take a leading role in adopting EPC contracts (Lee, Lam, & Lee, 2015). These aspects were respectively ranked as one and two, nevertheless to reach both measures the government procurement practices need to be modified to facilitate the use of EPC. This measure is ranked as third (Lee, Lam, & Lee, 2015). This outcome is in line with the statement of Marino et al. (2011) that “public procurement rules and evaluation criteria in the public tendering process remain the main barriers for ESCo project development in the public sector”. First the tendering process should be modified to provide possibilities to tender ESCo projects.

3.1.3 Brief history of tendering

Public procurement has a long history. The earliest procurement order dates from between 2400 and 2800 B.C., the order was written on a red clay tablet (Coe, 1989). Thai (2001) identified “other evidence of historical procurement includes the development of the silk trade between China and a Greek colony in 800 B.C”. Thai (2001) also mentioned that “It was until the late 1800s that state legislatures began to create boards or bureaus responsible for purchasing, but central purchasing was hardly a practice at that time”. Page (1980) stated that Oklahoma was the first state government to create a board to procure centrally for the complete state. After Oklahoma, soon many local governments followed, according to Thomas (1919). Since then centralized procurement gradually became common, nowadays public procurement is more decentralized (Thai, 2001). The process towards centralized procurement lead to procurement codes, which eventually developed towards the tendering procedures as they are called today (Thai, 2001).

These tender procedures are standardized according to tight processes (Brackmann, 2004; Chao-Duivis, Koning, & Ubink, 2013). Next to that public procurement traditionally has been strictly regulated (Bergman & Lundberg, 2013). Public procurement in the European community (EC) has moved away from the original framework model towards a common set of rules for the Member States of the EC. This trend has first been recognized in the development of the rules on award procedures for contracts (Arrowsmith, 2006). Arrowsmith (2006) noticed that the trend toward "more harmonized rules is a well-established and significant one, and is unlikely to reverse, but rather to accelerate". The transition towards a broad EC framework, certainly has advantages from a trade perspective (Arrowsmith, 2006). The need for a transformation of public procurement is also elucidated by Hyytinen et al. (2007). Hyytinen et al. (2007) identified that often procurement procedures in Sweden leave room for discretion. The outcome of the procurement procedure "cannot consistently and entirely be explained by quality differences, despite (…) studying data from one of the least corrupted countries in the world" (Hyytinen, Lundberg, & Toivanen, 2007). Bergman & Lundberg (2013) identified that the 2011 proposals for a revision of the EU Directives stated that the use of the MEAT approach should be mandatory.

3.2 The process of contractor selection in ESCo tendering

"The main purpose of public procurement is to stimulate competition and safeguard equal treatment off all potential bidders", as has been cited by Gugler et al. (2015). Relationship and integration between the customer and the contractor appear to be critical components to achieve the objectives of a construction project. Nevertheless in some cases at the end of projects customers and contractors communicate with each other by the lawyers (Kog & Yaman, 2014). Kog & Yaman (2014) specify that "the selection of the contractor by the client is one of the most challenging decision-making stages of a construction project". Bochenek (2014) emphasizes this to state that contractor selection is a complicated and complex process. The high complexity of this process is not only a recent problem. In the previous century Ng (1998) developed a decision support tool called Case-Based Reasoning on how rationally select a contractor. The process of tendering can be subdivided into two streams; (1) the strategy of contractors on how to approach the tender procedure and (2) the strategy of the customer on how to select the winning bid. First the bidding strategies of the contractors will be considered and then the selection strategies of customers. Before both strategies will be elucidated, the stakeholders involved in the process of ESCo tendering will be explained.

3.2.1 Stakeholders involved in the process of ESCo tendering

Stakeholder management is an essential part of project management. Olander & Landin (2005) state that project managers must consider stakeholder's needs and requirements to ensure project success. Next to stakeholder management, the quality of a construction project is largely dependent on the appropriate performance management of the different stakeholders. In construction projects especially the stakeholders; contractors and consultants are essential to the level of quality of the project. (Low Sui & Ke-Wei, 1996). This means that, "if major parties of a

contract are not committed to properly carrying out their responsibilities, it is likely to adversely affect the final project quality level", as has been stated by Heravi et al. (2015).

Heravi et al. (2015) also mentioned that, "the level of ability to impact the final project characteristics is at its highest at the beginning of the project and reduces as the project progresses". In project management literature it is widely advocated that project preparation and planning phase, is the phase wherein stakeholders have the highest possibility to influence the project outcome to their needs (Heravi, Coffey, & Trigunarsyah, 2015).

In the construction sector, during the lifetime of a project from the initial phase trough the operation and maintenance stages, several specific stakeholders get involved in the process. These stakeholders might affect the outcome of the project positively or negatively. Olander (2007) constructed a list of parties which can be involved during the project: (1) Customer, (2), project management team, (3) consultant and designing team, (4) contractor, (5) subcontractor, (6) supplier, (7) employees, (8) local communities, (9) funding bodies and (10) government authorities.

Vine (2005) added another party to this list; energy managers. Vine (2005) identified that energy managers of companies are important stakeholders for the promotion of ESCos. When these energy managers are familiar with the concept of ESCos, they are more capable and willing to implement ESCos (Vine, 2005). For this study a stakeholder analysis has been conducted, according to the list proposed by Olander (2007). The stakeholder analysis has been done by making use of a power interest matrix (Table 3-1 & Figure 3-1). The power interest matrix is a simplified stakeholder analysis tool proposed by Johnson and Scholes (1999), this tool is derived from Mendelow's (1981) initial analysis tool. The power and interest per stakeholder are evaluated on five different levels. These levels vary from 1 to 5, wherein (1) represents very low, (2) low, (3) neutral, (4) high and (5) very high. The levels are the same for power as well as interest evaluation.

The customer is the initiator of the project. All efforts have to contribute to customer satisfaction. For that reason the customer has very high power as well as influence. Low Sui & Ke-Wei (1996) stated that consultants and contractors are very important in the outcome of the project. Funding bodies are important in ESCo projects. As has been discussed previously (subchapter 2.1.4) ESCos can be financed by third parties. In this case these parties have high power and interest as they invest their own money (Bertoldi et al., 2006). The project management team overviews the project. They manage the project closely, but from a manager's point of view. They are to a lesser extent interested in the actual content (Olander & Landin, 2005). Subcontractors, suppliers and employees are all serving a higher purpose. They execute their activities but they do not have the power or interest to affect the outcome of a project. Local communities are classified as a stakeholder which should be monitored only. This can differ per project. The focus of this research is about the redevelopment of utility buildings, in that case the role of local communities is unsure due to the range of possible projects. Raco (2000) mentioned that the British government "places great importance on the real involvement of local communities in the whole range of regeneration activities. It is important to the success of regeneration programs to involve as many people as possible". For that reason one could imagine that the power and interest of local communities could differ from low to high. Government authorities is typically a stakeholder group which could positively contribute to the implementation of ESCos.

Table 3-1. Stakeholder analysis: Power interest matrix

Stakeholder	Interest	Power	Power x interest	Action
Customer	5	5	25	Manage closely
Project management team	4	5	20	Manage closely
Consultant and designing team	5	5	25	Manage closely
Contractor	5	5	25	Manage closely
Subcontractor	2	2	4	Monitor
Supplier	1	2	2	Monitor
Employees	2	2	4	Monitor
Local communities	2	1	2	Monitor
Funding bodies	4	4	16	Manage closely
Government authorities	3	5	15	Manage closely

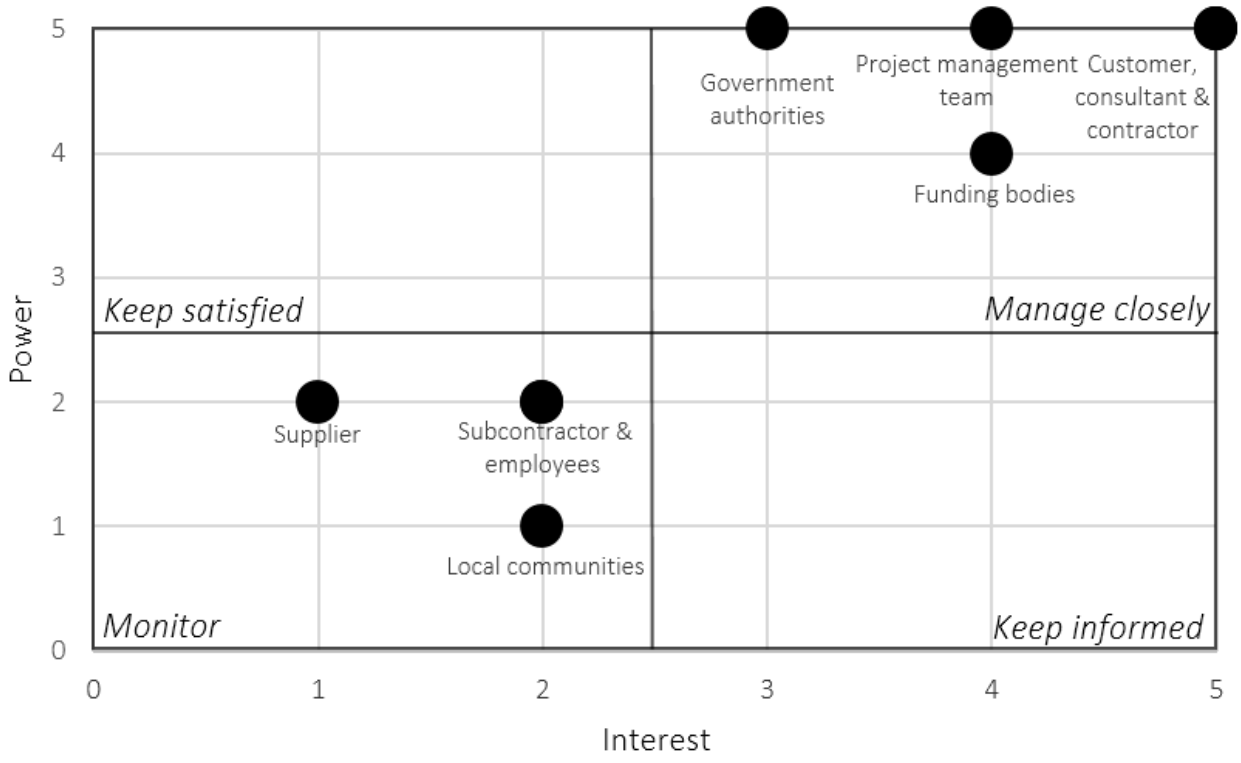


Figure 3-1. Stakeholder analysis: Power interest grid

Vine (2005) mentioned a lack of government support as one of the main barriers to the implementation of ESCos. Government authorities especially want to cooperate in projects wherein these parties are interested of how the project would affect the community as a whole (Olander & Landin, 2005). Next to the governmental policies on sustainable energy, ESCos also contribute to the level of comfort for the end-users. Goldman et al. (2005) mentioned that these indirect and difficult-to-quantify benefits can be key drivers of customer participation and satisfaction. Next to that Goldman et al. (2005) stated that these indirect benefits "may be as or more important than the direct cost-saving benefits of ESCo projects". These social consequences are of interest to government authorities, so therefore this stakeholder should be managed closely to realize higher quality levels. Government authorities are also required to get documents like building permits et cetera. When government authorities are actively involved synergy might be created.

3.2.1 Bidding strategies of buyers of ESCo contracts

Public procurement can be seen as competitive bid procurement. Competitive bid procurement involves suppliers of services competing for a contract (Soltys, 2014). The traditional method involves the contracting authority issuing a request to participate in a process of competition (Worthington, 2002). Bidders who wish to enter the tender procedure submit their bids before a fixed time limit in accordance with the requirements of the contracting authority (Worthington, 2002). This is the basic principle of public procurement whereby bidders can apply different bidding strategies. Basically, the bidding party has two different possibilities on how to enter a tender procedure. Bidders can enter the procedure with a traditional approach or an ESCo approach. Especially in the Netherlands, traditional energy efficiency projects are implemented which had left little space for the implementation of ESCos (Bertoldi et al., 2006). Vine (2005) mentioned that ESCo projects compete for scarce capital with traditional projects. This means that ESCos can enter the tender procedure with a traditional- or ESCo approach.

Milgrom & Weber (1981) designed a model of competitive bidding "in which the winning bidder's payoff may depend upon his personal preferences, the preferences of others, and the intrinsic qualities of the object being sold" (Milgrom & Weber, 1981). Jin & Yu (2015) define procurement auctions as "a market mechanism in which an object, service, or a set of objects desired by a buyer is communicated to the bidders (suppliers). After the bidders respond, the mechanism with pre-specified rules determines which bidder wins the right to supply to the buyer".

Gugler et al. (2015) investigated a sample of tender procedures, and all contracts were awarded by the principle of first-price sealed-bid auctions (2.3.1 Auction theory). Gugler et al. (2015) focused on Bayesian Nash equilibria as it is standard in literature in pure bidding strategies. The structural analysis of first-price sealed-bid auctions has a high numerical complexity associated with computation of the Bayesian Nash equilibrium strategy (Guerre, Perrigne, & Vuong, 2000).

Friedman (1956) presented a method to determine optimal bids in a first-price sealed bid auction. The Friedman model was formulated for the case of buyers of contracts, this is similar to ESCo tender procedure, as ESCos are also trying to "buy contracts". Friedman (1956) stated that

when a firm has an expected valuation of v_1 for the object being sold by a first price sealed bid auction. If it bids b_1, then its expected profit is (Eq.:1):

$$E\ (b_1) = (v_1 - b_1)\ P(b_1) \tag{1}$$

Where $P(b_1)$ is the probability that a bid of b_1 will be the highest and win the contract. The difficulty in obtaining the optimal bid lies in the determination of $P(b_1)$ (Laffont, 1997). This expected valuation is called the Von Neumann–Morgenstern utility theorem (Eq.:2) (Cox, Smith, & Walker, 1988). Suppose bidder $i = 2, \dots, n$ has valuation v_i. Player 1 wins the object if $b_1 > b_i$. If $i > 2$, than $b_1 > max\{b_2, \dots, b_n\}$ to win the object. If $b_1 < max\{b_2, \dots, b_n\}$ than player 1 does not win the tender. If $b_1 = max\{b_2, \dots, b_n\}$ than no procurement will take place. Thus player 1's payoff is (Menezes & Monteiro, 2005, p. 14):

$$\begin{cases} v - b_1, & b_1 > max\{b_2, \dots, b_n\} \\ 0, & b_1 \leq max\{b_2, \dots, b_n\} \end{cases} \tag{2}$$

Chen & Plott (1998) conducted a series of "first price auction experiments in an environment in which game theory predicts the existence of substantial nonlinearities in behavior. The predictions of game theory are then compared and tested against a family of alternative models. The class of linear decision rules (…) is used for generating alternative behavior models". Cox et al. (1988) developed a model called the log-concave model. In this model "individual bidders can differ from each other in any way that can be represented by a finite number of parameters" (Cox et al., 1988). In the 1980s "auction researchers recognized that bidders in sealed-bid auctions usually do not know the number of rival bidders at the time they submit their bids" (Levin & Ozdenoren, 2004). Nevertheless, this information is critical to develop an optimal bid strategy. Levin & Ozdenoren (2004) investigated how bidders and seller respond to ambiguity about the number of bidders in first-price sealed bid auctions, they model ambiguity aversion using maxmin expected utility (MMEU) (Levin & Ozdenoren, 2004). The MMEU approach has a set of probability measures regarding the number of bidders in the auction. Bidders compute their expected utility in the auction as the minimum expected utility over the set of priors (Levin & Ozdenoren, 2004). After the clarification of the concept of the Bayesian Nash equilibrium by Harsanyi (1967), the theory of auctions massively developed. Three major models were primarily studied (Laffont, 1997): The independent private value model, the symmetric common value model and the asymmetric common value model.

Much of the existing literature on auction theory captures the independent private value model. The basic principle in that model, is that an indivisible object is to be sold to one of several bidders (Milgrom & Weber, 1981). All bidders are risk neutral, and know the value of the object to their selves, but do not know the value of the object to the other bidders. This is the private values assumption (Milgrom & Weber, 1981).

The symmetric common value model, constructed by Rothkopf and Wilson, refers to a case where *n* bidders bid for a good or contract of unknown value *v* (Laffont, 1997). In the common value model, the value of the object is the same to every potential bidder, but the value is unknown

at the time of bidding. Regularly, individuals have some information about the value of the object. If this information is correlated across individuals then it is a symmetric common value model, if it is not correlated than it is an asymmetric common value model (Menezes & Monteiro, 2005).

3.2.2 Procurement strategies to select contracting ESCo

In the last decades, according to Hatush & Skitmore (1998) "there has been a steady increase in the range of methods used for the procurement of construction work. Despite this, however, there has been no commensurate improvement in the success rate of construction projects". Holt (1995) defines "confidently entrusting the project to a contractor" as one of the most important decisions faced by a customer. The lack of improvement in the success rate of construction projects, combined with the high level of importance of the customer's decision illustrates the high level of complexity and importance of procurement strategies.

In general there are two alternative methods for supplier selection, which are discussed previously (subchapter 2.3). First, the lowest price bid and second the most economically advantageous tender (MEAT) (Bergman & Lundberg, 2013). According to Bergman & Lundberg (2013), in the EU lowest price is used less frequently and instead the MEAT approach is used more often. Holt et al. (1995) mentioned that "the fundamental rationale behind competitive tendering is free market competition, i.e. genuine competition should achieve the best value for money for the client". For hundreds of years this has been the underlying philosophy of contractor selection (Holt, Olomolaiye, & Harris, A review of contractor selection practice in the U.K. construction industry, 1995). Boughton (1987) addressed profit maximization as the most frequently used bidding objective. He found this in a survey of 126 construction firms.

Lorentziadis (2010) stated that the lowest price criterion for procurement strategies is based on the notion that, "as long as a bid complies with the minimum requirements of pre-set tender specification characteristics, the only evaluation factor to consider is price." This means that bids which may provide better results, at a slightly higher price, do not receive any advantage in the evaluation process. The MEAT approach next to price, considers non-price factors. The evaluation factors or procurement criteria should be publicly announced in advance of the tender (Lorentziadis, 2010). Next to the actual procurement criteria, their evaluation weights, often called importance weights have to be publicly announced in advance of the tender. These weights are fixed. Fixed weights ensure objectivity and limit corruption in the evaluation of the bids, provided that they accurately reflect the relative importance of the evaluation factors (Csáki & Gelléri, 2005). Unfortunately, it is still possible to create an unfair evaluation system, in which too much emphasis is placed on specific evaluation criteria, thus favoring those bidders that score high on these criteria (Lorentziadis, 2010). Another possibility is that when importance weights of evaluation criteria are being modified after the bid process has begun. This "may raise serious questions about the integrity of the bidder selection process" as has been stated by Lorentziadis (2010).

Next to the level of integrity, the process of selection based on the MEAT approach is complex. Customers in the public sector have to be accountable for their decisions (Hatush & Skitmore, 1998). These decisions are becoming more complex, as they have to select others than only the lowest price. This has led to techniques for contractor selection, which "utilize information concerning client objectives and contractor capabilities as well bid price as objectively and

transparent as possible as a means of achieving the best value for money" as has been stated by Hatush & Skitmore, 1998. Qian & Guo (2014) define that ESCo projects are conducted over a long period of time and the project value "faces a random and unstable environment". Thus, not all of the uncercatinties can be modelled in a bargaining environment which is stable and certain (Qian & Guo, 2014). The tendering process already is defined as complex. The high level of complexity of ESCo projects, makes ESCo tender procedures even more complex. In order to select a contractor for an ESCo project, formally involves the use of multicriteria decision analysis to define the importance weights of the procurement criteria (Hatush & Skitmore, 1998). These methods will be elucidated hereafter (subchapter 3.4).

3.3 Procurement criteria in ESCo tendering

As already has been discussed contractor evaluation and selection is a complex and challenging process. Generally the process has two components, namely the bidding process and the procurement process. This process is linked by procurement criteria. Customers predefine a list of procurement criteria on which the bidding contractors will be evaluated. The choice of one contractor over another is largely dependent on the customer's preferences in terms of the procurement criteria (Watt, Kaysis, & Willey, 2009). The procurement criteria which are potentially part of tender procedures in ESCo tendering are listed in Table 3-2. The categories and the individual criteria are further elucidated hereafter.

Table 3-2a. Procurement criteria

Category	Criteria	References
Financial capacity	Credit rating	(Watt et al., 2009) (Weber et al., 1991) (Topcu, 2004) (Hatush & Skitmore, 1998) (Eddie et al., 2004) (Nieto-Morote & Ruz-Villa, 2012) (Holt et al., 1994)
	Liquidity ratio	(Watt et al., 2009) (Weber et al., 1991) (Hatush & Skitmore, 1998) (Eddie et al., 2004) (Nieto-Morote & Ruz-Villa, 2012) (Holt et al., 1994)
	Financial soundness	(Watt et al., 2009) (Weber et al., 1991) (Hatush & Skitmore, 1998) (Eddie et al., 2004) (Hannon et al., 2013) (Nieto-Morote & Ruz-Villa, 2012)

Table 3-2b. Procurement criteria

Category	Criteria	References
Financial capacity (continued)	Insurances	(Watt et al., 2009) (Weber et al., 1991) (Hatush & Skitmore, 1998) (Eddie et al., 2004) (Holt et al., 1994)
	Business turn over-cash flow	(Watt et al., 2009) (Weber et al., 1991) (Topcu, 2004) (Hatush & Skitmore, 1998) (Holt et al., 1994)
	Financing opportunities	(Lee et al., 2015) (Bertoldi et al., 2006) (Cagno et al., 2014) (Hannon et al., 2013) (Vine, 2005)
Health, Safety & Environment (HSE)	CSR policy	(Watt et al., 2009) (Weber et al., 1991) (Holt et al., 1994)
	Safety performance	(Watt et al., 2009) (Hatush & Skitmore, 1998) (Eddie et al., 2004) (Nieto-Morote & Ruz-Villa, 2012)
Location	Business location	(Watt et al., 2009) (Nieto-Morote & Ruz-Villa, 2012) (Holt et al., 1994)
	Area of catchment	(Watt et al., 2009) (Eddie et al., 2004) (Holt et al., 1994)
Project Management Expertise	Project management organization	(Watt et al., 2009) (Weber et al., 1991) (Hatush & Skitmore, 1998) (Watt et al., 2010)
	Management qualifications and competences	(Watt et al., 2009) (Weber et al., 1991) (Hatush & Skitmore, 1998) (Watt et al., 2010) (Nieto-Morote & Ruz-Villa, 2012) (Holt et al., 1994)

Table 3-2c. Procurement criteria

Category	Criteria	References
Project Management Expertise (continued)	Project management monitoring	(Watt et al., 2009) (Hatush & Skitmore, 1998) (Watt et al., 2010)
	Risk management	(Watt et al., 2009) (Lee et al., 2015) (Hannon et al., 2013) (Vine, 2005)
Past Project Performance	Cost outcomes overruns	(Watt et al., 2009) (Weber et al., 1991) (Topcu, 2004) (Hatush & Skitmore, 1998) (Watt et al., 2010) (Nieto-Morote & Ruz-Villa, 2012) (Holt et al., 1994)
	Past failures	(Watt et al., 2009) (Topcu, 2004) (Hatush & Skitmore, 1998) (Watt et al., 2010) (Nieto-Morote & Ruz-Villa, 2012) (Holt et al., 1994)
	Reliability	(Watt et al., 2009) (Weber et al., 1991) (Hatush & Skitmore, 1998) (Watt et al., 2010)
	References	(Watt et al., 2009) (Weber et al., 1991) (Topcu, 2004) (Hatush & Skitmore, 1998) (Eddie et al., 2004) (Watt et al., 2010) (Nieto-Morote & Ruz-Villa, 2012) (Holt et al., 1994)
Company reputation	Litigation tendency	(Watt et al., 2009) (Weber et al., 1991) (Nieto-Morote & Ruz-Villa, 2012) (Holt et al., 1994)
	Organizational maturity and stability	(Watt et al., 2009) (Holt et al., 1994)
	Desire for business	(Watt et al., 2009) (Weber et al., 1991)

Table 3-2d. Procurement criteria

Category	Criteria	References
Tendered price	Initial investment costs	(Watt et al., 2009) (Eddie et al., 2004) (Watt et al., 2010)
	Total costs of ownership (TCO)	(Watt et al., 2009) (Eddie et al., 2004) (Watt et al., 2010)
	Operating costs	(Watt et al., 2009) (Eddie et al., 2004) (Watt et al., 2010)
Quality control	Quality control policy	(Watt et al., 2009) (Weber et al., 1991) (Holt et al., 1994)
	Certification	(Watt et al., 2009) (Weber et al., 1991)
	Implemented quality systems	(Watt et al., 2009) (Weber et al., 1991) (Lee, Lam, & Lee, 2015) (Nieto-Morote & Ruz-Villa, 2012)
Customer-Supplier relations	Trust	(Watt et al., 2009) (Weber et al., 1991) (Watt et al., 2010) (Nieto-Morote & Ruz-Villa, 2012)
	Commitment to support	(Watt et al., 2009) (Watt et al., 2010)
	Responsiveness	(Watt et al., 2009) (Weber et al., 1991) (Hatush & Skitmore, 1998) (Watt et al., 2010)
	Ability to work as team	(Watt et al., 2009) (Watt et al., 2010)
	Stakeholder management	(Watt et al., 2009) (Watt et al., 2010)
	Customer service	(Watt et al., 2009) (Watt et al., 2010)
Technical Expertise	Experience of technical personnel	(Watt et al., 2009) (Weber et al., 1991) (Hatush & Skitmore, 1998) (Eddie et al., 2004) (Watt et al., 2010) (Nieto-Morote & Ruz-Villa, 2012) (Holt et al., 1994)

Table 3-2e. Procurement criteria

Category	Criteria	References
Technical Expertise (continued)	Technical competence and ability	(Watt et al., 2009) (Weber et al., 1991) (Hatush & Skitmore, 1998) (Watt et al., 2010) (Hannon et al., 2013) (Nieto-Morote & Ruz-Villa, 2012) (Holt et al., 1994)
	Availability and experience of technical design experts	(Watt et al., 2009) (Weber et al., 1991) (Topcu, 2004) (Hatush & Skitmore, 1998) (Eddie et al., 2004) (Watt et al., 2010) (Nieto-Morote & Ruz-Villa, 2012) (Holt et al., 1994)
Technical solution	Proposed system solution/ design	(Watt et al., 2009) (Watt et al., 2010) (Bertoldi et al., 2006)
	Functionality	(Watt et al., 2009) (Watt et al., 2010)
	Life cycle requirements	(Watt et al., 2009) (Watt et al., 2010)
	Flexibility of system	(Hannon et al., 2013) (Lee et al., 2015)
	Degree of compliance with request for tender (RFT)	(Watt et al., 2009) (Watt et al., 2010)
	Viability of technical solution	(Watt et al., 2009) (Watt et al., 2010)
	Form of contract	(Watt et al., 2009) (Watt et al., 2010) (Bertoldi et al., 2006) (Hannon et al., 2013) (Holt et al., 1994)
	Rationality of estimates	(Watt et al., 2009) (Watt et al., 2010)
	Post-delivery support	(Watt et al., 2009) (Weber et al., 1991) (Hatush & Skitmore, 1998) (Watt et al., 2010)
	Real time data monitoring	(Lee et al., 2015)

3.3.1 Financial capacity

Financial capacity and the ratios that go along with it, are cited the most as part of the procurement process (Watt et al., 2009; Weber et al., 1991; Topcu, 2004; Hatush & Skitmore, 1998; Eddie et al., 2004; Nieto-Morote & Ruz-Villa, 2012; Holt et al., 1994). Only those parties who meet the mandatory financial requirements can apply for tender (Topcu, 2004). The category of financial capacity is broken down into six criteria. *Business turnover-cash flow* is a measure of long term capacity, besides that, Holt et al. (1994) indicated that it "may assist in the analysis of the company's activities, as well as being a constituent of several performance and stability ratios". The long term aspect is especially important to ESCo projects, because of their long duration time. *Credit rating, liquidity ratio* and *insurances* offer further insight into a company's financial status (Holt et al., 1994). *Financial soundness* determines whether a contract has financial health or not (Nieto-Morote & Ruz-Villa, 2012). One of the challenges of ESCo projects are related to the financing of the project. Lee et al. (2015) stated that project finance is a unique feature in EPC projects, which causes a high level of complexity of project implementation. Hannon et al. (2013) defined *financing opportunities* of the ESCo to finance the project as a key activity. Hannon et al. (2013) stated that ESCos assume most financial and technical risks of "fulfilling customer's energy needs". Vine (2005) defined project financing as a key barrier to end users in order to apply an ESCo approach. Vine (2005) stated that lack of access to capital and financing credit is one of the barriers to further implementation of ESCos. Therefore the possibility for ESCos to arrange financing is essential.

3.3.2 Health, Safety & Environment

Health, Safety & Environment emerged as being the most important organizational category in public procurement in the United Kingdom (Holt et al., 1994). As reason for this high importance level Holt et al. (1994) declared that it may be due "to the statutory requirements of the Health & Safety at Work Act 197 and, the proposed enforcements in 1994". An ESCo approach is a long term relationship between customer and ESCo, therefore policies on health, safety and environment can be of influence. The category of Health, Safety & Environment is subdivided into two criteria: *CSR policy* and *safety performance* (Watt et al., 2009; Weber et al., 1991; Holt et al., 1994; Hatush & Skitmore, 1998; Eddie et al., 2004; Nieto-Morote & Ruz-Villa, 2012). CSR policy, corporate social responsibility, might be questioned whether it has a relationship with performance. But this criterion is suggested to be part of a preselection procedure (Holt et al., 1994). Watt et al. (2009) and Nieto-Morote & Ruz-Villa et al. (2012) identified the criterion of safety performance as part of the category of Health, Safety and Environment.

3.3.3 Location

Watt et al. (2009) initially stated the category Location as one of the categories part of tender evaluations. In their studies they applied a 5% Occurrence Test, wherein they eventually eliminated the category of Location. The category was subdivided in two criteria: *Business location* and *area of catchment* (Watt et al., 2009; Nieto-Morote & Ruz-Villa, 2012; Eddie et al., 2004; Holt et al., 1994). Holt et al. (1994) conducted research wherein the business location, was ranked as 16th out of 31 criteria. This result might be conflicting with the research results of Watt et al. (2009),

because they eliminated the category as well as the criteria. ESCo projects are highly complex projects, where there is a lot of feedback between stakeholders, for this reason it might be of interest to incorporate the category of location. On top of that studies of Holt et al. (1994) defined that the criterion area of catchment might be of particular interest to customers "seeking a continuity contract or serial tender where the works may be spread over a large geographic area".

3.3.4 Project Management Expertise

Hatush & Skitmore (1998) stated the category of Project Management Expertise as one of the six main categories in tender evaluation processes. The category is broken down into four criteria: *Project management organization, management qualifications and competences, project management monitoring* and *risk management* (Watt et al., 2009; Weber et al., 1991; Hatush & Skitmore, 1998; Watt et al., 2010; Nieto-Morote & Ruz-Villa, 2012; Holt et al., 1994; Lee et al., 2015; Hannon et al., 2013; Vine, 2005). Watt et al. (2010) conducted discrete choice experiments to evaluate the relative importance levels of procurement criteria. Project management expertise, as a category, scored 11.12% and thereby was ranked fourth. The criterion of project management organization is ranked 13th out of 23 criteria, by Weber (1991). Weber et al. (1991) and Nieto-Morote & Ruz-Villa (2012) define the criterion *management qualifications and competences* as whether the management abilities are adequate or not. Energy service contracts last for many years, since the ESCo and the customer are contractually locked into an agreement for a long period of time (Hannon et al., 2013). Together with the fact that customers are unfamiliar with the business model of ESCos, and financial organizations' perception of the business model as a higher risk business model means that risk management is a crucial part (Vine, 2005; Lee et al., 2015; Hannon et al., 2013). Vine (2005) even defined technical and business risks as a key barrier to end users. Vine (2005) and Lee et al. (2015) mentioned the crucial need for risk management.

3.3.5 Past Project Performance

Past project performance, Nieto-Morote & Ruz-Villa (2012) stated it as: "Considering the past performance of each contractor, the project manager will have a higher or lower degree of confidence in the possible contractors regarding the quality, time and cost control requirements.." This category of past project performance can be illustrated by several criteria: *Cost outcomes overruns, past failures, reliability* and *references* (Watt et al., 2009; Weber et al., 1991; Topcu, 2004; Hatush & Skitmore, 1998; Watt et al., 2010; Nieto-Morote & Ruz-Villa, 2012; Eddie et al., 2004; Holt et al., 1994). The criterion of cost outcomes overruns demonstrates the number of projects executed on budget (Nieto-Morote & Ruz-Villa, 2012), as the outcome of a construction project can be measured in terms of cost (Topcu, 2004). Hatush & Skitmore (1998) demonstrate that unless an increase in the range of procurement methods, there is an increase in cost overruns, which illustrates the level of complexity of construction projects. Next to an increase in cost overruns, Hatush & Skitmore (1998) identified an increase in serious problems in quality. Nieto-Morote & Ruz-villa (2012) mentioned that the number of project executed without failure, as one of the decision criteria to select a contractor, this results in the procurement criterion of past failures. Reliability was mentioned as criteria part of the category of part project performance by Watt et al. (2009). The size of projects completed in the past was ranked as second in research

conducted by Holt et al. (1994), briefly behind followed the criterion of the type of projects completed in the past. Nieto-Morote & Ruz-Villa (2012) also mentioned size and type of similar projects completed as one of the decision criteria, this criteria is called references.

3.3.6 Company Reputation

Weber (1991) ranked the category of company reputation as eleventh. The category of company reputation is subdivided into three criteria: *Litigation tendency, organizational maturity and stability* and *desire for business* (Watt et al., 2009; Weber et al., 1991; Nieto-Morote & Ruz-Villa, 2012; Holt et al., 1994). Nieto-Morote & Ruz-Villa (2012) defined reputation as follows: "The project manager must have an overall estimation or opinion about how good contractor is." A firm with a strong litigation tendency may be classed as having an "eye for opportunities to exploit", as has been stated by Holt et al. (1994). Watt et al. (2009) stated that the criterion of organizational maturity and stability is part of the category company reputation. In the studies of Weber et al. (1991) desire for business is ranked 12th out of 23 criteria.

3.3.7 Tendered Price

The category of tendered price is divided into three criteria: *Initial investment costs, total cost of ownership* and *operating costs* (Watt et al., 2009; Eddie et al., 2004; Watt et al., 2010). Eddie et al. (2004) identified interdependencies among tendered price and other procurement criteria, therefore they applied ANP, as ANP is more favorable to be employed in interdependent relationships. Watt et al. (2010) evaluated the relative importance of tender evaluation criteria, including tendered price. Tendered price was ranked third (Watt et al., 2010). Especially in ESCo projects total cost of ownership is of interest, because of the contract period encompasses a long duration time (Hannon et al., 2013).

3.3.8 Quality Control

Quality is one of the categories which receives the greatest amount of attention (Weber et al., 1991). In studies conducted by Weber et al. (1991) quality was ranked as most important criteria. Lee et al. (2015) mentioned that quality of system is one of the main factors affecting the delivery of expected energy savings. In order to manage the risk of quality, Lee et al. (2015) proposed that "before both parties commit themselves to an EPC contract, the ESCo will carry out a detailed energy audit to evaluate the room for saving and the feasibility of proposed ECMs in achieving it." Holt et al. (1994) mentioned that unsatisfactory quality, might lead to ultimate disappointment, which occasionally might result in the fact that a customer is glad to be relieved of a contractor. Watt et al. (2009) proposed the category of quality control, which is subdivided into the following criteria: *Quality control policy, certification* and *implemented quality systems* (Watt et al., 2009; Weber et al., 1991; Holt et al., 1994; Lee, Lam, & Lee, 2015; Nieto-Morote & Ruz-Villa, 2012). The criterion of quality control policy was ranked third by Holt et al. (1994), "reflecting owners' desire for attaining a product of suitable standard and is also cited by many writers on the subject of contractor selection as important". Watt et al. (2009) identified certification in quality control as procurement criterion among the category of quality control. The criterion of implemented quality

systems was identified by Nieto-Morote & Ruz-Villa (2012) as quality management system. Lee et al. (2015) stated an incomplete and poor quality system results in poor operating data.

3.3.9 Customer-Supplier Relations

The category of customer-supplier relations is proposed by Watt et al. (2009), they divided the category in several criteria: *Trust, commitment to support, responsiveness, ability to work as team, stakeholder management* and *customer service* (Watt et al., 2009; Weber et al., 1991; Watt et al., 2010 Nieto-Morote & Ruz-Villa, 2012; Hatush & Skitmore, 1998). The impression made by the contractor in personal contact with customers, and the ability of contractors to meet specified delivery schedules might lead to trust (Weber et al., 1991). Commitment to support the customer is stated as procurement criteria by Watt et al. (2009) and Watt et al. (2010). In ESCo projects, maintenance is important, Lee et al. (2015) even stated operation and maintenance as one of the main factors affecting the successful delivery of expected energy savings. Poor maintenance might lead to a faster rate of equipment degradation (Lee et al., 2015). Therefore routine maintenance and major repairs are important (Hatush & Skitmore, 1998), the criterion of responsiveness illustrates this aspect (Watt et al., 2009). Next to the above mentioned criteria Watt et al. (2009) mentioned the ability to work as team, stakeholder management and customer service as other procurement criteria which belong to the category of customer-supplier relations. Service is especially important in ESCo projects as an "EPC project not only involves the design and installation of ECMs, but also provides a number of services to the host", as has been stated by Lee et al. (2015).

3.3.10 Technical Expertise

Lee et al. (2015) identified that incorrect assumptions on technical aspects might lead to a model which is invalid for "estimating the baseline energy use after retrofitting, leading to disputes over actual energy savings". Nieto-Morote & Ruz-Villa (2012) mentioned that contractors must be able to demonstrate that they have the technical capacity to perform the activities of the project. The relevance of technical expertise, especially in ESCo projects, leads to the category technical expertise, proposed by Watt et al. (2009), which is subdivided into the following criteria: *Experience of technical personnel, technical competence and ability* and *availability and experience of technical design experts* (Watt et al., 2009; Weber et al., 1991; Topcu, 2004; Hatush & Skitmore, 1998; Eddie et al., 2004; Watt et al., 2010; Nieto-Morote & Ruz-Villa, 2012; Holt et al., 1994). Nieto-Morote & Ruz-Villa (2012) mentioned that the contractor must demonstrate its participation in other previous similar projects. In studies conducted by Weber et al. (1991) technical competence and ability was categorized as having considerable importance. Topcu (2004) mentioned that contractors first are assessed on the availability of experienced technical staff. Contractors which score less than a threshold value are screened out (Topcu, 2004). Studies conducted by Holt et al. (1994) ranked the availability of key persons and their certification as respectively 23rd and 10th, which demonstrates that technical competence and ability is more important.

3.3.11 Technical Solution

The category technical solution was mentioned by Watt et al. (2009). This category is subdivided into 10 criteria: *Proposed system solution/ design, functionality, life cycle requirements, flexibility of system, degree of compliance with request for tender (RFT), viability of technical solution, form of contract, rationality of estimates, post-delivery support* and *real time data monitoring* (Watt et al., 2009; Watt et al., 2010; Bertoldi et al., 2006; Hannon et al., 2013; Holt et al., 1994; Lee et al., 2015). The criterion of proposed system solution/ design was mentioned by Watt et al. (2009). Bertoldi et al. (2006) emphasized this criterion because they stated that project design is one of the core activities of energy services. Next to the actual solution, Watt et al. (2009) and Watt et al. (2010) also mentioned; functionality, life cycle requirements, degree of compliance with request for tender, viability of technical solution, rationality of estimates as procurement criteria. Lee et al. (2015) stated that a shorter payback period of the ESCo contract would enable the customer to have more flexibility in changing the building premises and operation to future needs. Therefore it would generate added value for customers if ESCos incorporate a level of flexibility in their system, in order to create possibilities to adjust the building in the future. ESCo projects can be constructed according to several different forms of contract (Hannon et al., 2013), as has been discussed previously (subchapter 2.1.3). The selection of form of contract is of high influence on the relationship between ESCo and customer, and on the operation and exploitation phase (Hannon et al., 2013). The operation and exploitation phase is part of the ESCo, this activities are part of the post-delivery support (Watt et al., 2009). Real time data monitoring is essential in ESCo projects, as energy savings should be validated. Poor data quality, causes an increase in uncertainty on energy savings, which might means that contractual predetermined energy savings cannot be assessed and validated (Lee et al., 2015). Real time data monitoring could tackle this problem, and successfully assess the contractual predefined energy savings (Lee et al., 2015).

3.4 Methods to evaluate bids

The high level of complexity of ESCo projects, makes ESCo tender procedures even more complex, as has already been discussed. The selection of a contractor for an ESCo project, formally involves the use of multicriteria decision analysis to define the importance weights of the procurement criteria (Hatush & Skitmore, 1998). Nowadays there are many multi criteria decision methodologies. For this research the focus will be on methods, which already have been applied in the past in contractor selection processes. These methods include Analytical Hierarchy Process, Analytical Networking Process, Discrete Choice Experiments, Data Envelopment Analysis and Game Theory.

3.4.1 Analytical Hierarchy Process

Analytical Hierarchy Process (AHP) can be utilized to set up a hierarchical skeleton, within which multi-criteria decision problems can be structured (Saaty, 1990). AHP is only applicable to a hierarchy structure, the top level represents the overall goal of the model. This goal will be decomposed to specific levels of elements (Eddie, Cheng, & Heng Li, 2004). To facilitate the supplier selection process, Chan (2003) developed a selection model with AHP. The model was

used to determine the relative importance of the procurement criteria. Chan & Chan (2004) applied AHP in a similar way. Their hierarchy structure was composed of six procurement criteria and 20 subcriteria.

Jaskowski et al. (2010) proposed the application of an extended fuzzy AHP method to define criteria weights, by aggregration of decision makers' judgements. Group decision making involves aggregation of differences in individual preferences. Such aggregation is difficult as opinions may be conflicting. The proposed fuzzy AHP method maximizes group satisfaction with the final group solution (Jaskowski, Biruk, & Bucon, 2010). Fuzzy AHP is an extension of AHP. Relative preferences are described by means of fuzzy numbers with triangular membership functions, instead of single values (Jaskowski et al., 2010). Kahraman et al. (2003) applied fuzzy AHP to select a supplier in a Turkish manufacturing company. Chan and Kumar (2007) applied fuzzy AHP, as both cases described. In all of the cases fuzzy AHP was applied to define the relative importance of the procurement criteria.

Hatush & Skitmore (1998) presented a multi-criteria analysis method based on utility theory. This method is especially suited for "the evaluation of bids where there are conflicting objectives and for sensitivity testing with several stakeholders" (Hatush & Skitmore, 1998). Therefore this method is suited for competitive tendering of construction procurement. Utility is a measure of desirability or satisfaction and a uniform scale so that criteria can be compared. Bids are assessed from a set of criteria, what connects the criteria scores with desirability is the called the utility function. Multi-criteria utility theory (Hatush & Skitmore, 1998). The utility functions in multi-criteria utility theory can be derived by making use of AHP (Eddie et al., 2004).

3.4.2 Analytical Networking Process

The strict hierarchical structure of AHP, may need to be relaxed when there is a decision problem that involves interdependencies between attributes of different or similar categories. This problem requires the Analytical Networking Process (ANP) (Eddie et al., 2004). In most studies of contractor selection, the procurement criteria are assumed to be independent of each other. Nevertheless, one could think about relationships between procurement criteria. Fong & Choi (2000) applied AHP to identify the importance levels of the procurement criteria. But, probably ANP would be a better solution, as the criteria are interrelated. For example, the criteria good past performance is related to good evidence of successful projects. Good evidence of successful projects, might lead to a strong financial capability. This is just one example, but illustrates the level of interdependency among criteria (Eddie et al., 2004). Bayazit & Karpak (2007) developed an ANP-based framework to evaluate the best manufacturer for successful total quality management. In total 32 factors where distinguished and successfully weighted according to an ANP approach.

3.4.3 Discrete Choice Experiments

Another method to determine the weights of the procurement criteria are Discrete Choice Experiments (DCE). Watt et al. (2010) defined DCE as "an effective means to investigate the factors (criteria) that effect client's choice of contractor". Respondents is asked to identify their preferred alternative, within a given choice set. Alternatives are described in terms of multiple criteria, wherein the level of each varies across two or more alternatives (Watt, Kaysis, & Willey, 2010).

Watt et al. (2010) applied the multinomial logit model, to derive the importance weights of the predefined nine criteria.

3.4.4 Data Envelopment Analysis

Data Envelopment Analysis (DEA) is a fractional mathematical programming method proposed by Charnes et al. 1978. Baker & Talluri (1996) state that DEA evaluates "the relative efficiency of homogeneous units by considering multiple inputs and outputs". In the case of ESCo tendering, inputs represent contractor capabilities and outputs represent contractor performances. Garfamy (2006) applied DEA based on total cost of ownership to select the best supplier. Falagario et al. (2012) used a DEA-cross efficiency approach in public procurement tenders. In the private sector the use of DEA in order to select a contractor is not new. Tender evaluation based on DEA does not need the use of subjective scoring systems. Weights of different criteria in the MEAT approach are not required. In public procurement the application of DEA, in contrary to the private sector, is relatively new as weights of criteria are not predefined, because weights are not required. The predefinition of weights is obliged in public procurement, so this leads to a challenge for the future when DEA will be applied structurally in public procurement (Falagario et al., 2012).

Juan (2009) applied a hybrid approach using DEA and case-based reasoning (CBR) for the selection of housing refurbishment contractors. CBR is a problem solving technique re-using past cases and experience to find a solution to a problem (Juan, Shih, & Perng, 2006).

3.4.5 Game Theory

Another approach to evaluate bids is by making use of game theory, and especially auction theory. Procurement procedures can be seen as auctions, which can be classified according to several different criteria. Some auctions are publicly open, some are not. And auctions can differentiate in whether they are ascending or descending (Klemperer, n.d; Menezes & Monteiro, 2005). Hatush & Skitmore (1998) proposed a technique which is suitable for the evaluation of bids where there are conflicting objectives and for sensitivity testing with several stakeholders. This technique is based on utility theory. Ang & Tang (1984) stated that utility is a measure of desirability or satisfaction and provides a uniform scale to compare criteria. A utility function will be applied to quantify the preference of a decision maker by assigning a numerical index. Different bids will be assessed on criteria. The connection between the criteria scores and the preference is the utility function (Hatush & Skitmore, 1998).

Hatush & Skitmore (1998) designed a hypothetical case study to illustrate the practical implementation of the methodology. A utility function has been constructed to successfully select the contractor.

3.5 Conclusion & discussion

Even though the Netherlands has traditionally been among the front-runners in energy efficiency policies, until 2005 there was barely any ESCo activity on the Dutch market (Marino et al., 2010,). Nevertheless, nowadays there is a deficit of trust and unfamiliarity with ESCos (Bertoldi et al., 2014). Nowadays the image of ESCos is seen as complex, hence customers decide to choose for

another sustainable alternative like for instance own investments (Bertoldi et al., 2014). There is a high level of mistrust in the ESCo model from customers. The lack of standardization has been quoted as the main driver of this perception (Bertoldi et al., 2010).

One of the opportunities to overcome these barriers is the Dutch energy agreement. An example of an aspect of the agreement is about the Environmental Protection Act. Utility buildings are obliged to invest in energy efficiency measures, when the payback period is less than five years. If companies ignore this, they risk a financial penalty of 1.5-2 times the energy efficiency investment (van den Tempel, 2009). Next to that ECN conducted research about the energy reduction potential in the Dutch utility buildings. The potential gas consumption savings appeared to be 37%, and the energy savings on lightning systems even appear to be 65% (Sipma, 2014). Lee et al. (2015) identified that the promotion of successful examples of EPC and the public sector has to take a leading role in adopting EPC contracts.

The process of tendering is labeled as high complex (Bochenek, 2014). In ESCo tendering ten different stakeholders are involved (Olander, 2007). Six of these have to be managed closely, this results in high complexity of stakeholder management. The two most important stakeholders are the customer and the contractor.

The tendering process is subdivided into a bidding- and a procurement process. The customer is responsible for the procurement process. The contractor is responsible for the bidding process. Partly because of the high level of complexity, several journal articles were published which describe the different procurement criteria which are part of this processes. When all relevant research articles are analyzed, 46 different criteria can be distinguished (Table 3-2). These procurement criteria form the link between the bidding process and the procurement process. In order to select the most appropriate contractor different evaluation methods are discussed. In existing literature there are four different main methods to be distinguished, namely AHP, ANP, DCE and DEA. All methods have their own advantages and disadvantages.

This literature review positively contributes to the clarification of ESCo tender procedures. The stakeholders involved in the decision making process of ESCo tender procedures of urban redevelopment projects are clarified. Next to that, a clear list of criteria has been conducted, which give a clear overview of the different procurement criteria. In future research it would be interesting to evaluate the different procurement criteria on their level of impact on the procurement process. Next to that, the list of procurement criteria could be validated by making use of experts' opinions.

4 Decision support tool for procurement & bidding strategies in ESCo tendering: applying Fuzzy Delphi Method & Game Theory

Abstract

The Netherlands has to realize that 14% of their energy is renewable energy in 2020. The Netherlands has to implement additional measures to meet the targets stated by the Renewable Energy Directive. One of the possible outcomes to this problem are Energy Service Companies (ESCos). The development of ESCo projects via ESCo tendering is a complex process, as one of the main drivers is mutual trust. The interactive tendering process between technical consultants and ESCos is divided into procurement criteria. Nevertheless, the level of impact of procurement criteria is unknown. Therefore this paper answers the research question: What are the impact levels of procurement criteria on the outcome of tender procedures? To answer this research question the Fuzzy Delphi method (FDM) and Game theory are applied. The data was collected via three, partly on-line, questionnaires. First the list of procurement criteria has been rated and validated, and then the criteria have been evaluated on their impact on the game outcome. Next to that, respondents is asked to express their preferences towards the four different possible game outcomes. The results illustrate that both players prefer the game outcome of MEAT procurement combined with an ESCo approach, which provides opportunities for the implementation of ESCos. About the impact of procurement criteria, in traditional processes both stakeholders assign the same impact levels. In more complex tender processes, ESCos should focus more on a solid business case in order to convince the consultants. A decision support tool has been constructed to clearly visualize the consequences of the in- or exclusion of some procurement criteria, and to develop procurement- as well as bidding strategies.

Keywords: ESCo tendering, procurement- , bidding strategies, Fuzzy Delphi, Game theory, impact levels, preference levels, decision support tool

4.1 Introduction

In the Netherlands the energy consumption between 1973 and 2013 has increased from 2617 PJ to 3256 PJ (Figure 4-1) that is an increase of 24% according to data of the Dutch Central Statistical Office (CBS, 2015). The International Energy Agency expects that the energy consumption will rise with another 18% up to 2020, and 30% until 2030 (Daniëls & van der Maas, 2009). The energy consumption in the Netherlands is rising year by year (Figure 4-1). Next to this the European Union (EU) set a target to increase the energy efficiency of the EU by 20% in 2020 (ING, 2013). This means that in spite of an increase in energy demand, the energy efficiency has to increase. Hence, there is a growing need for energy efficiency measures and sustainable energy solutions.

One of the possible outcomes for the energy efficiency problem are ESCos, in chapter 2 the concept of ESCos is elucidated clearly. In countries like for instance Germany, United Kingdom and France there are a lot of ESCo projects. This in contrary to the Dutch ESCo market. The Dutch ESCo market is lacking behind due to distrust, no standardization and the resistance towards outsourcing energy management (Marino et al., 2010).

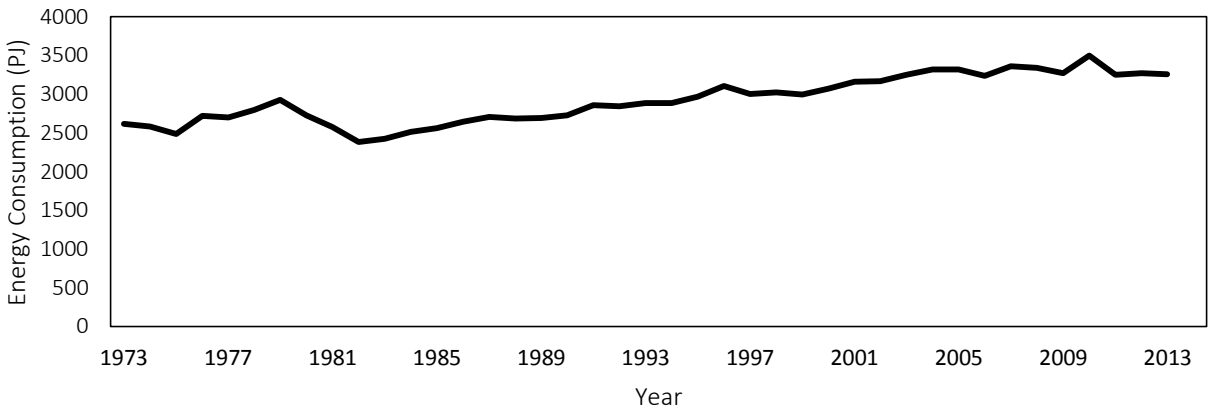


Figure 4-1 Energy consumption in the Netherlands between 1973-2013 (CBS, 2015)

In September 2013 the Dutch government released its report on the sustainable growth of the nation. This report is called the "Energieakkoord", which means energy agreement in English (EIB, 2013). An example of an aspect of the agreement is about the Environmental Protection Act.

Utility buildings are obliged to invest in energy efficiency measures, when the payback period is less than five years. If companies ignore this, they risk a financial penalty of 1.5-2 times the energy efficiency investment (van den Tempel, 2009).

Energieonderzoek Centrum Nederland (ECN) investigated the energy savings potential in the Dutch utility buildings. They investigated the potential on gas consumption, and the potential on energy savings on lighting. The potential gas consumption savings is 37%. The potential of energy savings on lighting systems is 65%. Lighting is responsible for 35% of the total amount of electricity consumption of buildings, which means there are, next to lighting, even more energy saving possibilities. This means that the savings potential in utility buildings has significant size (Sipma, 2014).

ESCo approaches could be applied to the redevelopment of utility buildings. This market could be targeted, as the government obliged the owners of these buildings to invest in energy efficiency measures. Nowadays, still large construction companies win tender procedures, to redevelop utility buildings. Building owner's behavior should experience a transition towards awareness about the benefits of an ESCo approach instead of the traditional process. This transition can be done by investigating the decision criteria of the customers, in order to set up a proper strategy to manage the stakeholders. Next to this, suggestions have to be made to ESCos an how to expose and proposition their self on the market.

ESCo tendering in urban development has been considered in chapter 3
ESCo tendering in urban redevelopment. Tender processes are stated as complex procedures. In this literature review all important procurement criteria are listed. The procurement criteria, can also be labeled as decision criteria of the customer. Nevertheless the impact levels of these criteria are not investigated yet. The objective of this research is to derive the impact levels of procurement criteria under different tender procedures. The research has to answer the question: What are the impact levels of procurement criteria on the outcome of tender procedures?

The contractor will be selected based on several procurement criteria. These procurement criteria can be part of two different procurement strategies: lowest price procurement & MEAT

procurement (Most Economical Attractive Tender) (Bochenek, 2014; Uttam & Le Lann Roos, 2015). The contractor can enter the tender procedure with two different strategies namely, on a traditional approach or via an ESCo approach (Bertoldi et al., 2006; Vine, 2005). In general this means that the procurement criteria can be part of four different scenarios: (1) Scenario A: Lowest price procurement and a traditional contractor approach, (2) Scenario B: Lowest price procurement and an ESCo contractor approach, (3) Scenario C: MEAT procurement and a traditional contractor approach, (4) Scenario D: MEAT procurement and an ESCo contractor approach. Bochenek (2014) stated that tender procedures are complex procedures. Therefore this research contributes to the development of a decision support tool for procurement and bidding strategies in ESCo tendering. This tool will make a proper match between the customer's and contractors' needs. The tool will demonstrate which outcome of the procurement process will generate the highest end results for both parties under each of the four different scenarios.

First of all the research methods will be discussed, followed by the research design. Step by step the research setup will be discussed. Than the results will be displayed together with the data collection process. The section of results will finish with the decision support tool. The last section will be about the conclusions and a discussion part.

4.2 Methodology: Fuzzy Delphi Method & Game Theory

The impact of the procurement criteria under each scenario will be derived. For this part the Fuzzy Delphi method will be applied. Murray et al. (1985) first proposed the application of fuzzy theory to the classical Delphi method. The impact levels which will be derived by the Fuzzy Delphi method will be analyzed and modelled by making use of game theory. Myerson (1991) explains game theory as a theory of mathematical models of conflict and cooperation between rational decision-makers and the outcome of their decisions cannot be determined by one party or actor only. In the case of ESCo tendering two parties: customer and ESCo, are in conflict. The customer wants to have high quality for a low price, in contrary to the ESCo who wants to generate the highest possible revenue. Fuzzy Delphi Method will contribute to the evaluation of the impact levels of the criteria. Game theory will model the interaction between both players. Both research methods are further explained in the following sections.

4.2.1 Fuzzy Delphi Method

There are three basic types of information uncertainty namely, ambiguity, discord and fuzziness that are covered by numerous uncertainty theories (Klir & Yuan, 1995). Fuzzy Delhi method (FDM) is derived from the traditional Delphi method and fuzzy set theory (Murray, Pipino, & van Gigch, 1985). Ishikawa et al. (1993) applied the maximum-minimum method together with cumulative frequency distribution and fuzzy scoring to compile the expert opinions into fuzzy numbers. Noorderhaven (1995) specified that applying the FDM to group decision can solve the fuzziness of mutual understanding of expert opinions. Glumac et al. (2011) stated that "this method is based on group thinking of qualified experts, that assures the validity of the collected information". The application of FDM will reduce the survey time and will reduce the number of required questionnaires. But more important is that FDM takes the fuzziness of the survey process in

account. FDM improves the level of efficiency and quality of the questionnaires (Glumac et al., 2011).

Glumac et al. (2011) identified that the triangular membership function is the most frequently used function in Fuzzy Delhpi. Next to this function, there are other options like trapezoid, quadratic, and Gaussian, which contain even more information. Ishikawa et al. (1993) applied a triangular membership function in the Max-Min Delhi method. In this research also the triangular membership function will be applied. As it will reduce the number of inputs of the respondents, which possibly will increase the response rate. According to previous research by Klir and Yuan (1995) and Glumac et al. (2011), this study uses FDM with geometric mean model to find a common group understanding of the impact level of the identified procurement criteria.

4.2.2 Game Theory

Rasmussen (1989) stated that game theory is generally considered to have begun with the publication of von Neumann & Morgenstern's The Theory of Games and Economic Behaviour in 1944. Like has been elucidated in the previous section game theory is a theory about decision-making in which the decision-makers have conflicting preferences and the outcome of the game cannot be determined by one player only (Myerson, 1991). Game theoretical modelling implies a simplification and abstraction from the real world (Samsura et al., 2010). In this research the simplification has been made that there are only two players involved in the decision making process of ESCo tender procedures. As can be seen in 3.2.1 Stakeholders involved in the process of ESCo tendering there are more stakeholders involved. Nevertheless the assumption is made that there are only two decision makers or players involved in the selection process: consultants and contractors. Nowadays, the complexity of redevelopment projects of utility buildings become more and more complex. Therefore customers are represented by technical consultants who are able to assess tenders of contractors on different procurement criteria, as the customer does not possess this capability. Next to the players involved in the game theoretical model, the model consists of other components, which will be discussed in the research design.

Game theory makes use of payoffs. Samsura et al. (2010) explain the term payoff as follows: “The payoff of an outcome for a player is the value of that outcome for the player. Different players will, in general, value outcomes differently and, consequently, will have different preferences over the set of outcomes. The players’ preferences over outcomes are represented by means of expected utility functions or, as they are called in game theory, by payoff functions.” The impact levels of the criteria will function as input for the game theory. Nevertheless, impact levels are not the same as preferences. For that reason the level of impact of each criterion will be combined with the preference towards each outcome. The combination of impact level and preference eventually will result in utility functions. This process will be elaborated in the following subchapter (4.2.3 Research design).

4.2.3 Research design

This research combines FDM and game theory to develop strategies for technical consultants as well as ESCos on how to approach ESCo tender procedures. This combination of both methods is customized for this research, to generate scientific results. The research design (Figure 4-2) will be

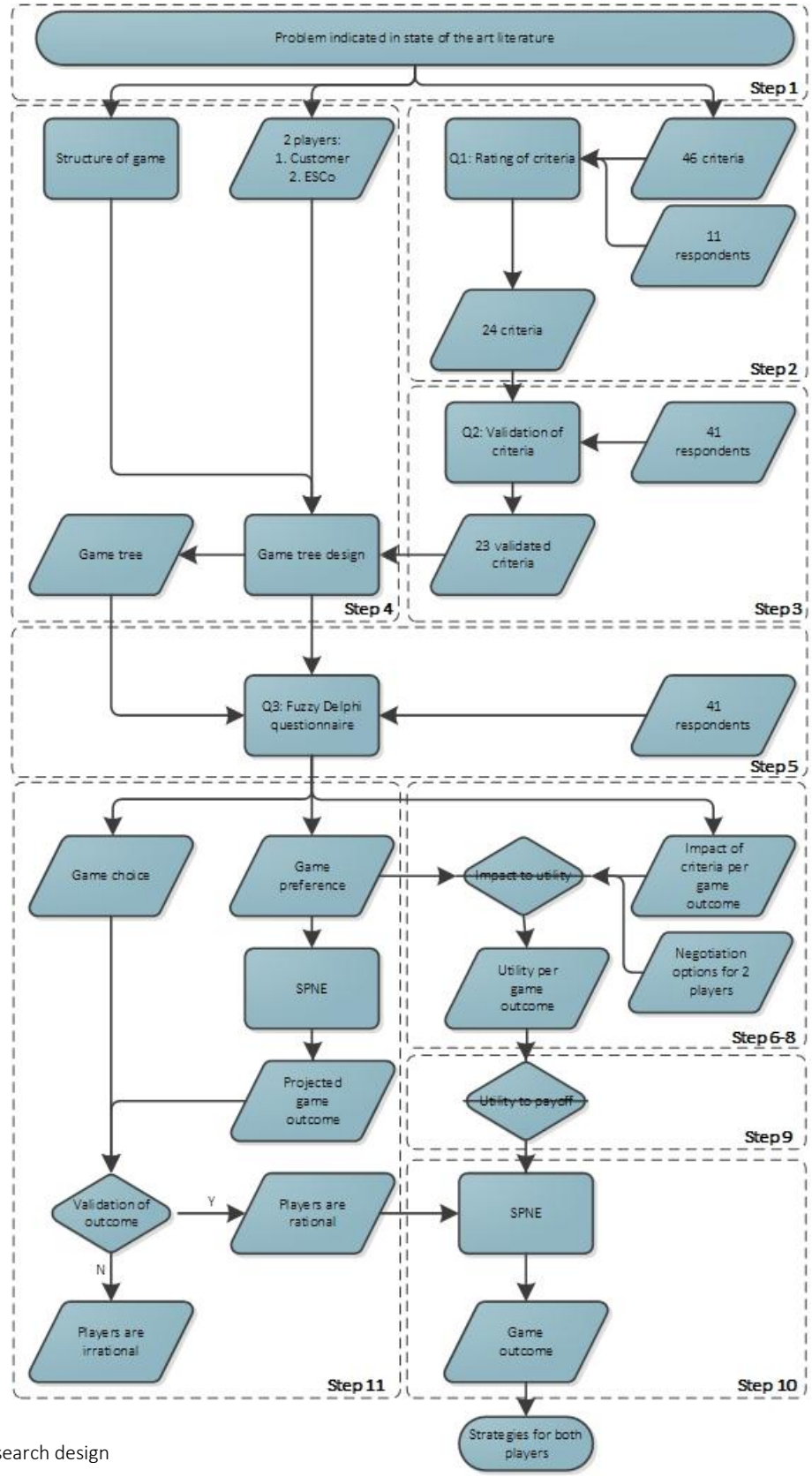


Figure 4-2 Research design

elucidated stepwise hereafter (Glumac et al., 2011; Hsu, Lee, & Kreng, 2010; Samsura et al., 2010; Glumac et al., 2015).

Step 1. Define a list of criteria. The procurement criteria, which are part of the tendering process, have to be collected. This list of criteria will be constructed by performing a literature study. This literature study has been elucidated in chapter 3. A list of procurement criteria was defined (Table 3-2). In total 46 different criteria were distinguished.

Step 2. Rating of criteria. In the first questionnaire (Appendix A) the respondents were asked to indicate whether criteria are not important, neutral or important (Table 4-1). Together with this, they were asked to add missing criteria from the initial list. The threshold value of criteria which will be input for the next step is stated at 50% (Asl et al., 2012; Duffield, 1993). This means that criteria should score 50% or higher on the level of importance in order to be included in the next step. Next to that, overlapping criteria are merged in order to create a list of procurement criteria without interdependencies (Eddie et al., 2004).

Table 4-1 Sample of first questionnaire

Category	Criteria	Rating
Financial capacity	Credit rating	~~Not important~~/ Neutral/ ~~Important~~
Financial capacity	Liquidity ratio	~~Not important~~/ ~~Neutral~~/ Important
…	…	…

Step 3. Validation of criteria. The criteria output from step 2, will function as input for the second step. In the second questionnaire (Appendix B) the respondents were asked to approve and add missing criteria from the list created by step 2 (Figure 4-3). The threshold value of criteria which will be input for the next step is stated at 50% (Asl et al., 2012; Duffield, 1993). This means that criteria should score 50% or higher on the level validity in order to be included in the next step. The first and second step of this process are part of the FDM process and refers to the brainstorming phase in classical Delphi method. The brainstorming phase consists of two questionnaires. The first one is about open-end questions wherein respondents can suggest any criteria. The second questionnaire is about validating the list of criteria generated in the first questionnaire (Delbecq et al., 1975; Schmidt et al., 2001).

Figure 4-3 Second questionnaire validation of criteria

Step 4. Game tree design. The game tree forms the basic framework behind the research. The data, which will be acquired from the respondents, has to be structured according to the game tree design. This subsection will elaborate on the aspects correlated to the game tree design.

Game class selection. Games can be classified as cooperative and non-cooperative games. Cooperative game theory in about situations wherein players already decided to cooperate. In the case of ESCo tendering this is excluded, as the tender procedure especially is composed to find a contractor. Next to that, if a contracting authority already made agreements with possible contractors, this will mean the organization is corrupt (Celentani & Ganuza, 2002). Non-cooperative game theory is based on players maximizing their own payoffs, without making binding agreements (Rasmussen, 1989). Next to the distinguishing of cooperative and non-cooperative games, game theory distinguishes between conflict and common interest games. In a conflict game the interest of the decision makers is opposed or only partly coincide. Decision makers will decide based on their own interest which has not to be the interest of others. In a common interest game, all decision makers share the same interest (Glumac et al., 2015). The process of ESCo tendering is clearly a non-cooperative game, as agreements among parties is forbidden by law. Next to this, the decision makers are in "conflict". The technical consultant who is representing the customer wants the highest quality for the lowest purchase price, and the contractor wants to generate the highest possible revenue.

Game form selection. Any game consists of two parts: a descriptive part and a solution part. The descriptive part describes the content of the game, the solution part presents the different outcomes of the game. As discussed previously (subchapter 4.2) both players have two possible options on how to act. First of all, the consultant can decide to apply lowest price procurement or MEAT procurement. After this decision the contractor can decide whether to enter the tender procedure with a traditional approach or an ESCo approach. This decision-making process can be structured in, a so-called, extensive form. The extensive form assumes that players decide sequentially. The first player decides a strategy, and the second player responds to that (Samsura et al., 2010).

This process is exactly how tender procedures are stated, as discussed previously (subchapter 2.3). This game can be structured by a so-called game tree (Figure 4-4). This game tree

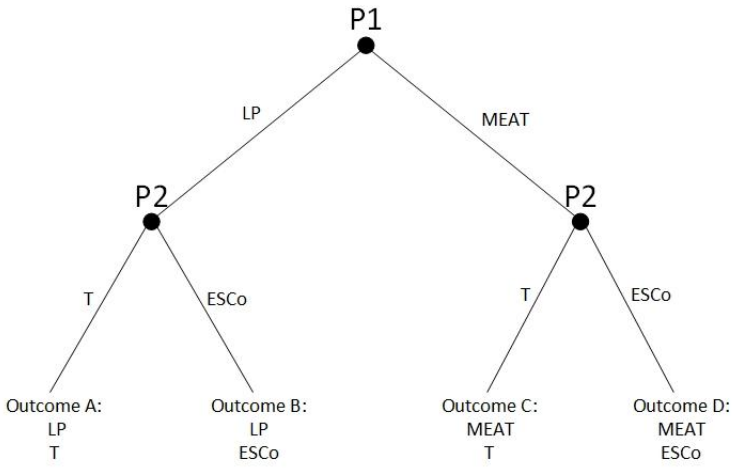


Figure 4-4 Game tree design

is a graphical representation of the strategic interactions of both players (Samsura et al., 2010). The tree is composed of nodes and branches. The nodes represent the decisions made by a player, and the branches refer to alternative actions for a player to choose from. The branches end in different decision nodes, these nodes are called end nodes (Samsura et al., 2010). Another form is called the strategic form. In the strategic form players act simultaneously in contrary to the extensive form (Glumac et al., 2015).

Players. The term players is already elucidated. In a game, the players are the decision makers (Glumac et al., 2015). In the tree of this model the players exactly know where they stand, this situation is called a game with perfect information. If the player does not know its position then the game is with imperfect information (Samsura et al., 2010). In this research there are two players involved, namely the technical consultants and the contractor. Player 1 represent the technical consultants and player 2 refers to the ESCo (Figure 4-4).

Strategies. The term strategy has also already been elaborated implicitly. Samsura et al. (2010) define a strategy as "a contingent plan of actions. It stipulates a priori how the player will act when a move is made by another player". In game theory players try to maximize their utility, and adopt a plan how to achieve this utility in their strategy. Game theory is about that all players selects their own strategy, but the overall result depends on the choices of all players involved. This means that each player only partially controls the outcome of the game (Samsura et al., 2010). The strategies for the technical consultants are lowest price procurement (LP) or Most Economical Attractive Tender procurement (MEAT). The contractor can decide to apply a traditional approach (T) or an ESCo approach (ESCo) (Figure 4-4).

Outcome & payoff. A clear distinction should be given about the definitions of the terms outcome and payoff. The term outcome refers to the social or physical state which results from the decisions of the players. Actually it represents the decision the players collectively make. The payoff of an outcome refers to the value of that outcome to a specific player. Because of the differences in preferences of players towards the different outcomes, players will have different payoff levels for the same game outcome. Samsura et al. (2010) mentioned: "The best possible outcome to one player, may be the worst for the other". In the game tree (Figure 4-4) the different outcomes are mentioned. The payoffs which belong to these outcomes, will be calculated by making use of the FDM.

Step 5. Collect opinions of expert groups. In the third questionnaire (Appendix C) the respondents were asked to evaluate the individual criteria by using three points in a row from 1 to 10, associated with the level of impact of criteria on the outcome. Next to that, respondents is asked to indicate their preference towards each of the four different outcomes (Figure 4-5). Respondents is asked to evaluate different scenarios instead of game outcomes, the term of scenarios refers to the game outcomes. This has been done to make the questionnaire more understandable for the respondents. Their preferences will be used to generate utility functions as input for the game theory model. The respondents are divided into two homogeneous groups: (1) the technical consultants and (2) the ESCos itself. First the respondents have to determine, per criterion, the range of minimum and maximum impact (Figure 4-6). Based on market conditions and situation, one could imagine that the level of impact of each criterion can differentiate. Sometimes the level of impact varies in its extreme, and sometimes it varies slightly. Next to the

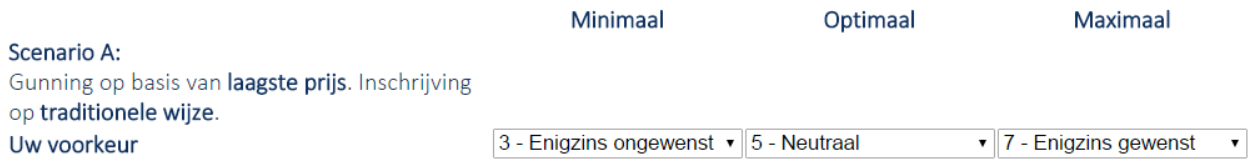


Figure 4-5 Assigning preference levels to outcomes

Figure 4-6 Assigning impact levels to criteria under different outcomes

minimum and maximum value respondents have to assign an optimum value (Figure 4-6). The optimum illustrates the generic value, which is dependent on the experience of the respondents. To resume, instead of just giving one weight, experts will provide three weights in range. By doing this, more information will be subtracted from the respondents, which makes the data analysis more reliable.

Step 6. Set up overall triangular fuzzy number. Per individual criterion the overall triangular fuzzy number will be determined by evaluation of the experts' opinions. For the evaluation value of criteria j of m criteria by expert i of n experts where $i = 1, 2, \dots, n$ and $j = 1, 2, \dots, m$. By using a general mean model (Klir & Yuan, 1995) the overall value of a criteria is estimated (Eq.:3) (Klir & Yuan, 1995):

$$\widetilde{w}_{ij} = a_{ij} + b_{ij} + c_{ij} \tag{3}$$

Where:

$$a_j = \min_j \{a_{ij}\}, \qquad b_j = \frac{1}{n}\sum_{i=1}^{n} b_{ij}\,, \qquad c_j = \min_j \{c_{ij}\}$$

Step 7. Defuzzification. The goal of this step is to turn the overall triangular fuzzy number per criterion into a single real number. This process is called defuzzification. The centre of gravity method has been used for this process (Klir & Yuan, 1995). For fuzzy weight $\widetilde{w}_{ij}$ of each criterion to derive a definite value S_j where$j = 1, 2, \dots, m$ (Eq.:4):

$$S_j = \frac{a_j + b_j + c_j}{3} \tag{4}$$

This step is the last step in the FDM process. The list of defuzzified numbers will function as input in the data transition process, to translate impact levels to game payoffs.

Step 8. Impact to utility. After the defuzzified numbers (S_j) of the impact levels per criterion are determined. These numbers have to be translated towards utility functions and payoffs. The

first step in this translation process is to generate utility functions. The main input for this function are the defuzzified numbers (S_j) generated in step 7. The utility function of a game outcome is defined as follows (Eq.:5):

$$U_{oi} = \sum_{i=1}^{n} \beta_{oi} * \beta_{oji} * x_{ji} \quad (5)$$

Where:

- U_{oi} represents the utility of game outcome o for player i
- β_{oi} represents the preference of game outcome o of player i
- β_{ji} represents the impact of criterion j for player i on game outcome o. Which represents S_j in step 7.
- x_{ji} represents the level of criterion j for player i

The preference of game outcome o of player i, β_{oi}, is evaluated by the FDM questionnaire (Appendix C). The four different game outcomes are evaluated independently. The impact of criterion j for player i on game outcome o, β_{oji}, also is evaluated by the FDM questionnaire (Appendix C). The 23 validated criteria all have been evaluated on the level of impact on each game outcome per player. The level of criterion j for player i, represents the negotiation options for both players. The list of criteria defined in step 1 consists of all criteria which could be included or excluded in a tendering procedure. The technical consultants as well as the ESCo can independently decide to include or exclude criteria. This provides negotiation option for both players. Therefore x_{ji} can adopt two values, 0 or 1. If $x_{ji} = 0$, it means that the criterion is not present in the tender procedure. If $x_{ji} = 1$, it means that the criterion is present in the tender procedure. This interactive process will be implemented in a decision support tool. This tool will offer opportunities to examine the consequences when criteria are incorporated or not. The decision support tool will be elucidated and demonstrated in section 4.3 Results.

Step 9. Utility to payoff. The determination of de utilities of the game outcomes (Eq.:5), will be executed four times for both players. This utility will be translated to a payoff as follows (Eq.:6):

$$P_{oi} = \frac{U_{oi}}{\sum_{i=1}^{n} U_{oi}} \quad (6)$$

Where:

- P_{oi} represents the payoff of game outcome o for player i
- U_{oi} represents the utility of game outcome o for player i
- $\sum_{i=1}^{n} U_{oi}$ represents the sum of the four different utility functions of the four different game outcomes for player i

Step 10. Determination of SPNE by backward induction. A solution concept represents a "formal rule for predicting how the game will be played", as has been stated by Glumac et al. (2015). There are several solution concepts for game theory, however the principle of Nash

equilibrium is most frequently applied (Samsura et al., 2010). Samsura et al. (2010) define a Nash equilibrium as "a profile of selected strategies – one strategy for each player – in which no player has an incentive to deviate from his selected strategy. The strategy selected by any player is a best response to the strategies chosen by all the other players." The term best means that deviating from the outcome will not lead to an increase in payoff. In some games it is possible to have two Nash equilibriums. Games in extensive form, as the one in Figure 4-4, often are solved with subgame perfect Nash equilibrium (SPNE) (Glumac et al., 2015). A subgame is explained by Samsura et al. (2010) as follows: "A subgame of an extensive form game is a part of the game that as such can be considered as a game on its own. It corresponds with a sub-tree in the game tree." SPNE can be find by the using the backward induction method. This process starts the searching process after equilibriums at the end of the tree in a sub-tree. Then, rolling back to the root of the tree. In this research the backward induction process is applied to evaluate the game outcome dependent on the impact levels generated by the FDM questionnaire in step 5.

Step 11. Check the rationality of players. Game theory assumes that players make rational decisions based on their utility functions. If players act rational they can perceive their own moves and strategies, but also the moves of others (Glumac et al., 2015). Rational behavior is a "precondition to solve a SPNE with backward induction", as has been stated by Glumac et al. (2015). Therefore it is required to implement this validation process into the questionnaire. In the third questionnaire respondents is asked to evaluate their preference over all of the four different outcomes, according to the FDM. Next to that, respondents is asked to choose which outcome they expect will lead to the highest results (Appendix C). The preferences they evaluate with the FDM approach should match with the expected outcome, in order to decide whether the respondents are rational or not.

Next to the process of evaluating the rationality of respondents, there is the amount of respondents. State of the art literature (Delbecq et al., 1975; Schmidt et al., 2001; Glumac et al., 2011) suggests that the number of respondents per homogeneous group should range from 10 to 15 participants to generate more reliable results. In this research the technical consultants as well as the ESCo form two independent homogeneous groups.

4.3 Results

As described in the methodology steps, this survey consists of three questionnaires. Technical consultants and ESCos were asked to participate. Both groups have contributed in all the three questionnaires. The three step process and the presence of both homogeneous groups assures that all relevant criteria are part of the research (Delbecq et al., 1975; Schmidt et al., 2001; Glumac et al., 2011). In this section the results of all questionnaires will be discussed. First of all the data collection will be elucidated. Next the process of deriving the impact levels will be discussed, followed by the game outcomes. This section will end with de demonstration of the decision support tool.

4.3.1 Data collection

To collect the data three approaches have been employed. The first questionnaire (Appendix A) consisted of the list of predefined criteria, this list was derived from state-of-the-art literature. In total 46 criteria were distinguished. The respondents were asked to indicate whether they think the criteria is important, neutral or not important (Table 4-1 & Appendix A). The total number of contacted persons in the first questionnaire was 15 amongst them 11 experts replied thus making 73.33 percent response rate. The experts were selected based on their experience and role within the energy service process. From the respondents 54.55 percent was part of an ESCo, 45.45 percent works as a technical consultant. This feedback is regarded as sufficient for the first questionnaire, as it represent the first step in the validation process. Experts were personally contacted via email and asked to participate in the three step process.

The first questionnaire resulted in 24 criteria, which had to be validated in the second questionnaire (Appendix B). The categories as well as the criteria have been restructured, so the categories as well as the criteria had to be validated. To collect the data for validating the results an on-line survey tool is used (Berg Enquête System©, 2007). The total number of contacted person in the second questionnaire was 41 amongst them 21 experts replied thus making 51.22 percent response rate. From the respondents 52.38 percent was part of an ESCo, 47.62 percent works as a technical consultant. This feedback is regarded as sufficient as the presence of both players is in balance. All the experts were personally contacted via email, the survey was open to enter for one week. After three days another email to all the respondents was sent with a reminder.

The validated 23 criteria partly were the input for the third questionnaire (Appendix C). To collect the data to derive impact levels of criteria and preference levels of game outcomes, an on-line survey tool is used used (Berg Enquête System©, 2007). In order to generate reliable results in FDM 10 to 15 respondents per homogenous group should participate (Delbecq et al., 1975; Schmidt et al., 2001; Glumac et al., 2011). Initially 41 respondents have been contacted via email, these are the same respondents as in the second questionnaire. The 41 respondents were divided into 20 ESCo experts and 21 technical consultants. The period of filling in the questionnaire was set at two weeks. After four days a reminder has been sent to the respondents. After nine days the respondents were contacted via telephone, in order to increase the response rate. Two weeks after the questionnaire has been distributed 14 ESCo experts returned the questionnaire and 7 technical consultants. The decision has been made to postpone the deadline one week. The homogenous group of ESCo experts already reached the range of 10 to 15 filled in questionnaires, nevertheless a reminder has been sent to the ESCo experts for the respondents who did not yet return the questionnaire. The homogenous group of technical consultants have been contacted via email, with the message that the deadline has been postponed for one week. Next to that 12 other technical consultants have been contacted by email and telephone to contribute to this research by filling in the questionnaire. Eventually this effort resulted in a total of 13 completed questionnaires for the homogenous group of technical consultants and a total of 15 completed questionnaire for the homogenous group of ESCo experts. Hence, the response rate of the ESCo experts is 75.00 percent, and for the technical consultants 39.40 percent. Overall the questionnaire has been distributed among 53 experts, with an overall response rate of 52.83 percent. The

number of returned questionnaires meets the requirement of 10 to 15 respondents per homogenous group to label the data as reliable data.

4.3.2 Rating of criteria

The list of procurement criteria (Table 3-2), has been rated in first questionnaire (Appendix A). Next to that respondents added missing criteria. The questionnaire has been returned by 11 respondents. The results of this questionnaire (Table 4-2) lead to a new list of 24 criteria.

Table 4-2a Results of rating questionnaire

#	Criteria	a Not important	b Neutral	c Important	d Ratio (%)
1.	Credit rating	4	4	3	**27.3**
2.	Liquidity ratio	3	5	3	**27.3**
3.	Financial soundness	3	5	3	**27.3**
4.	Insurances	4	5	2	**19.8**
5.	Business turnover-cash flow	3	5	3	**27.3**
6.	Financing opportunities	0	1	10	90.9
7.	CSR policy	0	4	7	63.6
8.	Safety performance	2	6	3	**27.3**
9.	Business location	2	6	3	**27.3**
10.	Area of catchment	0	4	7	63.6
11.	Project management organization	0	0	11	100
12.	Management qualifications and competences	0	1	10	90.9
13.	Project management monitoring	0	0	11	100
14.	Risk management	0	0	11	100
15.	Cost outcomes overruns	6	3	2	**18.2**
16.	Past failures	5	3	3	**27.3**
17.	Reliability	3	4	4	**36.7**
18.	References	1	1	9	81.8
19.	Litigation tendency	4	4	3	**27.3**
20.	Organizational maturity and stability	2	6	3	**27.3**
21.	Desire for business	1	8	3	**25.0**
22,	Initial investment costs	0	0	12	100
23.	Total costs of ownership (TCO)	0	0	12	100
24.	Operating costs	0	0	12	100
25.	Quality control policy	0	2	9	81.8
26.	Certification	0	1	10	90.9
27.	Implemented quality systems	0	2	9	81.8
28.	Trust	0	3	8	72.7
29.	Commitment to support	0	2	9	81.8
30.	Responsiveness	0	1	10	90.9
31.	Ability to work as team	0	1	10	90.9
32.	Stakeholder management	0	0	11	100
33.	Customer service	0	0	11	91.7
34.	Experience of technical personnel	0	1	10	90.9
35.	Technical competence and ability	0	1	10	90.9

Table 4-2b Results of rating questionnaire

#	Criteria	a Not important	b Neutral	c Important	d Ratio (%)
36.	Availability and experience of technical design experts	0	0	11	91.7
37.	Proposed system solution/ design	0	1	10	90.9
38.	Functionality	1	8	2	**18.2**
39.	Life cycle requirements	0	3	8	72.7
40.	Flexibility of system	0	1	10	90.9
41.	Degree of compliance with request for tender (RFT)	0	5	6	54.5
42.	Viability of technical solution	1	1	9	81.8
43.	Form of contract	2	2	7	63.6
44.	Rationality of estimates	0	1	10	90.9
45.	Post-delivery support	0	1	10	90.9
46.	Real time data monitoring	0	0	11	100

Table 4-3 Missing criteria by respondents

#	Criteria
47.	Expertise, experience & nature of project manager and composed team
48.	Financial plan and cost control
49.	Clear & pleasant communication style
50.	Strategic partnerships with technical suppliers
51.	Transparency of work
52.	Image of company
51.	Maintenance plan

In total the respondents rated 32 criteria (Table 4-2) of the initial list of 46 criteria as important. The criteria which were not stated as important by the respondents, are displayed by a bold ratio. The threshold value was stated at 50 percent (Asl et al., 2012; Duffield, 1993). The ratio is calculated as follows (Eq.:7):

$$d = \frac{c}{a+b+c} \tag{7}$$

Next to these 32 criteria respondents added 7 missing criteria (Table 4-3). Hence, the output of the rating questionnaire consists of 39 criteria. To shorten this list, overlapping criteria are combined in order to create a list of discrete variables without interdependencies. The initial list of criteria (Table 4-2) consisted of criteria which were interrelated. In order to create a list of criteria without these interdependencies criteria are merged and combined.

Table 4-4 Example of combination of criteria

#	New criterion	#	Combination of criteria:
1.	Project management organization plan, certifications & monitoring	11	Project management organization
		12	Management qualifications and competences
		13	Project management monitoring
2.	…	…	…

This analysis (Appendix D) resulted in a new list of discrete criteria divided among new labeled categories (Appendix E). To elucidate the process of combining overlapping criteria an example is illustrated (Table 4-4).

The criterion *Project management organization plan, certifications & monitoring* is a combination of the criteria (11) *Project management organization,* (12) *Management qualification and competences* and (13) *Project management monitoring.* The combination process ensured that the new criteria can be included or excluded in tender procedures. This means that criteria can be present or not-present in tender procedures. This option leads to negotiation options for both players.

Next to the creation of a new list of criteria, these criteria are divided among new labeled categories. This means the structure as well as the content of the list of criteria has changed since the rating questionnaire. Therefore, a second questionnaire was constructed to validate the list of criteria which has been composed.

4.3.3 Validation of criteria

The list of criteria without interdependencies (Appendix E) is validated in the second questionnaire. All categories and criteria are validated by the respondents, except for one criterion. Criterion 4 (Table 4-4) *ability to work as team* has been evaluated as invalid. This means a list of 23 criteria has been constructed as input for the FDM questionnaire. The threshold value for validation is stated at 50 percent, so 50 percent of the respondents should label a category or criterion as valid (Asl et al., 2012; Duffield, 1993).

Next to the validation process, again respondents is asked to add missing categories and criteria. Respondents did not add new missing categories and criteria. The results of the validation process of the categories (Table 4-5) and criteria (Table 4-6) are listed in tables. Both the frequencies and percentages are estimated by SPSS®.

Table 4-5 Validation results of categories

#	Category	Valid	Not valid	No opinion	Ratio (%)
1.	Project management expertise	21	0	0	100
2.	Financial	19	2	0	90.5
3.	Customer-supplier relations	13	3	5	61.9
4.	Technical expertise	20	1	0	95.2
5.	Technical solution & quality	21	0	0	100
6.	Exploitation	20	0	1	95.2

Table 4-6 Validation results of criteria

#	Criteria	Valid	Not valid	No opinion	Ratio (%)
1.	Project management organization plan, certifications & monitoring	21	0	0	100
2.	Similar types and size of projects completed	19	2	0	90.5
3.	Expertise, experience & nature of project manager and composed team	21	0	0	100
4.	Ability to work as a team	10	7	4	47.6
5.	Total costs of ownership (TCO) analysis	20	0	1	95.2
6.	Initial investment costs estimation	19	1	1	90.5
7.	Operating costs estimation	19	1	1	90.5
8.	Financing opportunities	14	4	3	66.7
9.	Financial plan, cost control & rationality of estimates	14	6	1	66.7
10.	Positive image of company & CSR policy	17	2	2	81.0
11.	Clear & pleasant communication style	12	3	6	57.1
12.	Customer service plan & commitment to support	14	1	6	66.7
13.	Experience, availability and certification of technical team	19	1	1	90.5
14.	Strategic partnerships with technical suppliers	13	4	4	61.9
15.	Delivered energy performance & user comfort	20	1	0	95.2
16.	Application of innovative solutions and optimizations	19	2	0	90.5
17.	Application of quality control system, policy & certification	17	2	2	81.0
18.	Transparency of work	14	3	4	66.7
19.	Technical flexibility of system	12	1	8	57.1
20.	Guarantees provided on availability rate & response time	19	2	0	90.5
21.	Modifications in contract	11	4	6	52.4
22,	Implementation plan	17	1	3	81.0
23.	Maintenance plan and monitoring	21	0	0	100
24.	Risk management plan	20	0	1	95.2

4.3.4 Evaluation of impact levels of criteria

The list of criteria is renumbered due to the validation process (Table 4-7). The criteria are individually evaluated on their impact on game outcomes. This means that criteria are evaluated under the four different game outcomes per player. The evaluation has been executed according to fuzzy numbers in FDM, eventually these numbers are defuzzified (Table 4-7 & Appendix F). In Appendix F the evaluation of the impact levels in fuzzy numbers per criteria is displayed per respondent. The impact levels of the procurement criteria are visually displayed in graphs (Figures 4-8: 4-11).

One can clearly see that the level of volatility will increase from game outcome A towards game outcome D. Game outcome A and B are based on lowest price procurement, where basically the lowest price bid wins the tender procedure. Tender procedures based on MEAT procurement are more complex processes, as more criteria are affecting the decision making process (De Bruijn et al., 2008). The differences in expert opinions of the impact levels of criteria increase in game outcome C and D. The differences in opinions of both players provide opportunities to develop strategies for both players to meet each other's demands.

Almost 50 percent of the respondents is active in the field for over 20 years (Figure 4-7). Next to that 69.7 percent already has experience in ESCo projects, which means the results are even more reliable because of the level of experience of the respondents.

The value of the impact levels of procurement criteria on the game outcome differ per homogeneous group. The difference *Delta Δ* (Table 4-11) is calculated by subtracting the impact level evaluated by ESCo experts from the impact levels consultants stated.

Game outcome A LP – T (Table 4-7 & Figure 4-8), is recognized as the traditional process. In this process customers in association with technical consultants open a tender procedure based on lowest price procurement. Contractors will enter this tender procedure based on a traditional approach. This traditional approach is characterized by a low level of complexity. After installment the collaboration will be broken. Overall the evaluation of the impact levels of the procurement criteria by both players is in quite balance (Figure 4-8). This result is in line with practice, as this specific tender procedure and contractor participation is of frequent occurrence. Nevertheless, there are some interesting aspects to distinguish. The *customer service plan & commitment to support* has been evaluated 2.44 by the consultants and 1.89 by the ESCo experts. This is a difference of 0.55, which illustrates that consultants think that the customer service plan and the commitment to support is more important than ESCo experts think it is. Next to this, a *clear & pleasant communication style* and the p*roject management organization plan, certifications & monitoring* differs per player, respectively 0.52 and 0.40. In contrary to those aspects ESCos focus more on the *initial investment costs estimation* and the *financial plan, cost control & rationality of estimates.* Instead of mainly focusing on cost optimization, ESCos should pay more attention to the above mentioned criteria which is evaluated of higher impact by the consultants. Nevertheless the differences are pretty small, which means that both players know each other well.

Game outcome B LP – ESCo (Table 4-8 & Figure 4-9) is a process which is not common in the field. A tender procedure will be opened based on lowest price procurement. Contractors will enter this tender procedure by applying an ESCo approach. Three criteria can be labeled as most important by the consultants, respectively: (1) *transparency of work* 2.19, (2) *initial investment*

costs estimation 1.63 and (3) s*imilar types and size of projects completed* 1.62 (Figure 4-9). These three criteria form a combination of criteria one would expect in lowest price procurement and in ESCo projects. Transparency of work is especially important in ESCo projects, where long term relationships form the basic principle. Striking result is that except for the *operating costs estimation* and the *financial plan, cost control & rationality of estimates* the consultants evaluated the impact of the criteria higher than the ESCo experts. As in game outcome A the ESCos evaluate financial aspects as most important, in contrary to the consultant, the contracting authority, which evaluates the other criteria higher in impact except for the *initial investment costs estimation*.

Game outcome C MEAT – T (Table 4-9 & Figure 4-10), can be labeled as a traditional process. In this process customers in association with technical consultants open a tender procedure based on MEAT procurement. Contractors will enter this tender procedure based on a traditional approach. Nevertheless, the evaluations of the consultants and ESCo experts is not in balance as it is in game outcome A (Figure 4-10). This might partly be due to the high level of complexity of MEAT procurement. The major difference between consultants and ESCo experts is about the criterion *expertise, experience & nature of project manager and composed team.* The consultants evaluate this as neutral impact, the ESCo experts think it is one of the least important criteria so with low impact. ESCos labeled the criterion *similar types and size of projects completed* as having neutral impact, the consultants think it has low impact. Transparency of work is regarded as the criterion with the highest impact by the ESCo experts in an ESCo approach in contrary to consultants who think the impact of transparency does not have that high impact. Next to that ESCos think the *risk management plan* and the *application of quality control system, policy & certification* has a higher impact, than the consultants' opinions.

Game outcome D MEAT – ESCo (Table 4-10 & Figure 4-11), can be seen as the ideal collaboration between both parties to employ a successful ESCo project. Nevertheless, the concept is relatively new as both parties still consider the level of impact of the criteria differently (Figure 4-11). Some impact levels of criteria are evaluated quite the same like for instance the *total costs of ownership (TCO) analysis,* both parties evaluate the impact of the TCO analysis as relatively high. The consultants valued the *operating costs estimation*, *financing opportunities* and the *financial plan, cost control & rationality of estimates* of significant higher impact than the ESCo experts. The same goes for the *delivered energy performance & user comfort,* which the consultants identified as the criterion with the highest impact.

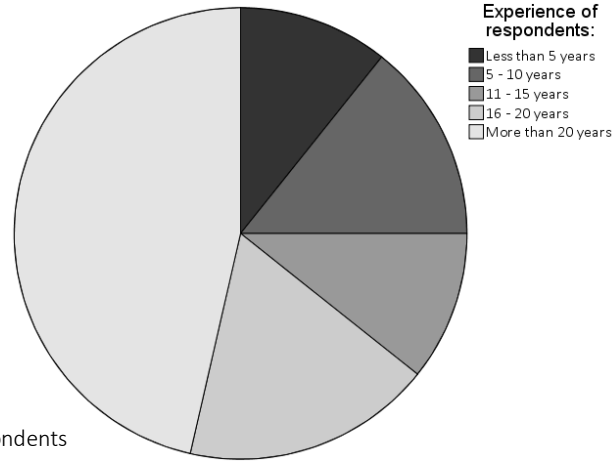


Figure 4-7 Experience of respondents

Table 4-7 Game outcome A: Lowest price procurement – Traditional approach

#	Criteria	# Consultant	# ESCo
1.	Project management organization plan, certifications & monitoring	2,333	1,933
2.	Similar types and size of projects completed	2,667	2,267
3.	Expertise, experience & nature of project manager and composed team	1,949	1,949
4.	Total costs of ownership (TCO) analysis	2,179	1,889
5.	Initial investment costs estimation	2,564	3,067
6.	Operating costs estimation	2,256	2,178
7.	Financing opportunities	1,436	1,733
8.	Financial plan, cost control & rationality of estimates	1,795	2,289
9.	Positive image of company & CSR policy	1,846	1,556
10.	Clear & pleasant communication style	2,385	1,867
11.	Customer service plan & commitment to support	2,436	1,889
12.	Experience, availability and certification of technical team	2,077	2,067
13.	Strategic partnerships with technical suppliers	1,974	1,778
14.	Delivered energy performance & user comfort	1,974	1,911
15.	Application of innovative solutions and optimizations	1,846	1,822
16.	Application of quality control system, policy & certification	2,282	2,000
17.	Transparency of work	2,205	2,200
18.	Technical flexibility of system	2,000	1,756
19.	Guarantees provided on availability rate & response time	2,077	2,067
20.	Modifications in contract	2,026	2,178
21.	Implementation plan	2,051	1,889
22.	Maintenance plan and monitoring	2,026	1,956
23.	Risk management plan	1,846	1,956

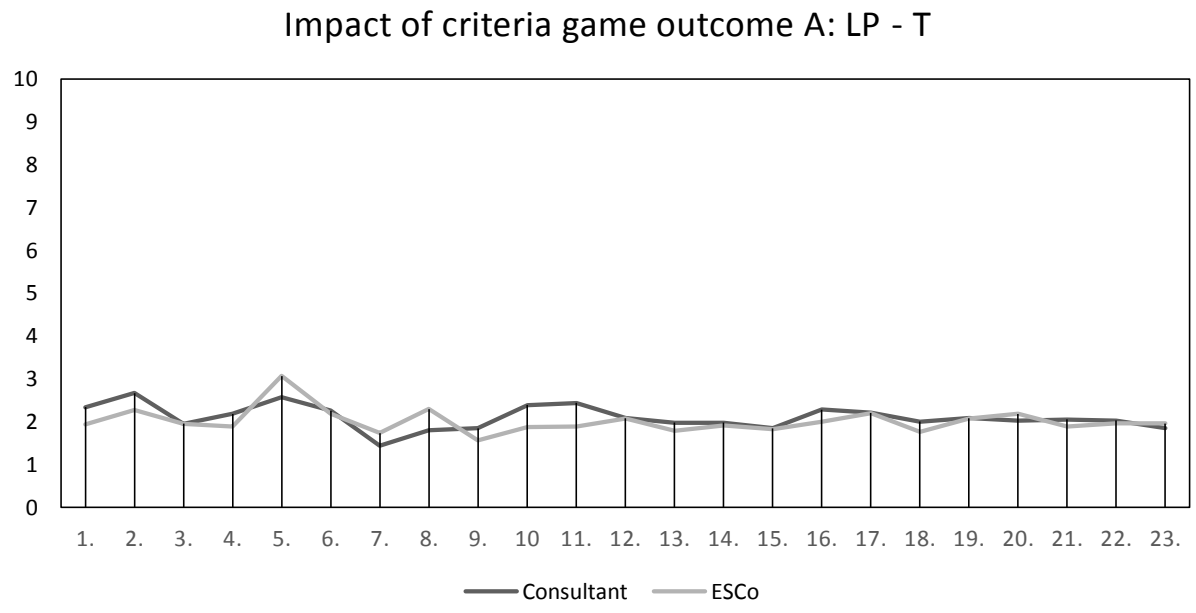


Figure 4-8 Impact levels of criteria in game outcome: lowest price procurement – traditional approach

Table 4-8 Game outcome B: Lowest price procurement – ESCo approach

#	Criteria	# Consultant	# ESCo
1.	Project management organization plan, certifications & monitoring	2,949	2,222
2.	Similar types and size of projects completed	3,974	2,356
3.	Expertise, experience & nature of project manager and composed team	2,487	2,178
4.	Total costs of ownership (TCO) analysis	3,359	2,711
5.	Initial investment costs estimation	4,077	2,444
6.	Operating costs estimation	3,462	4,156
7.	Financing opportunities	2,385	2,333
8.	Financial plan, cost control & rationality of estimates	2,462	2,644
9.	Positive image of company & CSR policy	2,949	2,022
10.	Clear & pleasant communication style	2,872	2,156
11.	Customer service plan & commitment to support	2,026	1,089
12.	Experience, availability and certification of technical team	2,949	2,200
13.	Strategic partnerships with technical suppliers	2,744	2,244
14.	Delivered energy performance & user comfort	3,231	2,422
15.	Application of innovative solutions and optimizations	3,000	2,267
16.	Application of quality control system, policy & certification	2,436	2,200
17.	Transparency of work	4,615	2,422
18.	Technical flexibility of system	2,846	2,244
19.	Guarantees provided on availability rate & response time	3,026	2,444
20.	Modifications in contract	2,333	2,400
21.	Implementation plan	2,513	2,200
22.	Maintenance plan and monitoring	3,154	2,333
23.	Risk management plan	2,872	2,267

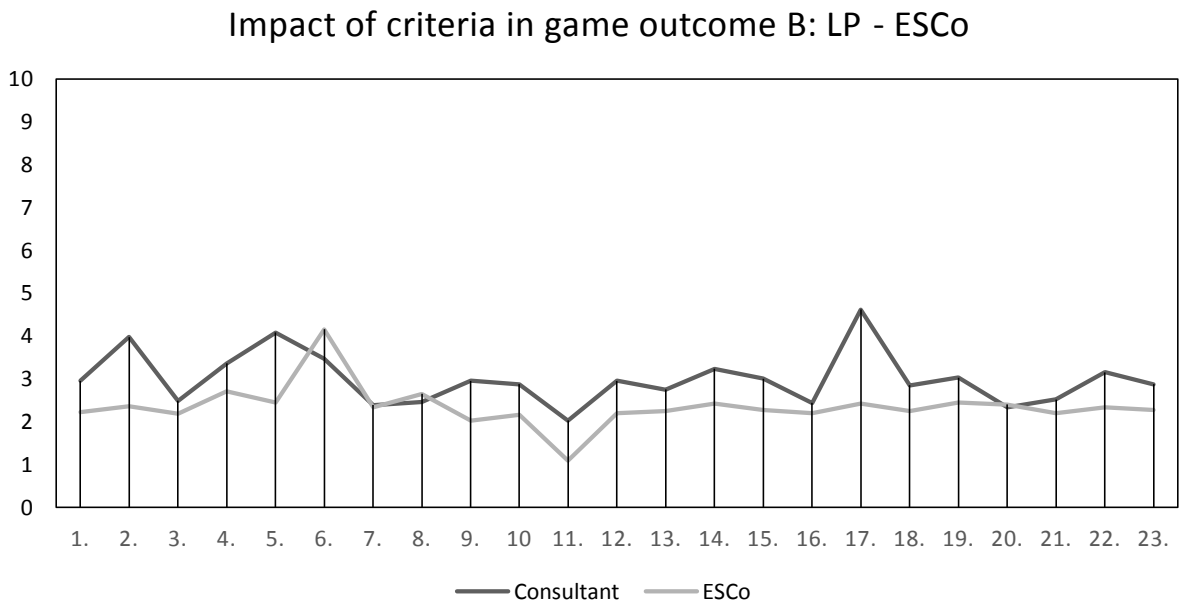


Figure 4-9 Impact levels of criteria in game outcome: lowest price procurement – ESCo approach

Table 4-9 Game outcome C: Most Economical Attractive Tender – Traditional approach

#	Criteria	# Consultant	# ESCo
1.	Project management organization plan, certifications & monitoring	4,769	4,933
2.	Similar types and size of projects completed	3,769	5,222
3.	Expertise, experience & nature of project manager and composed team	5,051	3,400
4.	Total costs of ownership (TCO) analysis	3,205	4,311
5.	Initial investment costs estimation	4,667	4,800
6.	Operating costs estimation	3,949	3,444
7.	Financing opportunities	2,974	3,089
8.	Financial plan, cost control & rationality of estimates	3,872	3,289
9.	Positive image of company & CSR policy	3,667	2,467
10.	Clear & pleasant communication style	4,692	4,044
11.	Customer service plan & commitment to support	4,436	4,733
12.	Experience, availability and certification of technical team	4,692	4,133
13.	Strategic partnerships with technical suppliers	3,641	4,044
14.	Delivered energy performance & user comfort	4,000	4,756
15.	Application of innovative solutions and optimizations	3,692	3,489
16.	Application of quality control system, policy & certification	3,410	4,600
17.	Transparency of work	4,179	5,267
18.	Technical flexibility of system	4,615	4,000
19.	Guarantees provided on availability rate & response time	4,385	5,067
20.	Modifications in contract	2,385	3,156
21.	Implementation plan	4,590	4,156
22.	Maintenance plan and monitoring	3,897	4,022
23.	Risk management plan	3,487	4,711

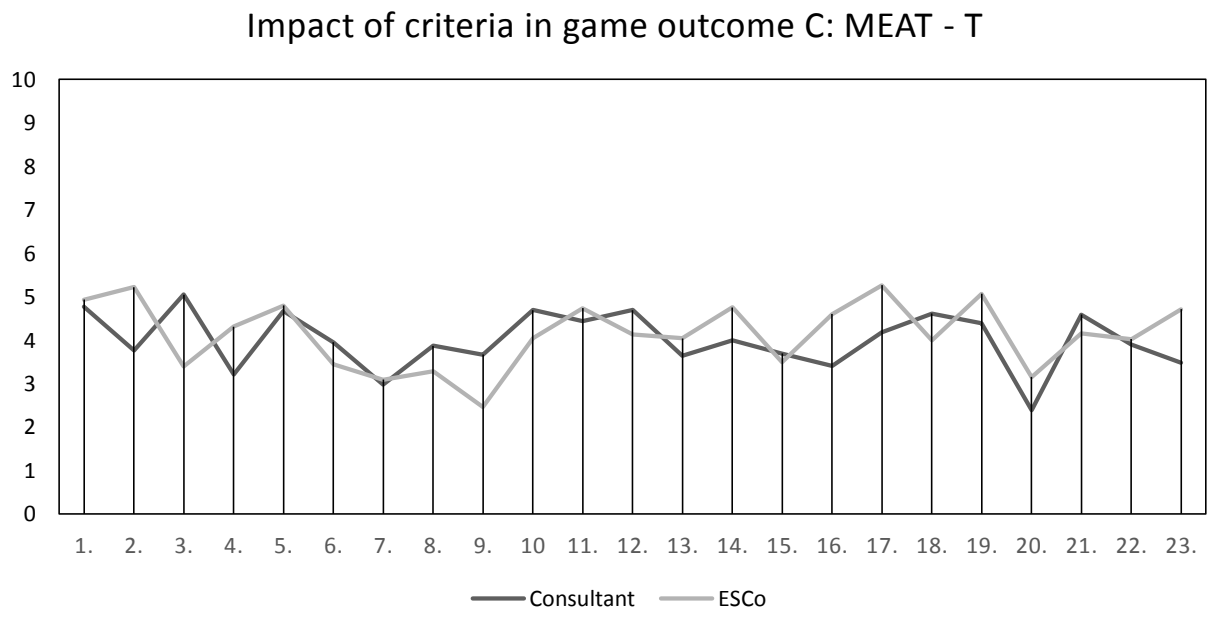


Figure 4-10 Impact levels of criteria in game outcome: Most Economical Attractive Tender procurement – traditional approach

Table 4-10 Game outcome D: Most Economical Attractive Tender – ESCo approach

#	Criteria	# Consultant	# ESCo
1.	Project management organization plan, certifications & monitoring	6,436	6,556
2.	Similar types and size of projects completed	6,436	5,867
3.	Expertise, experience & nature of project manager and composed team	5,026	5,533
4.	Total costs of ownership (TCO) analysis	6,462	6,622
5.	Initial investment costs estimation	3,667	4,022
6.	Operating costs estimation	5,410	3,867
7.	Financing opportunities	5,718	4,356
8.	Financial plan, cost control & rationality of estimates	6,205	3,378
9.	Positive image of company & CSR policy	1,556	2,822
10.	Clear & pleasant communication style	5,5890	4,178
11.	Customer service plan & commitment to support	4,974	6,022
12.	Experience, availability and certification of technical team	5,897	6,111
13.	Strategic partnerships with technical suppliers	3,974	4,356
14.	Delivered energy performance & user comfort	7,282	5,156
15.	Application of innovative solutions and optimizations	6,179	5,733
16.	Application of quality control system, policy & certification	4,026	5,178
17.	Transparency of work	5,897	6,156
18.	Technical flexibility of system	4,103	4,600
19.	Guarantees provided on availability rate & response time	4,949	5,489
20.	Modifications in contract	2,769	3,333
21.	Implementation plan	4,615	5,156
22.	Maintenance plan and monitoring	5,667	5,022
23.	Risk management plan	5,179	5,822

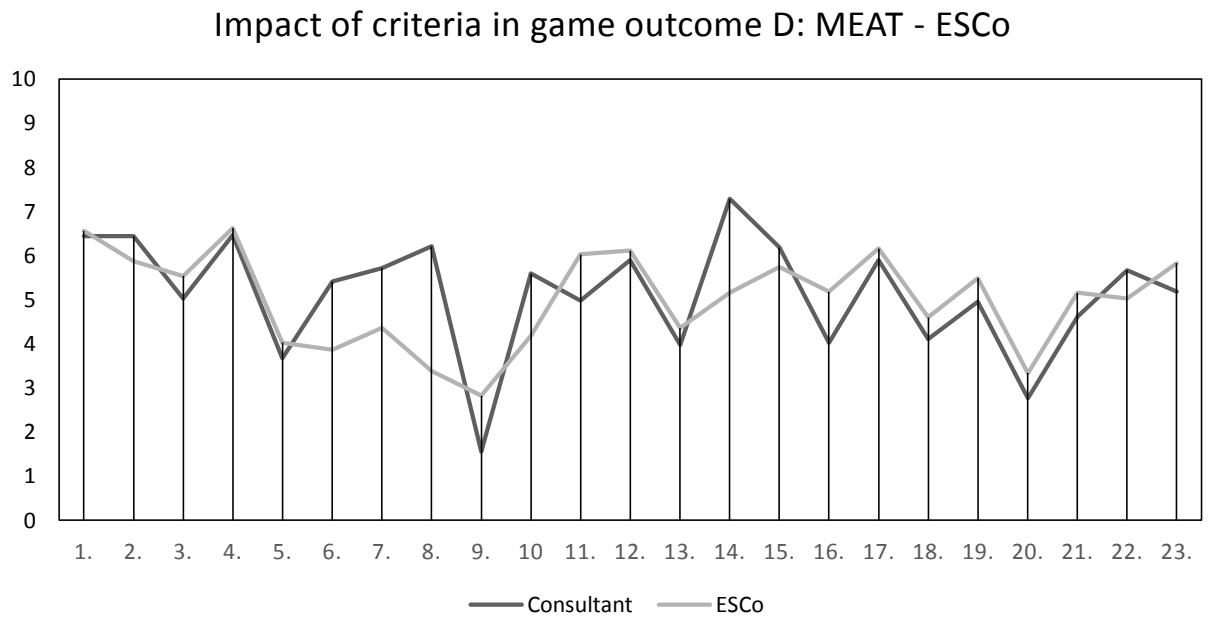


Figure 4-11 Impact levels of criteria in game outcome: Most Economical Attractive Tender procurement – ESCo approach

Table 4-11a Game outcome A: LP – T Difference between experts' opinions & ranking of both players

#	Criteria	Delta Δ	Rank p1	Rank p2
1.	Project management organization plan, certifications & monitoring	0,400	5	13
2.	Similar types and size of projects completed	0,000	1	3
3.	Expertise, experience & nature of project manager and composed team	0,000	18	12
4.	Total costs of ownership (TCO) analysis	0,291	9	15
5.	Initial investment costs estimation	-0,503	2	1
6.	Operating costs estimation	0,079	7	5
7.	Financing opportunities	-0,297	23	22
8.	Financial plan, cost control & rationality of estimates	-0,494	22	2
9.	Positive image of company & CSR policy	0,291	19	23
10.	Clear & pleasant communication style	0,518	4	18
11.	Customer service plan & commitment to support	0,547	3	16
12.	Experience, availability and certification of technical team	0,010	10	7
13.	Strategic partnerships with technical suppliers	0,197	16	20
14.	Delivered energy performance & user comfort	0,063	17	14
15.	Application of innovative solutions and optimizations	0,024	20	19
16.	Application of quality control system, policy & certification	0,282	6	9
17.	Transparency of work	0,005	8	4
18.	Technical flexibility of system	0,244	15	21
19.	Guarantees provided on availability rate & response time	0,010	11	8
20.	Modifications in contract	-0,152	13	6
21.	Implementation plan	0,162	12	17
22.	Maintenance plan and monitoring	0,070	14	10
23.	Risk management plan	-0,109	21	11

Table 4-11b Game outcome B: LP – ESCo Difference between experts' opinions & ranking of both players

#	Criteria	Delta Δ	Rank p1	Rank p2
1.	Project management organization plan, certifications & monitoring	0,726	10	16
2.	Similar types and size of projects completed	1,619	3	9
3.	Expertise, experience & nature of project manager and composed team	0,309	18	20
4.	Total costs of ownership (TCO) analysis	0,648	5	2
5.	Initial investment costs estimation	1,632	2	4
6.	Operating costs estimation	-0,694	4	1
7.	Financing opportunities	0,051	21	10
8.	Financial plan, cost control & rationality of estimates	-0,183	19	3
9.	Positive image of company & CSR policy	0,926	11	22
10.	Clear & pleasant communication style	0,716	13	21
11.	Customer service plan & commitment to support	0,937	23	23
12.	Experience, availability and certification of technical team	0,749	12	17
13.	Strategic partnerships with technical suppliers	0,499	16	14
14.	Delivered energy performance & user comfort	0,809	6	6
15.	Application of innovative solutions and optimizations	0,733	9	12
16.	Application of quality control system, policy & certification	0,236	20	18
17.	Transparency of work	2,193	1	7
18.	Technical flexibility of system	0,602	15	15
19.	Guarantees provided on availability rate & response time	0,581	8	5
20.	Modifications in contract	-0,067	22	8
21.	Implementation plan	0,313	17	19
22.	Maintenance plan and monitoring	0,821	7	11
23.	Risk management plan	0,605	14	13

Table 4-11c Game outcome C: MEAT – T Difference between experts' opinions & ranking of both players

#	Criteria	Delta Δ	Rank p1	Rank p2
1.	Project management organization plan, certifications & monitoring	-0,164	2	4
2.	Similar types and size of projects completed	-1,453	15	2
3.	Expertise, experience & nature of project manager and composed team	1,651	1	19
4.	Total costs of ownership (TCO) analysis	-1,106	21	10
5.	Initial investment costs estimation	-0,133	5	5
6.	Operating costs estimation	0,504	12	18
7.	Financing opportunities	-0,115	22	22
8.	Financial plan, cost control & rationality of estimates	0,583	14	20
9.	Positive image of company & CSR policy	1,200	17	23
10.	Clear & pleasant communication style	0,648	3	13
11.	Customer service plan & commitment to support	-0,297	8	7
12.	Experience, availability and certification of technical team	0,559	4	12
13.	Strategic partnerships with technical suppliers	-0,403	18	14
14.	Delivered energy performance & user comfort	-0,756	11	6
15.	Application of innovative solutions and optimizations	0,203	16	17
16.	Application of quality control system, policy & certification	-1,190	20	9
17.	Transparency of work	-1,087	10	1
18.	Technical flexibility of system	0,615	6	16
19.	Guarantees provided on availability rate & response time	-0,682	9	3
20.	Modifications in contract	-0,771	21	21
21.	Implementation plan	0,434	7	11
22.	Maintenance plan and monitoring	-0,125	13	15
23.	Risk management plan	-1,224	19	8

Table 4-11d Game outcome D: MEAT – ESCo Difference between experts' opinions & ranking of both players

#	Criteria	Delta Δ	Rank p1	Rank p2
1.	Project management organization plan, certifications & monitoring	-0,120	3	2
2.	Similar types and size of projects completed	0,569	4	6
3.	Expertise, experience & nature of project manager and composed team	-0,508	14	9
4.	Total costs of ownership (TCO) analysis	-0,161	2	1
5.	Initial investment costs estimation	-0,356	21	19
6.	Operating costs estimation	1,544	12	20
7.	Financing opportunities	1,362	9	16
8.	Financial plan, cost control & rationality of estimates	2,827	5	21
9.	Positive image of company & CSR policy	-1,267	23	23
10.	Clear & pleasant communication style	1,412	11	18
11.	Customer service plan & commitment to support	-1,048	15	5
12.	Experience, availability and certification of technical team	-0,214	7	4
13.	Strategic partnerships with technical suppliers	-0,381	20	17
14.	Delivered energy performance & user comfort	2,126	1	12
15.	Application of innovative solutions and optimizations	0,446	6	8
16.	Application of quality control system, policy & certification	-1,152	19	11
17.	Transparency of work	-0,258	8	3
18.	Technical flexibility of system	-0,497	18	15
19.	Guarantees provided on availability rate & response time	-0,540	16	10
20.	Modifications in contract	-0,564	22	22
21.	Implementation plan	-0,540	17	13
22.	Maintenance plan and monitoring	0,644	10	14
23.	Risk management plan	-0,643	13	7

The level of volatility increases from game outcome A to D (Figure 4-8: 4-11). Next to the volatility, also the average impact of criteria increases from game outcome A to D (Figure 4-12 & Figure 4-13). The average impact of criteria on game outcomes varies from 2.0970 to 5.1312 for the consultants, and 2.0084 to 5.0145 for the ESCo experts (Figure 4-12 & Figure 4-13)

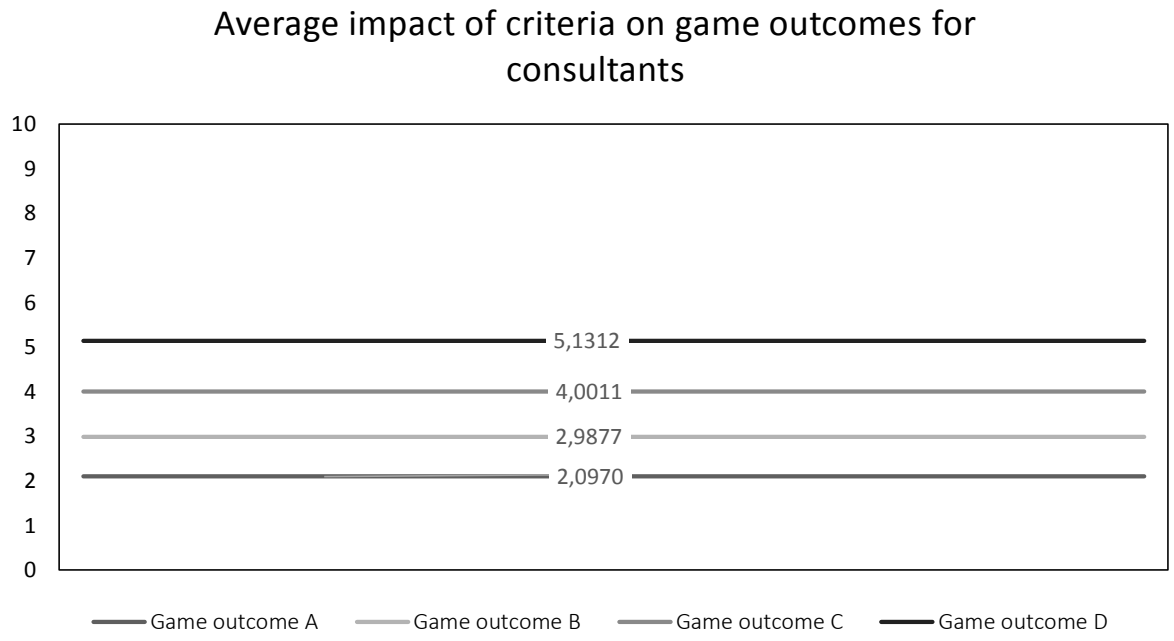


Figure 4-12 Average impact of criteria on game outcomes evaluated by the consultants

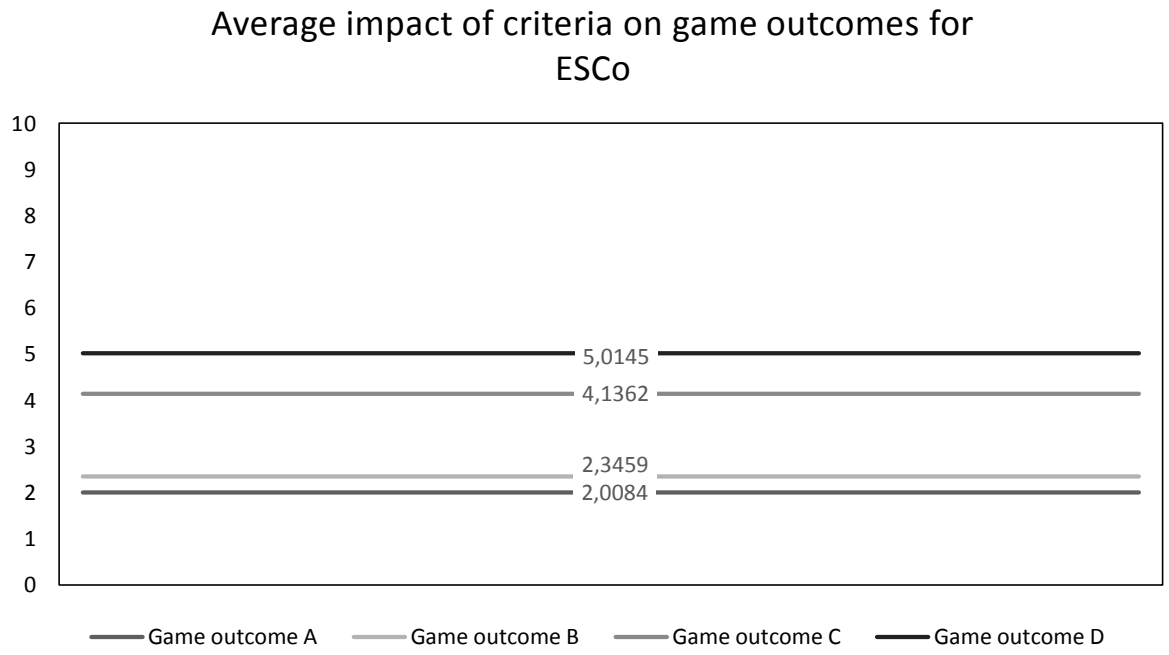


Figure 4-13 Average impact of criteria on game outcomes evaluated by the ESCo experts

4.3.5 Evaluation of projected game outcome, game choice and game outcome via impact levels

Three different game outcomes are evaluated: (1) projected game outcome, (2) game choice and (3) game outcome via impact levels. The projected game outcome is calculated by applying SPNE on the respondents' preferences collected in the FDM questionnaire. The game choice acted as a validation tool, to check whether the projected game outcome and the game choice match. A match between both game outcomes meant that respondents were acting rational. The third game outcome is a combination of the preference levels and the impact levels of criteria on these outcomes.

The preference levels of both homogenous groups on the four different outcomes (Table 4-12) are translated to payoffs (Figure 4-14). In Appendix G the evaluation of the preference levels in fuzzy numbers per outcome is displayed per respondent. Backward induction on the payoff matrix resulted in a SPNE. The SPNE resulted in the project game outcome D MEAT – ESCo. Both players have the highest preference to game outcome MEAT – ESCo. Per each individual respondent the projected game outcome is compared to the game choice. All respondents acted rational. All respondents, except two, assigned the highest preference to game outcome D. Two players prefer game outcome C MEAT – T, their game choice was game outcome C as well, which means both respondents acted rational.

The game outcome via impact levels (Figure 4-15) is calculated by the combination of the preference levels of game outcomes, the impact levels of criteria on those game outcomes and the level of the criteria (Eq.:6 & Eq.:7). The level of criteria results in an interactive process which will be elucidated in the following section (subchapter 4.3.6). When $x_{ji} = 1$, it means that the criterion is present in the tender procedure. Before the decision support tool will be discussed, first the payoffs are displayed (Figure 4-15) when all criteria are present, so when $x_{ji} = 1$ for all criteria. The application of the backward induction method on the payoff matrix of game outcomes evaluated via impact levels resulted in a SPNE, namely game outcome D MEAT – ESCo. This is the same SPNE derived via preference levels.

Table 4-12 Preference out game outcomes per player evaluated with FDM

Player	A: LP - T	B: LP - ESCo	C: MEAT - T	D: MEAT – ESCo
Consultants	2.00	2.87	4.00	5.21
ESco	1.76	3.38	4.20	7.11

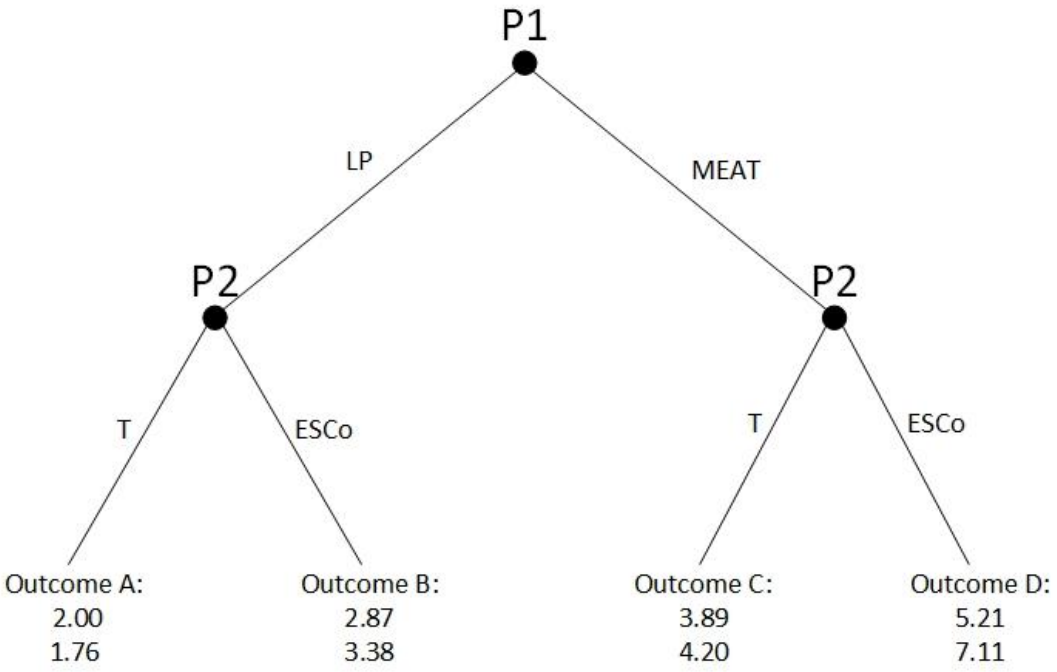


Figure 4-14 Payoffs per player via preference levels of game outcomes

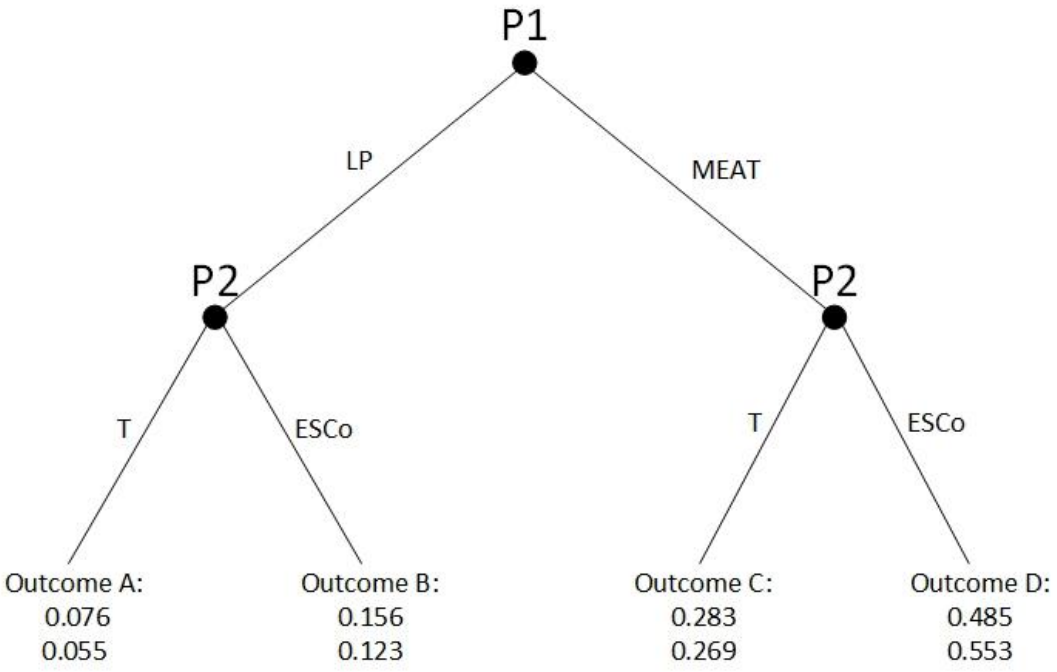


Figure 4-15 Payoffs per player via impact levels of game outcomes

4.3.6 Decision support tool

As already has been elucidated (subchapter 4.2.3) a decision support tool (DSS) is constructed. The technical consultants as well as the ESCos can independently decide to include or exclude criteria in a tender procedure. The 23 validated criteria can independently be included or excluded in the tender procedure. Consultants can decide, based upon customer' preferences, to include or exclude criteria. For instance in game outcome A LP – T consultants as well as the ESCo experts evaluated the criterion of *similar types and size of projects completed* as relatively important. Theoretically one could imagine that this criteria would be excluded of the tender procedure. Of course, in practice this would not be expected because of the level of impact on the game outcome. Nevertheless, this could be an option to both players. This process of including or excluding criteria is translated to a DSS, wherein both players independently can decide to include or exclude criteria (Figure 4-16).

The objective of the DSS is two sided. First of all it can contribute to the decision making process of ESCos, as they can evaluate the consequences of in- or excluding criteria. Namely, they can immediately derive the new estimated payoff due to the inclusion or exclusion. Secondly, ESCos can proactively approach consultants and customers, and illustrate that the payoff will rise if the customer decides to include other criteria. ESCos who will apply this DSS can generate a competitive advantage as they can actively anticipate on customer needs. Next to that, ESCos illustrate to customers that they put effort in customer satisfaction, by figuring out how to generate the highest quality for the customer. Next to these objectives, this DSS contributes to the transparency of tender procedures. Especially in ESCo tendering, wherein trust is a main barrier, transparency is essential. This DSS visually illustrates the focus of the ESCo to customers which might result in trust.

The DSS consists of three parts (Figure 4-16 & Appendix H). The four graphs on the right side, illustrate the impact levels of the 23 criteria for each of the four game outcomes. The two left tables provide negotiation options for both players, as they can include or exclude criteria. This inclusion or exclusion affects the payoff levels, which are displayed in the middle part. First the preference towards the four game outcomes is given. The game tree illustrates the payoff per game outcome via impact levels. This payoff will be affected by the negotiation options which are provided towards both players. The SPNE is automatically calculated, and will be illustrated via a *green checkmark* sign (Figure 4-16 & Appendix H).

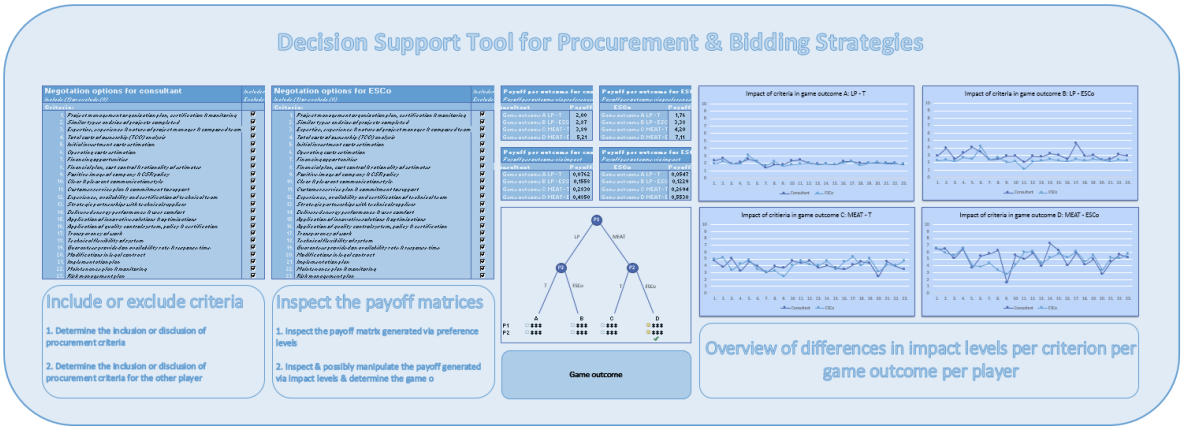


Figure 4-16 Decision support tool for procurement- & bidding strategies

4.4 Conclusion & discussion

This research provides an insight in the field of ESCo tendering. Tendering processes, and especially ESCo tendering processes become more complex. The level of complexity is partly due to the required level of mutual trust. Lack of trust is regarded as one of the main barriers in the Dutch ESCo market (Marino, Bertoldi, & Rezessy, 2010). Besides this a lot of contractual agreements and requirements are required. Therefore it is useful to figure out the decision criteria of the parties involved. Hence, customers and contractors can better match each other's' demands. A decision support tool has been introduced to provide a better understanding of decision-makers interactive behavior and expected decision outcomes. This decision support tool is constructed via the application of Fuzzy Delphi method and Game theory. In total three questionnaires have taken place to collect the required data. First of all a list of defined procurement criteria has been rated and then the new list has been validated. The validated list of 23 criteria acted as input for the FDM questionnaire. The impact levels of the different procurement criteria are evaluated under four different game outcomes. The preferences of these game outcomes have been evaluated as well. These results answer the research question: What are the impact levels of procurement criteria on the outcome of tender procedures?

Game outcome A, *Lowest Price procurement – Traditional approach* is regarded as the traditional process. The technical consultants as well as the ESCo have the same evaluations about the impact levels of the procurement criteria. All criteria are evaluated as having a low to very low impact on the outcome. This is in line with reality as initially lowest price procurement only focuses on the lowest price bid. Nevertheless the consultants still rank the criterion of similar types and size of projects completed as highest, which means that lowest price procurement is not only about the lowest price bid. This phenomenon could refer to the intrinsic value of both players.

Game outcome B, *Lowest Price procurement – ESCo approach* is not common to the field. Therefore this situation probably will not occur in reality. Nevertheless, some important notions can be made. First of all, consultants assign higher impact levels to the procurement criteria than the ESCo experts do. Especially transparency of work is stated by consultants as having a high impact on the outcome. Next to that, ESCos are focusing at operating costs, while consultants focus on initial investment costs. Both costs structures should be considered to clarify the financial statement.

Game outcome C, *MEAT procurement – Traditional approach* is a process of frequent occurrence. In contrary to game outcome A it is still relatively new. Hence, the evaluations of impact levels by both players is not in balance as it is in game outcome A. ESCos should focus more on the expertise, experience and nature of the project manager and the composed team, as this is very influential according to the input of the consultants. Transparency of work is regarded as most influential criterion by ESCos, this attitude provides opportunities to realize long term relationships as it will gain trust. Nevertheless, ESCos should not forget to apply a clear and pleasant communication style as consultants ranked it as third criteria based on impact.

Game outcome D, *MEAT procurement – ESCo approach* provides the best opportunities to employ successful ESCo projects. In this game outcome the procurement criteria are evaluated as having the highest impacts, in contrary to the other game outcomes. This means that especially in

this game outcome, the impact of all criteria is significantly higher than in the other game outcomes. Both parties agree that the TCO analysis is one of the most important procurement criteria. This analysis forms the basic analysis, which forms the business case. Nevertheless, consultants want to expand the financial statement by providing a solid financial plan, cost control and rationality of estimates. Next to this, financing opportunities are evaluated as having a moderate to high impact by the consultants. This means that ESCos should expand their financial analysis of the ESCo project to convince consultants of their bid. The delivered energy performance and user comfort has been evaluated as having the highest impact by the consultants. Consultants label it as having moderate to high impact on the game outcome, ESCo experts label it as neutral impact. ESCos should invest more effort in the business case in order to convince consultants of the ESCo approach. ESCos should enter the tender procedure with a solid business case, based on significant energy performance levels and comfort levels for the end-user. This is a result of the perception of consultants towards ESCo approaches. Consultants regard an ESCo project especially as a management tool to implement sustainable solutions on an innovative way. The delivered energy performance levels and user comfort are regarded as most influential by the consultants. This is due to the traditional core activity of technical consultants, as they strive for the best energy performance levels for the end user. Next to that ESCo should pay attention to a clear and pleasant communication style, as consultants evaluate it as moderate to high impact in contrary to ESCo who think it has moderate to low impact.

Remarkable is the drop of criterion 9 – *Positive image of company & CSR policy* in scenario D in contrary to scenario C. In an ESCo approach one would expect that the image of the contracting company is influential, as ESCo approaches result in long term relationships. However, the image is regarded as having lower impact on game outcome D as it has in game outcome C. This is due to data input. One of the respondents evaluated criterion 9 as having *extreme low impact* on all of the four game outcomes. The effect of this evaluation by that specific respondent is greater on game outcome D than on game outcome C. If this respondent evaluated the impact on all of the game outcomes as *neutral,* in total the impact of criterion 9 would be the highest on game outcome D.

Next to the evaluation of the impact levels, this research scientifically identified that both players, consultants and ESCos, prefer game outcome D, *MEAT procurement – ESCo approach*. This result provides opportunities to employ ESCos, as both players prefer the game outcome. The payoff of game outcome D is so high in relation to the other game outcomes, that there is no combination of criteria which would result in another equilibrium. This means that the decision support tool, always will lead to game outcome D as subgame perfect Nash equilibrium. However, the DSS can visually display the result of in- or excluding criteria. This tool could be helpful in negotiation procedures between customers & consultants and the ESCo. The tool can demonstrate for both parties how the payoff will be react on the in- or exclusion of specific criteria. ESCos can proactively visit customers to illustrate hypothetically the benefits of an ESCo approach.

The DSS is constructed upon impact levels and preference levels of criteria and game outcomes. For future research it would be interesting to expand this model with financial data. For instance what are the added costs of including a risk management plan? Does the increase of payoff weight up against the costs which have to be made to create the plan? Next to that, the

model could be further expanded. Next to direct consequences of ESCo, like for instance energy reduction, ESCos also contribute to secondary, not directly measurable, consequences. One could think of health of employees or about the productivity of employees. These attributes also can be calculated and implemented in the DSS to further illustrate the advantages of ESCo approaches.

Next to the creation of the DSS ESCos should involve the government. ESCo projects contribute to better environmental performances, and to better health circumstances for people. These are social activities of the government. A complete social cost-benefit analysis could be made, to visualize the benefits of ESCo projects to the government. The government acts as a reliable partner to customers. Besides this, ESCos should collaborate with network operators. On industrial areas network operators can be responsible for the network between buildings, where the ESCo will be responsible for the buildings itself.

Consultants think that an ESCo approach mainly functions as a business model to implement sustainable solutions. ESCos think they provide a full-service product with an ESCo approach. ESCos want to assure that all boundary conditions are set, while consultants are mainly focusing at financial components. Therefore, ESCos should proactively contact consultants and explain the full-service product they offer via an ESCo approach, and explain the advantages. Next to that, they should also focus on the consultants' needs, namely a solid business case. ESCos which are able to finance their projects can generate competitive advantage, as financing opportunities is regarded as having moderate to high impact by the consultants. Lack of experience in successful ESCo projects is regarded as one of the main barriers in the Dutch ESCo market. Therefore ESCos should construct a partnership, including the government, technical consultants and a construction company, to proactively contact potential customers. Via this approach a successful ESCo project could be employed, which might would stimulate the Dutch ESCo market.

Next to these remarks some final remarks regarding this research should be given. The research focused on four different game outcomes. In the future it is recommended to only focus on one game outcome, as it reduces the amount of data required. Namely, the respondents complained that the FDM questionnaire took too long. Respondents was asked to determine the impact of 23 criteria under four different game outcomes based on the FDM this resulted in a questionnaire of a total of approximately 300 inputs. This extremely high input is regarded as unpleasant by the respondents. Because of the fact that the respondents were actively involved in the complete research period, they were willing to also fill in the FDM questionnaire. Otherwise, it might resulted in too few respondents. Nevertheless, for this research enough reliable data was collected to label it as scientific reliable research.

The rating questionnaire is constructed on the evaluation of three levels: (a) *not important*, (b) *neutral* and (c) *important*. Respondents was asked to assign these levels to procurement criteria. The threshold value was stated at 50 percent. This means that if 50% or more respondents evaluate the criterion as important, the criteria would be input for the next questionnaire. This ratio (d) was calculated as follows (Eq. 8):

$$d = \frac{c}{a+b+c} \tag{8}$$

In retrospect the level (b) *neutral* could be better excluded. Neutral importance, also refers to a specific kind of importance. In future research it would be better to rate criteria on two levels: *important* and *not important*. For this method the approach of equation 8 would be appropriate.

Next to that, the DSS presents an abstraction of the reality. Not all engagements of real-life interaction processes between consultants and ESCo have been covered. The interaction process between consultant and only one ESCo has been modelled, while in real tender procedures more ESCos are involved. Nevertheless, this research provides an insight in the field of ESCo tendering and will hopefully contribute to the development of more ESCo projects.

5 Conclusion

This chapter will elucidate on the relevance of this research. First the societal relevance will be discussed. Followed up the scientific relevance. This chapter will end with a section about the beneficiary relevance.

5.1 Societal relevance

Due to agreements, like the Kyoto Protocol and the Dutch energy agreement, the Netherlands still has to put a lot of effort in the energy transition. Nevertheless, the high potential of the concept of ESCos is still not utilized. This research contributes to the practical implementation for ESCos. In the past a lot of research has been conducted on principles of ESCos, now it is time to make it reality. This research illustrates which strategies ESCos have to apply under which tender procedure in order to increase their success rate. Next to this, suggestions will be made for customers in order to involve the ESCos in tender procedures. This might lead to more ESCo projects, which will positively contribute to the energy reduction process. ESCos will contribute to the implementation of sustainable energy solutions. Next to that the level of energy efficiency will rise, which will lower the energy demand.

Another aspect in societal relevance is about health and comfort of the end-users. Next to energy savings, ESCos also focus on the comfort level of for instance employees. This might will increase the productivity and efficiency of employees. Next to that employee satisfaction will rise, which will lower absence due to sickness. First, this leads to direct benefits of the employer. Second it will lower the societal costs for the government, as less people have to stay home due to sickness.

5.2 Scientific relevance

The scientific relevance of this research is mainly about the research design. As far as known, no research has been conducted yet where impact levels of criteria are combined with preferences of outcomes to generate payoffs. The research design which is designed especially for this research, will provide opportunities in the near future. The combination of Fuzzy Delphi method and Game theory is familiar, but not the way it is applied in this research. Instead of evaluating only the game outcome, also the building blocks of the game outcome are evaluated. Game outcomes can be composed out of smaller elements, in this case the procurement criteria. Each element contributes to its extent to the payoff of the game outcome. By doing this one could easily investigate which elements of the game outcome are influential and which are not. Hence, a higher level of quality can be reached when recommendations have to be made.

Next to this relevance the decision support tool provides opportunities to further expand the attributes. For future research it would be interesting to expand this model with financial data. Next to direct consequences of ESCo, like for instance energy reduction, ESCos also contribute to secondary, not directly measurable, consequences. One could think of health of employees or about the productivity of employees. These attributes also can be calculated and implemented in the DSS to further illustrate the advantages of ESCo approaches.

5.3 Beneficiary relevance

A decision support tool has been constructed. The technical consultants as well as the ESCos can independently decide to include or exclude criteria in a tender procedure. The objective of the DSS is two sided. First of all it can contribute to the decision making process of ESCos, as they can evaluate the consequences of in- or excluding criteria. Namely, they can immediately derive the new estimated payoff due to the inclusion or exclusion. Secondly, ESCos can proactively approach consultants and customers, and illustrate that the payoff will rise if the customer decides to include other criteria. ESCos who will apply this DSS can generate a competitive advantage as they can actively anticipate on customer needs. Next to that, ESCos illustrate to customers that they put effort in customer satisfaction, by figuring out how to generate the highest quality for the customer. At the end this will lead to better end results for the customer.

Next to these objectives, this DSS contributes to the transparency of tender procedures. Especially in ESCo tendering, wherein trust is a main barrier, transparency is essential. This DSS visually illustrates the focus of the ESCo to customers which might result in trust.

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7 Appendix

A. The first questionnaire – The rating questionnaire

In onderstaande tabel zijn gunningscriteria opgenomen die uit de literatuur naar voren zijn gekomen. Aan u wordt gevraagd om per criterium aan te geven of het criterium niet belangrijk, neutraal of wel belangrijk is. Doe dit voor elk afzonderlijk criterium.

Afsluitend zal gevraagd worden om aan te geven of u nog ontbrekende criteria kent die niet in deze lijst zijn opgenomen. U wordt dan verzocht deze eraan toe te voegen.

Category	Criteria	Rating
Financial capacity	• Credit rating • Liquidity ratio • Financial soundness • Insurances • Business turnover-cash flow • Financing opportunities	Not important/ Neutral/ Important Not important/ Neutral/ Important Not important/ Neutral/ Important Not important/ Neutral/ Important Not important/ Neutral/ Important Not important/ Neutral/ Important
Health Safety Environment (HSE)	• CSR policy • Safety performance	Not important/ Neutral/ Important Not important/ Neutral/ Important
Location	• Business location • Area of catchment	Not important/ Neutral/ Important Not important/ Neutral/ Important
Project Management Expertise	• Project management organization • Management qualifications and competences • Project management monitoring • Risk management	Not important/ Neutral/ Important Not important/ Neutral/ Important Not important/ Neutral/ Important Not important/ Neutral/ Important
Past Project Performance	• Cost outcomes overruns • Past failures • Reliability • References	Not important/ Neutral/ Important Not important/ Neutral/ Important Not important/ Neutral/ Important Not important/ Neutral/ Important
Company Reputation	• Litigation tendency • Organizational maturity and stability • Desire for business	Not important/ Neutral/ Important Not important/ Neutral/ Important Not important/ Neutral/ Important
Tendered price	• Initial investment costs • Total costs of ownership (TCO) • Operating costs	Not important/ Neutral/ Important Not important/ Neutral/ Important Not important/ Neutral/ Important
Quality Control	• Quality control policy • Certification • Implemented quality systems	Not important/ Neutral/ Important Not important/ Neutral/ Important Not important/ Neutral/ Important
Client-Supplier Relations	• Trust • Commitment to support • Responsiveness • Ability to work as team • Stakeholder management • Customer service	Not important/ Neutral/ Important Not important/ Neutral/ Important Not important/ Neutral/ Important Not important/ Neutral/ Important Not important/ Neutral/ Important Not important/ Neutral/ Important
Technical Expertise	• Experience of technical personnel • Technical competence and ability • Availability and experience of technical design experts	Not important/ Neutral/ Important Not important/ Neutral/ Important Not important/ Neutral/ Important

Category	Criteria	Rating
Method/ Technical Solution	• Proposed system solution/ design	Not important/ Neutral/ Important
	• Functionality	Not important/ Neutral/ Important
	• Life cycle requirements	Not important/ Neutral/ Important
	• Flexibility of system	Not important/ Neutral/ Important
	• Degree of compliance with request for tender (RFT)	Not important/ Neutral/ Important
	• Viability of technical solution	Not important/ Neutral/ Important
	• Form of contract	Not important/ Neutral/ Important
	• Rationality of estimates	Not important/ Neutral/ Important
	• Post-delivery support	Not important/ Neutral/ Important
	• Real time data monitoring	Not important/ Neutral/ Important

Hieronder kunt u ontbrekende gunningscriteria toevoegen:

1.

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B. The second questionnaire - The validation questionnaire

Page 1

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Welkom!

Deze enquête is onderdeel van een onderzoek naar de verschillen in wensen en behoeften van de klant en de inschrijvende technisch dienstverleners. Aangezien de klant wordt vertegenwoordigd door een adviesbureau, is ervoor gekozen om de adviseur de rol van de klant op zich te laten nemen.

Deze enquête is een vervolg op interviews welke hebben plaatsgevonden, en zal als validatie dienen voor de uiteindelijke enquête waarin criteria worden gewaardeerd. **Na deze enquête volgt dus de uiteindelijke enquête.**

In de enquête zal gevraagd worden, om aan te geven welke categoriën en criteria volgens u onderdeel zijn van de aanbestedingstrajecten.

Allereerst zullen enkele introductievragen gesteld worden, alvorens de kern van de enquête zal worden toegelicht.

De enquête zal ongeveer 5-10 minuten in beslag nemen.

Bij vragen en/of opmerkingen kunt u contact opnemen met Falco Zeekaf.

Telefoonnummer: 0643484750
E-mail: flezeekaf@gmail.com

Vorige **Volgende**

Page 2

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Wat is uw geslacht?

- [ ] Man
- [x] Vrouw

Wat is uw leeftijd?

- [ ] Minder dan 20 jaar
- [ ] 21 - 30 jaar
- [ ] 31 - 40 jaar
- [x] 41 - 50 jaar
- [ ] Meer dan 50 jaar

Voor welke organisatie bent u werkzaam? (Niet verplicht om in te vullen)

Welke rol neemt u aan binnen het proces?

- [ ] Adviseur van de klant
- [x] Technisch dienstverlener (uitvoerende partij)

Hoeveel jaar bent u betrokken (geweest) op het gebied van technische installaties?

- [ ] Minder dan 5 jaar
- [x] 5 - 10 jaar
- [ ] 11 - 15 jaar
- [ ] 16 - 20 jaar
- [ ] Meer dan 20 jaar

Bent u ooit betrokken geweest bij herontwikkelingstrajecten van bestaand vastgoed waarin gebruik is gemaakt van een ESCo-constructie?

- [x] Ja
- [ ] Nee

Vorige Volgende

Page 3

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Hieronder is aangegeven op welke manier antwoord gegeven dient te worden op de categorieën en criteria. U dient aan te geven of u denkt/weet op welke categorieën en criteria inschrijvingen worden getoetst binnen aanbestedingsprocedures. Met andere woorden zijn de gestelde categorieën en criteria onderdeel van het gunningsproces. Wanneer u denkt dat dit zo is selecteert u "Ja", zo niet selecteert u "Nee". Weet u geen antwoord te geven dan selecteert u "Geen mening".

VOORBEELDOPGAVE

Geef voor de volgende categorie en daarbij horende criteria aan of ze MOGELIJK onderdeel vormen van de gunningsprocedure bij aanbestedingstrajecten. Met andere woorden: worden inschrijvingen hierop getoetst?

Categorie: Project management expertise	Ja
Criteria: Project management organisatie plan, certificering en monitoring van het project	Ja
Referenties van projecten van vergelijkbaar type en grootte	Nee
Deskundigheid, ervaring en persoonlijkheid van project manager en het project team	Nee
Vaardigheid om in een team te werken	Geen mening

Het voorbeeld geeft aan dat het categorie "Project management expertise" deel uitmaakt van de toetsing van de inschrijvingen.

Wat betreft de criteria geeft het voorbeeld aan dat de *"Project management organisatie plan, certificering en monitoring van het project"* **WEL** onderdeel zijn van de gunningscriteria.

De criteria *"Referenties van projecten van vergelijkbaar type en grootte"* en *"Deskundigheid, ervaring en persoonlijkheid van project manager en het project team"* **NIET** onderdeel maken van de toetsing.

Wat betreft de *"Vaardigheid om in een team te werken"* is het **ONBEKEND** voor de respondent of het deel uitmaakt of niet.

Let op! Er bestaan geen foute antwoorden! Het kan bijvoorbeeld best zo zijn dat u overal "Ja" antwoord.

Vorige Volgende

Page 4

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Geef voor de volgende categorie en daarbij horende criteria aan of ze MOGELIJK onderdeel vormen van de gunningsprocedure bij aanbestedingstrajecten. Met andere woorden: worden inschrijvingen hierop getoetst?

Categorie:
Project management expertise ▼

Criteria:
Project management organisatie plan, certificering en monitoring van het project ▼

Referenties van projecten van vergelijkbaar type en grootte ▼

Deskundigheid, ervaring en persoonlijkheid van project manager en het project team ▼

Vaardigheid om in een team te werken ▼

Ontbreken er volgens u nog criteria binnen deze categorie? Zo ja, dan kunt u deze hieronder toevoegen: (niet verplicht om in te vullen)

Vorige Volgende

Page 5

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Geef voor de volgende categorie en daarbij horende criteria aan of ze MOGELIJK onderdeel vormen van de gunningsprocedure bij aanbestedingstrajecten. Met andere woorden: worden inschrijvingen hierop getoetst?

Categorie:
Financiën

Criteria:
Total costs of ownership (TCO) analyse

Initiële investeringskosten raming

Exploitatie kosten raming

Financierings mogelijkheden

Financiële plan, kostenbeheerssysteem en de onderbouwing van de aannames

Ontbreken er volgens u nog criteria binnen deze categorie? Zo ja, dan kunt u deze hieronder toevoegen: (niet verplicht om in te vullen)

Vorige Volgende

Page 6

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Geef voor de volgende categorie en daarbij horende criteria aan of ze MOGELIJK onderdeel vormen van de gunningsprocedure bij aanbestedingstrajecten. Met andere woorden: worden inschrijvingen hierop getoetst?

Categorie:
Klant - dienstverlener relatie

Criteria:
Positief imago en maatschappelijk verantwoord ondernemen

Duidelijke en prettige communicatie stijl

Klanten service plan en toewijding om te ondersteunen

Ontbreken er volgens u nog criteria binnen deze categorie? Zo ja, dan kunt u deze hieronder toevoegen:
(niet verplicht om in te vullen)

Vorige Volgende

Page 7

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Geef voor de volgende categorie en daarbij horende criteria aan of ze MOGELIJK onderdeel vormen van de gunningsprocedure bij aanbestedingstrajecten. Met andere woorden: worden inschrijvingen hierop getoetst?

Categorie:
Technische expertise ▼

Criteria:
Ervaring, beschikbaarheid en certificering van het technisch team ▼

Strategische partnerships met technische leveranciers ▼

Ontbreken er volgens u nog criteria binnen deze categorie? Zo ja, dan kunt u deze hieronder toevoegen:
(niet verplicht om in te vullen)

Vorige Volgende

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Page 8

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Geef voor de volgende categorie en daarbij horende criteria aan of ze MOGELIJK onderdeel vormen van de gunningsprocedure bij aanbestedingstrajecten. Met andere woorden: worden inschrijvingen hierop getoetst?

Categorie:
Technische oplossing en kwaliteit ▼

Criteria:
Geleverde energie prestatie en het geleverde gebruikerscomfort ▼

Toepassing van innovatieve oplossingen, en het doorvoeren van optimalisaties ▼

Toepassing van een kwaliteitsbeheersysteem, het kwaliteitsbeleid en de certificering ▼

Transparantie van de inschrijving ▼

Technische flexibiliteit van het geïnstalleerde systeem ▼

Garanties op het beschikbaarheidspercentage en responstijden ▼

Aangebrachte wijzigingen in het juridische contract ▼

Ontbreken er volgens u nog criteria binnen deze categorie? Zo ja, dan kunt u deze hieronder toevoegen:
(niet verplicht om in te vullen)

Vorige Volgende

Page 9

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Geef voor de volgende categorie en daarbij horende criteria aan of ze MOGELIJK onderdeel vormen van de gunningsprocedure bij aanbestedingstrajecten. Met andere woorden: worden inschrijvingen hierop getoetst?

Categorie:
Exploitatie

Criteria:
Implementatieplan

Onderhoudsplan en de monitoring

Risicomanagement plan

Ontbreken er volgens u nog criteria binnen deze categorie? Zo ja, dan kunt u deze hieronder toevoegen:
(niet verplicht om in te vullen)

Vorige Volgende

Page 10


technische universiteit eindhoven
Gunningscriteria binnen aanbestedingsprocedures
Ontbreekt er volgens u nog een categorie met daarbij horen criteria, of is de lijst met criteria volgens u compleet?
Ja, er ontbreken nog criteria
Nee, naar mijn mening is de lijst compleet
Vorige
Volgende
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Page 11

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

In onderstaande tekstvelden kunt u de ontbrekende categorie toevoegen, en de daarbij horende criteria:

Categorie:

Criteria:

Wilt u naast deze categorie en criteria nog een categorie en daarbij horende criteria toevoegen?

- Ja, er ontbreken nog criteria
- Nee, naar mijn mening is de lijst compleet

Vorige Volgende

Page 12

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

U heeft zojuist het invullen van de eerste enquête voltooid

Deze enquête zal vervolgens dienen als input voor de uiteindelijke enquête. Ik zal u telefonisch of via email hierover op de hoogte brengen.

Ik wil u hartelijk danken voor uw medewerking!

Wanneer u op de knop **versturen** klikt worden de gegevens, **geheel anoniem**, verstuurd.

Met vriendelijke groet,

Falco Zeekaf
0643484750

Wanneer u aan- of opmerkingen heeft over de enquête kunt u deze hieronder toelichten:

Vorige **Versturen**

C. The third questionnaire – The FDM questionnaire

Page 1

Gunningscriteria binnen aanbestedingsprocedures

Welkom!

Deze enquête is onderdeel van een onderzoek naar de verschillen in wensen en behoeften van de klant en de inschrijvende technisch dienstverleners binnen aanbestedingsprocedures. Aangezien de klant wordt vertegenwoordigd door een adviesbureau, is ervoor gekozen om de adviseur de rol van de klant op zich te laten nemen.

De focus van het onderzoek is op de gunningscriteria binnen ESCo projecten en traditionele projecten. In de enquête zal gevraagd worden, om criteria te waarderen op een 1-10 schaal. Hierin is 1 de laagste/slechtste waarde en 10 de hoogste/beste waarde. De precieze uitleg zal aan de hand van een voorbeeld worden toegelicht verderop in de enquête.

Allereerst zullen enkele introductievragen gesteld worden, alvorens de kern van de enquête zal worden toegelicht.

De enquête zal ongeveer 30 minuten in beslag nemen.

Bij vragen en/of opmerkingen kunt u contact opnemen met Falco Zeekaf.

Telefoonnummer: 0643484750
E-mail: flezeekaf@gmail.com

Vorige **Volgende**

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Page 2

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Welke rol neemt u aan binnen de aanbestedingsprocedure?

- ○ Adviseur van de klant, en daarmee aan de zijde van de opdrachtgever
- ◉ Technisch dienstverlener, dus de uitvoerende partij van ofwel de ESCo ofwel de traditionele aanpak

Hoeveel jaar bent u betrokken (geweest) op het gebied van technische installaties?

- ○ Minder dan 5 jaar
- ○ 5 - 10 jaar
- ○ 11 - 15 jaar
- ○ 16 - 20 jaar
- ◉ Meer dan 20 jaar

Bent u ooit betrokken geweest bij herontwikkelingstrajecten van bestaand vastgoed waarin gebruik is gemaakt van een ESCo-constructie?

- ○ Ja
- ◉ Nee

Voor welke organisatie bent u werkzaam? (Niet verplicht om in te vullen)

Vorige Volgende

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Page 3

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Evaluatie van de afzonderlijke criteria onder verschillende scenario's

In de hierna volgende pagina's volgen de verschillende criteria welke gewaardeerd dienen te worden. Iedere pagina zal één enkel criteria bevatten. Ieder criteria dient geëvalueerd te worden onder vier verschillende scenario's. De scenario's zijn in alle gevallen hetzelfde:

Scenario A. Het scenario waarbij technisch dienstverleners op een **traditionele wijze** inschrijven op een aanbesteding met gunning op basis van **laagste prijs**

Scenario B. Het scenario waarbij technisch dienstverleners middels een **ESCo aanpak** inschrijven op een aanbesteding met gunning op basis van **laagste prijs**

Scenario C. Het scenario waarbij technisch dienstverleners op een **traditionele wijze** inschrijven op een aanbesteding met gunning op basis van **de EMVI methode**

Scenario D. Het scenario waarbij technisch dienstverleners middels een **ESCo aanpak** inschrijven op een aanbesteding met gunning op basis van **de EMVI methode**

LET OP!

Een ESCo is gedefinieerd als een organisatie die energie diensten en/of energiebesparende maatregelen doorvoert in een gebouw. Hierbij worden afspraken gemaakt, welke worden vastgelegd in een prestatiecontract. De ESCo kan garant staan voor de financiering van het project.

Binnen dit onderzoek wordt uitgegaan van een gebouw-ESCo. Hierin neemt de ESCo de volledige herontwikkeling van het gebouw voor zijn rekening. Vanuit deze definitie en oogpunt dienen de afzonderlijke criteria dan ook te worden gewaardeerd.

Vorige | Volgende

Page 4

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

De toelichting op de termen die gelden bij de verschillende scenario's zijn als volgt:

1. Een traditionele wijze van inschrijven door de technisch dienstverleners:

Deze manier van inschrijven wordt gekenmerkt door een lage waarde van complexiteit, waarbij enkel en alleen installaties worden geleverd en geïnstalleerd, dit tegen een zo laag mogelijke prijs. Na oplevering wordt de samenwerking tussen de dienstverlener en opdrachtgever verbroken.

2.Een technisch dienstverlener schrijft in aan de hand van een ESCo aanpak:

Deze manier van inschrijven wordt gekenmerkt door een hoge mate van complexiteit. Binnen de ESCo aanpak, wordt een langdurig contract aangegaan van 10-15 jaar. Hierin wordt het volledige vastgoedobject herontwikkeld en wordt het energieverbruik gereduceerd.

3.Een aanbesteding aan de hand van gunning op basis van laagste prijs:

Het laagste prijs criterium is het meest eenvoudige criterium om te gunnen. Slechts de prijs telt. Een inschrijving die niet aan de minimumkwaliteit voldoet wordt terzijde gelegd, een inschrijving die uitgaat boven de minimumkwaliteit wordt niet extra gewaardeerd.

4.Een aanbesteding aan de hand van gunning op basis van de EMVI methode:

Bij EMVI (economisch meest voordelige inschrijving) kunnen naast prijs andere criteria meegewogen worden. De aanbesteder is vrij in het kiezen van het aantal en soort gunningscriteria. Het relatieve gewicht per criterium dient vastgesteld te worden. Hierdoor kunnen achteraf scores per inschrijving worden bepaald, waarbij (normaliter) de hoogst scorende partij wint.

Vorige Volgende

Page 5

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

DEEL 1

In dit deel zal u gevraagd worden om per scenario aan te geven in welke mate u dit scenario wenst. U dient uw voorkeur uit te spreken jegens de vier afzonderlijke scenario's.

Hieronder is de invultabel weergegeven zoals deze op de volgende pagina zal worden toegepast. Er wordt gevraagd naar uw voorkeur ten aanzien van de vier verschillende scenario's.

De voorkeur houdt in welke mate u het betreffende scenario wenst voor te komen.

De voorkeur van elk van de scenario's dient door middel van drie waardes te worden weergegeven. De minimale en maximale waarde geven de range aan van uw voorkeur. Er wordt gevraagd om een range toe te kennen, aangezien onder verschillende markt omstandigheden en afhankelijk van de casus uw voorkeur kan variëren binnen deze range. De optimale waarde geeft uw algemene voorkeur weer die afhankelijk is van uw ervaring in verschillende projecten.

Let op! De minimale waarde mag niet groter zijn dan de optimale waarde, en de optimale waarde mag niet groter zijn dan de maximale waarde.

VOORBEELDOPGAVE
Gevraagd wordt om per scenario aan te geven in hoeverre u dit scenario wenst. Met andere woorden: Geef uw voorkeur aan ten aanzien van de scenario's.

	Minimaal	Optimaal	Maximaal
Scenario A: Gunning op basis van **laagste prijs**. Inschrijving op **traditionele wijze**. Uw voorkeur	5 - Neutraal	6 -	7 - Enigzins gewenst
Scenario B: Gunning op basis van **laagste prijs**. Inschrijving middels een **ESCo aanpak**. Uw voorkeur	1 - Zeer ongewenst	2 -	3 - Enigzins ongewenst
Scenario C: Gunning op basis van **de EMVI methode**. Inschrijving op **traditionele wijze**. Uw voorkeur	3 - Eningzins ongewenst	4 -	5 - Neutraal
Scenario D: Gunning op basis van **de EMVI methode**. Inschrijving middels een **ESCo aanpak**. Uw voorkeur	8 -	9 - Zeer gewenst	10 - Extreem gewenst

Het voorbeeld van bovenstaande tabel geeft aan dat **scenario A** op een schaal van 1 tot 10, gewaardeerd wordt van 5 - 7, het optimum van deze range ligt bij 6. Dit betekent dat het scenario op 1-10 schaal, gewenst wordt met een waarde **6 -** . Met als minimale waarde **5 - Neutraal** en maximaal **7 - Eningzins gewenst**.

Vorige Volgende

Page 6

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Alvorens de afzonderlijke criteria worden gewaardeerd. Wordt eerst uw voorkeur gevraagd ten aanzien van de vier verschillende scenario's.

Hieronder staan vier verschillende scenario's omschreven, welke steeds terug zullen komen in dit onderzoek.

Gevraagd wordt om per scenario aan te geven in hoeverre u dit scenario wenst. Met andere woorden: Geef uw voorkeur aan ten aanzien van de scenario's.

	Minimaal	Optimaal	Maximaal
Scenario A: Gunning op basis van **laagste prijs**. Inschrijving op **traditionele wijze**. Uw voorkeur	▼	▼	▼
Scenario B: Gunning op basis van **laagste prijs**. Inschrijving middels een **ESCo aanpak**. Uw voorkeur	▼	▼	▼
Scenario C: Gunning op basis van **de EMVI methode**. Inschrijving op **traditionele wijze**. Uw voorkeur	▼	▼	▼
Scenario D: Gunning op basis van **de EMVI methode**. Inschrijving middels een **ESCo aanpak**. Uw voorkeur	▼	▼	▼

Vorige Volgende

Page 7

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

U heeft zojuist uw voorkeur uitgesproken ten aanzien van de vier verschillende scenario's. Hieronder wordt nogmaals een vraag gesteld ten aanzien van deze scenario's:

Afgezien van de ingevulde waardes op de vorige pagina, welk scenario leidt tot volgens u tot het beste resultaat, voor zowel de opdrachtgever als de uitvoerende ESCo?

- (•) Gunning op basis van laagste prijs. Inschrijving op traditionele wijze.
- ( ) Gunning op basis van laagste prijs. Inschrijving middels een ESCo aanpak.
- ( ) Gunning op basis van de EMVI methode. Inschrijving op traditionele wijze.
- ( ) Gunning op basis van de EMVI methode. Inschrijving middels een ESCo aanpak.

Vorige **Volgende**

Page 8

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

DEEL 2

In dit deel zal u gevraagd worden om per criterium aan te geven wat de impact van het betreffende criterium is op de uiteindelijke keuze van gunning. Wat is de impact van het criterium op de einduitkomst van de aanbesteding?

De impact van de criteria dienen te gewaardeerd te worden onder de vier verschillende scenario's. De impact dient op een zelfde manier te worden aangegeven als u uw voorkeur heeft uitgesproken over de afzonderlijke scenario's.

De impact van elk van de scenario's dient door middel van drie waardes te worden weergegeven. De minimale en maximale waarde geven de range aan van de impact. Er wordt gevraagd om een range toe te kennen, aangezien onder verschillende markt omstandigheden en afhankelijk van de casus de impact van een criteria op de gunning kan variëren binnen deze range. De optimale waarde geeft de algemene impact weer die u door uw ervaring tegen bent gekomen binnen projecten.

Vorige **Volgende**

Page 9

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Beoordeel in welke mate u het **project management organisatie plan, de certificering en monitoring van het project** impact vindt hebben op de keuze van gunning onder de afzonderlijke scenario's.

De project management organisatie houdt in, door middel van welke organisatie structuur het project wordt bestuurd. De certificering welke de dienstverlener daarvoor bezit, en op welke manier de dienstverlener beoogd dit te monitoren.

	Minimaal	Optimaal	Maximaal
Scenario A: Gunning op basis van **laagste prijs**. Inschrijving op **traditionele wijze**. Uw mening	▼	▼	▼
Scenario B: Gunning op basis van **laagste prijs**. Inschrijving middels een **ESCo aanpak**. Uw mening	▼	▼	▼
Scenario C: Gunning op basis van **de EMVI methode**. Inschrijving op **traditionele wijze**. Uw mening	▼	▼	▼
Scenario D: Gunning op basis van **de EMVI methode**. Inschrijving middels een **ESCo aanpak**. Uw mening	▼	▼	▼

Vorige Volgende

Page 10

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Beoordeel in welke mate u het hebben van **referenties van vergelijkbare types en grootte van projecten door de technisch dienstverlener** impact vindt hebben op de keuze van gunning onder de afzonderlijke scenario's.

	Minimaal	Optimaal	Maximaal
Scenario A: Gunning op basis van **laagste prijs**. Inschrijving op **traditionele wijze**. Uw mening	▼	▼	▼
Scenario B: Gunning op basis van **laagste prijs**. Inschrijving middels een **ESCo aanpak**. Uw mening	▼	▼	▼
Scenario C: Gunning op basis van **de EMVI methode**. Inschrijving op **traditionele wijze**. Uw mening	▼	▼	▼
Scenario D: Gunning op basis van **de EMVI methode**. Inschrijving middels een **ESCo aanpak**. Uw mening	▼	▼	▼

Vorige Volgende

Page 11

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Beoordeel in welke mate u de **deskundigheid, ervaring en de persoonlijkheid van de projectmanager en het project team** impact vindt hebben op de keuze van gunning onder de afzonderlijke scenario's.

	Minimaal	Optimaal	Maximaal
Scenario A: Gunning op basis van **laagste prijs**. Inschrijving op **traditionele wijze**. Uw mening	▼	▼	▼
Scenario B: Gunning op basis van **laagste prijs**. Inschrijving middels een **ESCo aanpak**. Uw mening	▼	▼	▼
Scenario C: Gunning op basis van **de EMVI methode**. Inschrijving op **traditionele wijze**. Uw mening	▼	▼	▼
Scenario D: Gunning op basis van **de EMVI methode**. Inschrijving middels een **ESCo aanpak**. Uw mening	▼	▼	▼

Vorige Volgende

Page 12

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Beoordeel in welke mate u de **Total cost of ownership (TCO) analyse** impact vindt hebben op de keuze van gunning onder de afzonderlijke scenario's.

Total cost of ownership is gebaseerd op het volledig inzichtelijk maken van alle kosten gerelateerd aan de aanschaf en gebruik gedurende de levenscyclus van de installaties.

	Minimaal	Optimaal	Maximaal
Scenario A: Gunning op basis van **laagste prijs**. Inschrijving op **traditionele wijze**. **Uw mening**	▼	▼	▼
Scenario B: Gunning op basis van **laagste prijs**. Inschrijving middels een **ESCo aanpak**. **Uw mening**	▼	▼	▼
Scenario C: Gunning op basis van de **EMVI methode**. Inschrijving op **traditionele wijze**. **Uw mening**	▼	▼	▼
Scenario D: Gunning op basis van de **EMVI methode**. Inschrijving middels een **ESCo aanpak**. **Uw mening**	▼	▼	▼

Vorige Volgende

Page 13

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Beoordeel in welke mate u de **initiële investeringskosten raming** impact vindt hebben op de keuze van gunning onder de afzonderlijke scenario's.

De initiële investeringskosten, zijn de investeringskosten bij aanvang van het project.

	Minimaal	Optimaal	Maximaal
Scenario A: Gunning op basis van **laagste prijs**. Inschrijving op **traditionele wijze**. Uw mening			
Scenario B: Gunning op basis van **laagste prijs**. Inschrijving middels een **ESCo aanpak**. Uw mening			
Scenario C: Gunning op basis van **de EMVI methode**. Inschrijving op **traditionele wijze**. Uw mening			
Scenario D: Gunning op basis van **de EMVI methode**. Inschrijving middels een **ESCo aanpak**. Uw mening			

Vorige Volgende

Page 14

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Beoordeel in welke mate u de **exploitatie kosten raming** impact vindt hebben op de keuze van gunning onder de afzonderlijke scenario's.

Exploitatiekosten zijn kosten die gemaakt worden gedurende de gehele exploitatieduur van de installaties.

	Minimaal	Optimaal	Maximaal
Scenario A: Gunning op basis van **laagste prijs**. Inschrijving op **traditionele wijze**. Uw mening			
Scenario B: Gunning op basis van **laagste prijs**. Inschrijving middels een **ESCo aanpak**. Uw mening			
Scenario C: Gunning op basis van de **EMVI methode**. Inschrijving op **traditionele wijze**. Uw mening			
Scenario D: Gunning op basis van de **EMVI methode**. Inschrijving middels een **ESCo aanpak**. Uw mening			

Vorige Volgende

Page 15

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Beoordeel in welke mate u de **financieringsmogelijkheden vanuit de technisch dienstverlener** impact vindt hebben op de keuze van gunning onder de afzonderlijke scenario's.

Financieringsmogelijkheden houdt in dat de technisch dienstverlener kan zorgen voor de financiering van het project. Dit betekent dat de opdrachtgever deze financiering uitbesteedt aan de dienstverlener.

	Minimaal	Optimaal	Maximaal
Scenario A: Gunning op basis van **laagste prijs**. Inschrijving op **traditionele wijze**. **Uw mening**	▼	▼	▼
Scenario B: Gunning op basis van **laagste prijs**. Inschrijving middels een **ESCo aanpak**. **Uw mening**	▼	▼	▼
Scenario C: Gunning op basis van **de EMVI methode**. Inschrijving op **traditionele wijze**. **Uw mening**	▼	▼	▼
Scenario D: Gunning op basis van **de EMVI methode**. Inschrijving middels een **ESCo aanpak**. **Uw mening**	▼	▼	▼

Vorige Volgende

Page 16

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Beoordeel in welke mate u het **financiële plan, kostenbeheerssysteem en de onderbouwing van de aannames** impact vindt hebben op de keuze van gunning onder de afzonderlijke scenario's.

Het financiële plan geeft aan op welke manier het project wordt gefinancierd gedurende de hele looptijd van het contract. Daarnaast wordt aangegeven hoe kosten worden beheerst. Dit alles wordt onderbouwd door middel van aannames en schattingen, aangezien er dikwijls over langere termijnen wordt gesproken met hoge onzekerheden en risico's. Deze aannames dienen onderbouwd te worden.

	Minimaal	Optimaal	Maximaal
Scenario A: Gunning op basis van **laagste prijs**. Inschrijving op **traditionele wijze**. Uw mening	▼	▼	▼
Scenario B: Gunning op basis van **laagste prijs**. Inschrijving middels een **ESCo aanpak**. Uw mening	▼	▼	▼
Scenario C: Gunning op basis van **de EMVI methode**. Inschrijving op **traditionele wijze**. Uw mening	▼	▼	▼
Scenario D: Gunning op basis van **de EMVI methode**. Inschrijving middels een **ESCo aanpak**. Uw mening	▼	▼	▼

Vorige Volgende

Page 17

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Beoordeel in welke mate u een positief imago en de maatschappelijk-verantwoord-ondernemen activiteiten van de technisch dienstverlener impact vindt hebben op de keuze van gunning onder de afzonderlijke scenario's.

	Minimaal	Optimaal	Maximaal
Scenario A: Gunning op basis van laagste prijs. Inschrijving op traditionele wijze. Uw mening			
Scenario B: Gunning op basis van laagste prijs. Inschrijving middels een ESCo aanpak. Uw mening			
Scenario C: Gunning op basis van de EMVI methode. Inschrijving op traditionele wijze. Uw mening			
Scenario D: Gunning op basis van de EMVI methode. Inschrijving middels een ESCo aanpak. Uw mening			

Vorige Volgende

Page 18

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Beoordeel in welke mate u een **duidelijke en prettige communicatie stijl** impact vindt hebben op de keuze van gunning onder de afzonderlijke scenario's.

Met de belangrijkheid van de communicatie stijl, bedoelt men in hoeverre de communicatie stijl voor u van belang is binnen de beoordeling van de inschrijvingen binnen aanbestedingsprocedures.

	Minimaal	Optimaal	Maximaal
Scenario A: Gunning op basis van **laagste prijs**. Inschrijving op **traditionele wijze**. **Uw mening**			
Scenario B: Gunning op basis van **laagste prijs**. Inschrijving middels een **ESCo aanpak**. **Uw mening**			
Scenario C: Gunning op basis van **de EMVI methode**. Inschrijving op **traditionele wijze**. **Uw mening**			
Scenario D: Gunning op basis van **de EMVI methode**. Inschrijving middels een **ESCo aanpak**. **Uw mening**			

Vorige Volgende

Page 19

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Beoordeel in welke mate u het klanten service plan en de toewijding van de technisch dienstverlener om te ondersteunen impact vindt hebben op de keuze van gunning onder de afzonderlijke scenario's.

Klanten service omschrijft alle handelingen die worden genomen om het gemak van de opdrachtgever te dienen. Dit gaat gepaard met ondersteunde activiteiten die worden gefaciliteerd door de technisch dienstverlener.

	Minimaal	Optimaal	Maximaal
Scenario A: Gunning op basis van laagste prijs. Inschrijving op traditionele wijze. Uw mening	▼	▼	▼
Scenario B: Gunning op basis van laagste prijs. Inschrijving middels een ESCo aanpak. Uw mening	▼	▼	▼
Scenario C: Gunning op basis van de EMVI methode. Inschrijving op traditionele wijze. Uw mening	▼	▼	▼
Scenario D: Gunning op basis van de EMVI methode. Inschrijving middels een ESCo aanpak. Uw mening	▼	▼	▼

Vorige Volgende

Page 20

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Beoordeel in welke mate u de **ervaring, beschikbaarheid en certificering van het technisch team** impact vindt hebben op de keuze van gunning onder de afzonderlijke scenario's.

Het technisch team zijn de personen, welke onderdeel vormen van het project team en verantwoordelijk zijn voor de daadwerkelijke uitvoering.

	Minimaal	Optimaal	Maximaal
Scenario A: Gunning op basis van **laagste prijs**. Inschrijving op **traditionele wijze**. **Uw mening**			
Scenario B: Gunning op basis van **laagste prijs**. Inschrijving middels een **ESCo aanpak**. **Uw mening**			
Scenario C: Gunning op basis van **de EMVI methode**. Inschrijving op **traditionele wijze**. **Uw mening**			
Scenario D: Gunning op basis van **de EMVI methode**. Inschrijving middels een **ESCo aanpak**. **Uw mening**			

Vorige Volgende

Page 21

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Beoordeel in welke mate u de **strategische partnerships van de technisch dienstverlener met technische leveranciers** impact vindt hebben op de keuze van gunning onder de afzonderlijke scenario's.

Strategische partnerships met leveranciers duidt op structurele langdurige samenwerkingsverbanden tussen leveranciers en de technisch dienstverlener.

	Minimaal	Optimaal	Maximaal
Scenario A: Gunning op basis van **laagste prijs**. Inschrijving op **traditionele wijze**. **Uw mening**	▼	▼	▼
Scenario B: Gunning op basis van **laagste prijs**. Inschrijving middels een **ESCo aanpak**. **Uw mening**	▼	▼	▼
Scenario C: Gunning op basis van de **EMVI methode**. Inschrijving op **traditionele wijze**. **Uw mening**	▼	▼	▼
Scenario D: Gunning op basis van de **EMVI methode**. Inschrijving middels een **ESCo aanpak**. **Uw mening**	▼	▼	▼

Vorige Volgende

Page 22

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Beoordeel in welke mate u de **geleverde energie prestaties en het geleverde gebruikerscomfort** impact vindt hebben op de keuze van gunning onder de afzonderlijke scenario's.

De geleverde energie prestaties verwijzen naar de concrete prestaties van de technische oplossing. Het comfort verwijst naar het niveau van comfort, welke gerealiseerd zal worden voor de klant door middel van de technische oplossing.

	Minimaal	Optimaal	Maximaal
Scenario A: Gunning op basis van **laagste prijs**. Inschrijving op **traditionele wijze**. Uw mening			
Scenario B: Gunning op basis van **laagste prijs**. Inschrijving middels een **ESCo aanpak**. Uw mening			
Scenario C: Gunning op basis van de **EMVI methode**. Inschrijving op **traditionele wijze**. Uw mening			
Scenario D: Gunning op basis van de **EMVI methode**. Inschrijving middels een **ESCo aanpak**. Uw mening			

Vorige Volgende

Page 23

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Beoordeel in welke mate u de **toepassing van innovatieve oplossingen, en het doorvoeren van optimalisaties** impact vindt hebben op de keuze van gunning onder de afzonderlijke scenario's.

Onder de toepassing van innovatieve oplossingen, wordt verondersteld dat een technisch dienstverlener zelf vernieuwingen implementeert in het plan. Dit om te zorgen voor optimalisatie van de resultaten van de opdrachtgever.

	Minimaal	Optimaal	Maximaal
Scenario A: Gunning op basis van **laagste prijs**. Inschrijving op **traditionele wijze**. **Uw mening**	▼	▼	▼
Scenario B: Gunning op basis van **laagste prijs**. Inschrijving middels een **ESCo aanpak**. **Uw mening**	▼	▼	▼
Scenario C: Gunning op basis van **de EMVI methode**. Inschrijving op **traditionele wijze**. **Uw mening**	▼	▼	▼
Scenario D: Gunning op basis van **de EMVI methode**. Inschrijving middels een **ESCo aanpak**. **Uw mening**	▼	▼	▼

Vorige Volgende

Page 24

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Beoordeel in welke mate u de **toepassing van een kwaliteitsbeheersysteem, het kwaliteitsbeleid en de certificering van de technisch dienstverlener hierin** impact vindt hebben op de keuze van gunning onder de afzonderlijke scenario's.

Het kwaliteitsbeheersysteem illustreert op welke manier de kwaliteit voor de gebruiker wordt gegarandeerd. Het kwaliteitsbeleid geeft aan, welk beleid de technisch dienstverlener intern voert om de kwaliteit te garanderen. Certificering indiceert en onderbouwd de mate van professionaliteit op het gebied van kwaliteitsbeheersing van de technisch dienstverlener.

	Minimaal	Optimaal	Maximaal
Scenario A: Gunning op basis van **laagste prijs**. Inschrijving op **traditionele wijze**. **Uw mening**	▼	▼	▼
Scenario B: Gunning op basis van **laagste prijs**. Inschrijving middels een **ESCo aanpak**. **Uw mening**	▼	▼	▼
Scenario C: Gunning op basis van **de EMVI methode**. Inschrijving op **traditionele wijze**. **Uw mening**	▼	▼	▼
Scenario D: Gunning op basis van **de EMVI methode**. Inschrijving middels een **ESCo aanpak**. **Uw mening**	▼	▼	▼

Vorige Volgende

Page 25

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Beoordeel in welke mate u de **transparantie van de inschrijving** impact vindt hebben op de keuze van gunning onder de afzonderlijke scenario's.

Met de transparantie wordt verwezen naar de mate waarin een technisch dienstverlener openheid geeft van zijn plannen en de risico's die daarbij komen kijken.

	Minimaal	Optimaal	Maximaal
Scenario A: Gunning op basis van **laagste prijs**. Inschrijving op **traditionele wijze**. Uw mening			
Scenario B: Gunning op basis van **laagste prijs**. Inschrijving middels een **ESCo aanpak**. Uw mening			
Scenario C: Gunning op basis van **de EMVI methode**. Inschrijving op **traditionele wijze**. Uw mening			
Scenario D: Gunning op basis van **de EMVI methode**. Inschrijving middels een **ESCo aanpak**. Uw mening			

Vorige Volgende

Page 26

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Beoordeel in welke mate u de **technische flexibiliteit van het geïnstalleerd systeem** impact vindt hebben op de keuze van gunning onder de afzonderlijke scenario's.

De technische flexibiliteit van het geïnstalleerd systeem, refereert naar de mogelijkheid om gedurende de exploitatiefase relatief eenvoudig aanpassingen door te voeren in het systeem. Denk aan mogelijke aanpassing van leidingen, doordat scheidingsmuren gedurende de levensduur veranderen van locatie.

	Minimaal	Optimaal	Maximaal
Scenario A: Gunning op basis van **laagste prijs**. Inschrijving op **traditionele wijze**. Uw mening	▼	▼	▼
Scenario B: Gunning op basis van **laagste prijs**. Inschrijving middels een **ESCo aanpak**. Uw mening	▼	▼	▼
Scenario C: Gunning op basis van **de EMVI methode**. Inschrijving op **traditionele wijze**. Uw mening	▼	▼	▼
Scenario D: Gunning op basis van **de EMVI methode**. Inschrijving middels een **ESCo aanpak**. Uw mening	▼	▼	▼

Vorige Volgende

Page 27

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Beoordeel in welke mate u de **garanties op het beschikbaarheidspercentage van het systeem en de daarbij horende responstijd** impact vindt hebben op de keuze van gunning onder de afzonderlijke scenario's.

Het beschikbaarheidspercentage verwijst naar de mate waarin de technisch dienstverlener kan garanderen dat het systeem functioneert. Dit wordt onderbouwd door ervaringen uit het verleden. De responstijd verwijst naar de snelheid van herstel wanneer het systeem niet functioneert. Met andere woorden; hoe snel is de technisch dienstverlener aanwezig om de problemen te verhelpen.

	Minimaal	Optimaal	Maximaal
Scenario A: Gunning op basis van **laagste prijs**. Inschrijving op **traditionele wijze**. Uw mening	▼	▼	▼
Scenario B: Gunning op basis van **laagste prijs**. Inschrijving middels een **ESCo aanpak**. Uw mening	▼	▼	▼
Scenario C: Gunning op basis van **de EMVI methode**. Inschrijving op **traditionele wijze**. Uw mening	▼	▼	▼
Scenario D: Gunning op basis van **de EMVI methode**. Inschrijving middels een **ESCo aanpak**. Uw mening	▼	▼	▼

Vorige Volgende

Page 28

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Beoordeel in welke mate u het **aanbrengen van wijzigingen in het contract door de technisch dienstverlener** impact vindt hebben op de keuze van gunning onder de afzonderlijke scenario's.

Onder het aanbrengen van wijzigingen in het contract wordt verwezen naar de mogelijkheid voor technisch dienstverlener om eventueel wijzigingen aan te brengen in het juridische contract.

	Minimaal	Optimaal	Maximaal
Scenario A: Gunning op basis van **laagste prijs**. Inschrijving op **traditionele wijze**. **Uw mening**			
Scenario B: Gunning op basis van **laagste prijs**. Inschrijving middels een **ESCo aanpak**. **Uw mening**			
Scenario C: Gunning op basis van **de EMVI methode**. Inschrijving op **traditionele wijze**. **Uw mening**			
Scenario D: Gunning op basis van **de EMVI methode**. Inschrijving middels een **ESCo aanpak**. **Uw mening**			

Vorige Volgende

Page 29

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Beoordeel in welke mate u het **implementatieplan** impact vindt hebben op de keuze van gunning onder de afzonderlijke scenario's.

Het implementatieplan geeft weer op welke wijze de installaties worden geïmplementeerd en de gevolgen voor het primaire bedrijfsproces van de opdrachtgever.

	Minimaal	Optimaal	Maximaal
Scenario A: Gunning op basis van **laagste prijs**. Inschrijving op **traditionele wijze**. Uw mening	▼	▼	▼
Scenario B: Gunning op basis van **laagste prijs**. Inschrijving middels een **ESCo aanpak**. Uw mening	▼	▼	▼
Scenario C: Gunning op basis van **de EMVI methode**. Inschrijving op **traditionele wijze**. Uw mening	▼	▼	▼
Scenario D: Gunning op basis van **de EMVI methode**. Inschrijving middels een **ESCo aanpak**. Uw mening	▼	▼	▼

Vorige Volgende

Page 30

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Beoordeel in welke mate u het **onderhoudsplan en de monitoring hiervan** impact vindt hebben op de keuze van gunning onder de afzonderlijke scenario's.

r> Het onderhoudsplan indiceert op welke manier gedurende de levensduur van het systeem onderhoud wordt uitgevoerd. Hierbij wordt rekening gehouden met reactief (klachten etc.) en proactief (preventief etc.) onderhoud.

	Minimaal	Optimaal	Maximaal
Scenario A: Gunning op basis van **laagste prijs**. Inschrijving op **traditionele wijze**. **Uw mening**	▼	▼	▼
Scenario B: Gunning op basis van **laagste prijs**. Inschrijving middels een **ESCo aanpak**. **Uw mening**	▼	▼	▼
Scenario C: Gunning op basis van de **EMVI methode**. Inschrijving op **traditionele wijze**. **Uw mening**	▼	▼	▼
Scenario D: Gunning op basis van de **EMVI methode**. Inschrijving middels een **ESCo aanpak**. **Uw mening**	▼	▼	▼

Vorige Volgende

Page 31

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

Beoordeel in welke mate u het **risico managementplan** impact vindt hebben op de keuze van gunning onder de afzonderlijke scenario's.

Het risico managementplan indiceert de kansen en bedreigingen die aanwezig zijn en op welke manier hierop wordt ingegaan. De wijze waarop risico's worden afgedekt en toegelicht is ook onderdeel van het plan.

	Minimaal	Optimaal	Maximaal
Scenario A: Gunning op basis van **laagste prijs**. Inschrijving op **traditionele wijze**. Uw mening	▼	▼	▼
Scenario B: Gunning op basis van **laagste prijs**. Inschrijving middels een **ESCo aanpak**. Uw mening	▼	▼	▼
Scenario C: Gunning op basis van **de EMVI methode**. Inschrijving op **traditionele wijze**. Uw mening	▼	▼	▼
Scenario D: Gunning op basis van **de EMVI methode**. Inschrijving middels een **ESCo aanpak**. Uw mening	▼	▼	▼

Vorige Volgende

Page 32

technische universiteit eindhoven

Gunningscriteria binnen aanbestedingsprocedures

U heeft zojuist het invullen van de enquête voltooid

Ik wil u hartelijk danken voor uw medewerking!

Wanneer u op de knop **versturen** klikt worden de gegevens, **geheel anoniem**, verstuurd.

Met vriendelijke groet,

Falco Zeekaf
0643484750

Wanneer u aan- of opmerkingen heeft over de enquête kunt u deze hieronder toelichten:

Vorige Versturen

D. Combination of overlapping criteria

Category	#	Criteria	Table 4-2 & 4-3
Project Management expertise	1.	Project management organization plan, certifications & monitoring	11. 12. 13.
	2.	Similar types and size of projects completed	18.
	3.	Expertise, experience & nature of project manager and composed team	47.
	4.	Ability to work as a team	31. 32.
Financial	5.	Total costs of ownership (TCO) analysis	23.
	6.	Initial investment costs estimation	22.
	7.	Operating costs estimation	24.
	8.	Financing opportunities	6.
	9.	Financial plan, cost control & rationality of estimates	44. 48.
Customer-supplier relations	10.	Positive image of company & CSR policy	7. 52.
	11.	Clear & pleasant communication style	49.
	12.	Customer service plan & commitment to support	33. 29.
Technical expertise	13.	Experience, availability and certification of technical team	34. 35. 36.
	14.	Strategic partnerships with technical suppliers	50.
Technical solution & quality	15.	Delivered energy performance & user comfort	37.
	16.	Application of innovative solutions and optimizations	41. 42.
	17.	Application of quality control system, policy & certification	25. 26. 27.
	18.	Transparency of work	28. 51.
	19.	Technical flexibility of system	40.
	20.	Guarantees provided on availability rate & response time	10. 30.
	21.	Modifications in contract	43.
Exploitation	22.	Implementation plan	45.
	23.	Maintenance plan and monitoring	46. 51. 39.
	24.	Risk management plan	14.

E. Overview of criteria and their descriptions

#	Criteria	Description
1.	Project management organization plan, certifications & monitoring	Project management organization plan is about the way the project is being organized/supervised, monitored and whether the organization is certificated for the specific management approach.
2.	Similar types and size of projects completed	References refers to whether the ESCo has finished similar types and size of projects before.
3.	Expertise, experience & nature of project manager and composed team	The expertise, experience of the executive team. Next to this the personality of the project manager.
4.	Ability to work as a team	The capabilities of the ESCo to work in a team.
5.	Total costs of ownership (TCO) analysis	Total cost of ownership analysis a an approach to completely visualize all life cycle costs related to the installation process, as well as the exploitation phase.
6.	Initial investment costs estimation	The initial investment costs estimation refers to the costs which have to be made at the start of the project.
7.	Operating costs estimation	The operating costs estimation refers to the costs which will be made during the exploitation phase.
8.	Financing opportunities	Financing opportunities refers to the possibility to, as a customer, outsource the financing of the project to the ESCo.
9.	Financial plan, cost control & rationality of estimates	The financial plan illustrates all financial aspects during the project. The way on which manner will costs be monitored and managed and the rationality of the estimates.
10.	Positive image of company & CSR policy	The image refers to the overall company image. CSR refers to corporate social responsibility activities.
11.	Clear & pleasant communication style	The communication style refers to the way the ESCo communicates to its customers.
12.	Customer service plan & commitment to support	Customer service plan and commitment to support refers to the approach the ESCo will apply on how to support the customer, and how dedicated the ESCo acts in these situations.
13.	Experience, availability and certification of technical team	The technical team is responsible for the execution of the project, so their experience, availability and certification is essential.
14.	Strategic partnerships with technical suppliers	ESCos have partnerships with sub suppliers of systems and components.

15.	Delivered energy performance & user comfort	The delivered energy performance reduction and the user comfort that goes along with that.
16.	Application of innovative solutions and optimizations	The application of new innovative solutions, and the optimizations for the customer.
17.	Application of quality control system, policy & certification	The application of a quality control system, to guarantee quality for the customer.
18.	Transparency of work	Transparency refers to the aspect, to which extent the ESCos clarifies their risks and estimations to the customer.
19.	Technical flexibility of system	Technical flexibility refers to whether the system is able to be modified during the life cycle, as the building might has to be redeveloped slightly.
20.	Guarantees provided on availability rate & response time	What guarantees provides the ESCo to the customer according to the well-functioning of the system. And what will be the consequences if there are failures.
21.	Modifications in contract	Modifications in the EPC/ESC contract by the ESCo.
22.	Implementation plan	This implementation plan covers the activities the ESCo will execute from start to beginning during the project. And how it will support the primary activities of the customer during the implementation phase.
23.	Maintenance plan and monitoring	The maintenance plan refers to the plan the ESCo will apply on maintenance. Proactive and reactive maintenance.
24.	Risk management plan	Risk management plan is about how the ESCo will cope with risks during the life cycle, and how they are covered.

F. Fuzzy numbers of impact levels per criteria per respondent

Impact criterion 1

Project management organization plan, certifications & monitoring

Game outcome A LP - T				Game outcome B LP - ESCo			
consultant	Min	Opt	Max	consultant	Min	Opt	Max
1.	2	4	5	1.	3	4	5
2.	1	2	3	2.	2	3	4
3.	5	6	7	3.	5	6	8
4.	2	2	2	4.	4	5	6
5.	5	6	8	5.	5	6	8
6.	3	5	6	6.	6	7	8
7.	3	3	3	7.	3	3	3
8.	1	2	2	8.	1	2	3
9.	3	3	3	9.	3	4	4
10	3	5	5	10	3	5	5
11.	1	2	3	11.	4	5	7
12.	5	7	8	12.	6	7	8
13.	2	5	6	13.	3	6	7

Game outcome A LP - T				Game outcome B LP - ESCo			
ESCo	Min	Opt	Max	ESCo	Min	Opt	Max
1.	3	4	5	1.	7	8	9
2.	1	2	3	2.	1	2	3
3.	3	4	5	3.	3	4	5
4.	1	1	1	4.	1	1	1
5.	2	3	4	5.	4	5	6
6.	1	2	4	6.	2	3	5
7.	5	5	5	7.	5	5	5
8.	5	6	7	8.	5	6	7
9.	5	5	5	9.	6	6	6
10	1	2	3	10	1	2	3
11.	6	8	9	11.	7	8	9
12.	1	1	1	12.	2	3	4
13.	3	5	6	13.	4	5	6
14.	4	5	6	14.	7	8	9
15.	3	4	5	15.	3	4	5

Game outcome C MEAT - T			
consultant	Min	Opt	Max
1.	5	6	7
2.	6	7	8
3.	5	6	7
4.	3	4	5
5.	5	6	7
6.	8	9	10
7.	4	5	6
8.	6	7	7
9.	6	7	8
10	4	5	6
11.	5	6	7
12.	6	7	8
13.	5	7	8

Game outcome D MEAT - ESCo			
consultant	Min	Opt	Max
1.	7	8	9
2.	7	8	9
3.	5	6	8
4.	6	7	8
5.	5	6	7
6.	8	9	10
7.	6	7	8
8.	6	7	8
9.	7	8	8
10	5	6	7
11.	6	8	9
12.	6	8	9
13.	6	7	10

Game outcome C MEAT - T			
ESCo	Min	Opt	Max
1.	5	6	7
2.	6	7	8
3.	6	8	10
4.	6	6	6
5.	5	6	7
6.	2	5	6
7.	8	8	8
8.	5	6	7
9.	5	7	8
10	6	8	9
11.	6	8	9
12.	5	7	7
13.	5	6	7
14.	5	6	7
15.	6	8	10

Game outcome D MEAT - ESCo			
ESCo	Min	Opt	Max
1.	8	9	10
2.	7	8	9
3.	5	6	9
4.	9	9	9
5.	7	8	8
6.	5	6	9
7.	8	8	8
8.	5	6	7
9.	5	7	8
10	7	9	10
11.	7	8	9
12.	7	7	8
13.	6	7	8
14.	8	9	10
15.	6	8	10

Overall triangular fuzzy numbers *Criterion 1*			
Game outcome A	**LP - T**		
consultant	**Min**	**Opt**	**Max**
	1	4	2
Defuzzified number			2,333333

Game outcome B	**LP - ESCo**		
consultant	**Min**	**Opt**	**Max**
	1	4,846154	3
Defuzzified number			2,948718

Game outcome C	**MEAT - T**		
consultant	**Min**	**Opt**	**Max**
	3	6,307692	5
Defuzzified number			4,7692

Game outcome D	**MEAT - ESCo**		
consultant	**Min**	**Opt**	**Max**
	5	7,307692	7
Defuzzified number			6,435897

Game outcome A	LP - T		
ESCo	Min	Opt	Max
	1	3,8	1
Defuzzified number			1,933333

Game outcome B	LP - ESCo		
ESCo	Min	Opt	Max
	1	4,666667	1
Defuzzified number			2,222222

Game outcome C	MEAT - T		
ESCo	Min	Opt	Max
	2	6,8	6
Defuzzified number			4,933333

Game outcome D	MEAT - ESCo		
ESCo	Min	Opt	Max
	5	7,666667	7
Defuzzified number			6,555556

Impact criterion 2

Similar types and size of projects completed

Game outcome A LP - T			
consultant	Min	Opt	Max
1.	1	2	3
2.	4	5	6
3.	5	6	8
4.	2	2	2
5.	5	7	8
6.	5	6	7
7.	6	7	8
8.	5	6	7
9.	6	6	6
10	1	2	3
11.	2	3	3
12.	6	8	8
13.	3	5	6

Game outcome B LP - ESCo			
consultant	Min	Opt	Max
1.	3	4	5
2.	5	6	7
3.	5	6	8
4.	5	5	6
5.	6	7	8
6.	7	8	9
7.	6	7	8
8.	5	6	7
9.	6	6	7
10	2	3	4
11.	3	5	6
12.	6	8	8
13.	4	6	6

Game outcome A LP - T			
ESCo	Min	Opt	Max
1.	5	6	7
2.	1	2	3
3.	5	7	8
4.	1	1	1
5.	4	5	6
6.	2	4	6
7.	6	6	6
8.	2	3	4
9.	5	5	5
10	3	6	7
11.	6	8	9
12.	3	4	4
13.	3	4	5
14.	4	6	7
15.	4	5	6

Game outcome B LP - ESCo			
ESCo	Min	Opt	Max
1.	6	7	8
2.	1	2	3
3.	5	7	8
4.	1	1	1
5.	5	6	7
6.	2	5	7
7.	6	6	6
8.	3	4	5
9.	5	5	5
10	5	6	7
11.	6	8	9
12.	4	5	5
13.	3	4	5
14.	3	5	8
15.	4	5	6

Game outcome C MEAT - T			
consultant	Min	Opt	Max
1.	6	7	8
2.	6	7	8
3.	5	6	8
4.	2	3	3
5.	6	7	8
6.	7	8	10
7.	7	8	9
8.	5	6	7
9.	6	6	7
10	4	5	6
11.	4	5	6
12.	6	8	8
13.	5	6	7

Game outcome D MEAT - ESCo			
consultant	Min	Opt	Max
1.	8	9	10
2.	6	7	8
3.	5	6	8
4.	6	7	9
5.	6	8	9
6.	8	9	10
7.	7	8	9
8.	5	6	7
9.	7	7	8
10	6	7	8
11.	5	6	7
12.	6	8	8
13.	6	7	10

Game outcome C MEAT - T			
ESCo	Min	Opt	Max
1.	5	6	7
2.	6	7	8
3.	7	8	10
4.	6	6	6
5.	4	5	6
6.	6	6	6
7.	7	7	7
8.	6	7	7
9.	5	7	8
10	3	6	7
11.	7	8	9
12.	5	7	7
13.	4	5	6
14.	5	7	9
15.	6	8	9

Game outcome D MEAT - ESCo			
ESCo	Min	Opt	Max
1.	7	8	9
2.	7	8	9
3.	8	9	10
4.	9	9	9
5.	6	7	7
6.	5	6	9
7.	7	7	7
8.	7	8	9
9.	5	7	8
10	3	6	7
11.	8	9	10
12.	7	8	10
13.	6	7	8
14.	4	7	10
15.	6	8	9

Overall triangular fuzzy numbers *Criterion 2*			
Game outcome A	**LP - T**		
consultant	**Min**	**Opt**	**Max**
	1	5	2
Defuzzified number			2,6667

Game outcome B	**LP - ESCo**		
consultant	**Min**	**Opt**	**Max**
	2	5,923077	4
Defuzzified number			3,9744

Game outcome C	**MEAT - T**		
consultant	**Min**	**Opt**	**Max**
	2	6,307692	3
Defuzzified number			3,7692

Game outcome D	**MEAT - ESCo**		
consultant	**Min**	**Opt**	**Max**
	5	7,307692	7
Defuzzified number			6,4359

Game outcome A	LP - T		
ESCo	Min	Opt	Max
	1	4,8	1
Defuzzified number			2,2667

Game outcome B	LP - ESCo		
ESCo	Min	Opt	Max
	1	5,066667	1
Defuzzified number			2,3556

Game outcome C	MEAT - T		
ESCo	Min	Opt	Max
	3	6,666667	6
Defuzzified number			5,2222

Game outcome D	MEAT - ESCo		
ESCo	Min	Opt	Max
	3	7,6	7
Defuzzified number			5,8667

Impact criterion 3

Expertise, experience & nature of project manager& composed team

Game outcome A LP - T			
consultant	Min	Opt	Max
1.	1	1	1
2.	2	3	4
3.	5	6	8
4.	5	5	5
5.	6	8	9
6.	7	8	9
7.	3	3	3
8.	1	2	2
9.	3	3	3
10	2	3	3
11.	1	1	1
12.	3	4	5
13.	2	3	5

Game outcome B LP - ESCo			
consultant	Min	Opt	Max
1.	2	2	2
2.	3	4	5
3.	5	6	9
4.	5	7	7
5.	6	8	9
6.	6	7	9
7.	3	3	3
8.	1	1	2
9.	3	3	3
10	2	3	3
11.	2	5	6
12.	3	4	5
13.	3	5	6

Game outcome A LP - T			
ESCo	Min	Opt	Max
1.	4	5	6
2.	1	2	3
3.	4	6	7
4.	1	1	1
5.	1	2	3
6.	4	4	5
7.	6	6	6
8.	1	2	3
9.	5	5	5
10	2	3	4
11.	7	8	9
12.	2	2	4
13.	4	5	6
14.	1	4	6
15.	3	4	5

Game outcome B LP - ESCo			
ESCo	Min	Opt	Max
1.	6	7	8
2.	1	2	3
3.	4	6	7
4.	1	1	1
5.	2	3	3
6.	5	5	5
7.	6	6	6
8.	4	5	5
9.	5	5	5
10	2	3	4
11.	7	8	9
12.	3	3	5
13.	4	5	6
14.	3	5	8
15.	3	4	5

Game outcome C MEAT - T			
consultant	Min	Opt	Max
1.	4	5	6
2.	6	7	8
3.	5	6	8
4.	5	5	5
5.	6	8	9
6.	5	6	7
7.	6	7	8
8.	5	6	6
9.	6	6	8
10	4	5	6
11.	5	6	7
12.	5	7	8
13.	5	6	7

Game outcome D MEAT - ESCo			
consultant	Min	Opt	Max
1.	7	8	9
2.	8	9	10
3.	5	6	9
4.	6	8	8
5.	6	8	9
6.	5	6	7
7.	6	7	8
8.	5	6	7
9.	6	7	8
10	8	9	9
11.	6	7	8
12.	3	4	5
13.	6	7	10

Game outcome C MEAT - T			
ESCo	Min	Opt	Max
1.	6	7	8
2.	6	7	8
3.	6	8	9
4.	6	6	6
5.	1	2	3
6.	6	6	8
7.	7	7	7
8.	5	6	7
9.	7	7	8
10	4	5	6
11.	7	8	9
12.	5	6	8
13.	5	6	7
14.	5	6	8
15.	5	6	7

Game outcome D MEAT - ESCo			
ESCo	Min	Opt	Max
1.	7	8	9
2.	7	8	9
3.	6	8	10
4.	9	9	9
5.	4	5	5
6.	8	9	9
7.	6	7	7
8.	6	7	7
9.	7	8	9
10	6	8	9
11.	7	8	9
12.	8	8	9
13.	6	7	8
14.	5	8	10
15.	5	6	7

Overall triangular fuzzy numbers *Criterion 3*			
Game outcome A	**LP - T**		
consultant	**Min**	**Opt**	**Max**
	1	3,846154	1
Defuzzified number			1,9487

Game outcome B	**LP - ESCo**		
consultant	**Min**	**Opt**	**Max**
	1	4,461538	2
Defuzzified number			2,4872

Game outcome C	**MEAT - T**		
consultant	**Min**	**Opt**	**Max**
	4	6,153846	5
Defuzzified number			5,0513

Game outcome D	**MEAT - ESCo**		
consultant	**Min**	**Opt**	**Max**
	3	7,076923	5
Defuzzified number			5,0256

Game outcome A	LP - T		
ESCo	Min	Opt	Max
	1	3,933333	1
Defuzzified number			1,9778

Game outcome B	LP - ESCo		
ESCo	Min	Opt	Max
	1	4,533333	1
Defuzzified number			2,1778

Game outcome C	MEAT - T		
ESCo	Min	Opt	Max
	1	6,2	3
Defuzzified number			3,4000

Game outcome D	MEAT - ESCo		
ESCo	Min	Opt	Max
	4	7,6	5
Defuzzified number			5,5333

Impact criterion 4

Total costs of ownership (TCO) analysis

Game outcome A LP - T

consultant	Min	Opt	Max
1.	3	4	5
2.	6	7	8
3.	2	4	5
4.	2	2	2
5.	6	7	8
6.	3	4	5
7.	1	3	3
8.	1	2	3
9.	3	3	3
10	2	3	3
11.	1	2	2
12.	1	2	3
13.	2	3	4

Game outcome B LP - ESCo

consultant	Min	Opt	Max
1.	4	5	6
2.	7	8	9
3.	5	6	7
4.	9	9	9
5.	6	7	8
6.	4	5	6
7.	3	3	3
8.	5	5	5
9.	3	3	3
10	3	3	3
11.	3	4	5
12.	2	3	4
13.	3	5	6

Game outcome A LP - T

ESCo	Min	Opt	Max
1.	2	3	4
2.	6	7	8
3.	5	7	9
4.	1	1	1
5.	2	2	3
6.	3	5	6
7.	5	5	5
8.	1	3	3
9.	5	5	5
10	1	2	3
11.	2	3	4
12.	2	3	3
13.	4	5	6
14.	1	1	3
15.	2	3	4

Game outcome B LP - ESCo

ESCo	Min	Opt	Max
1.	8	9	10
2.	7	8	9
3.	6	8	10
4.	1	1	1
5.	6	7	8
6.	2	5	6
7.	7	7	7
8.	3	4	4
9.	5	5	5
10	7	8	9
11.	6	7	8
12.	3	3	3
13.	5	6	7
14.	8	9	10
15.	4	5	6

Game outcome C MEAT - T			
consultant	Min	Opt	Max
1.	5	6	7
2.	5	6	7
3.	4	5	6
4.	2	2	2
5.	6	7	8
6.	4	6	7
7.	6	8	9
8.	6	6	6
9.	6	7	7
10	4	5	6
11.	3	5	7
12.	3	4	5
13.	4	6	7

Game outcome D MEAT - ESCo			
consultant	Min	Opt	Max
1.	8	8	9
2.	6	7	8
3.	6	8	9
4.	9	9	9
5.	6	7	8
6.	7	8	9
7.	7	8	9
8.	7	7	7
9.	6	7	8
10	5	7	8
11.	5	6	8
12.	6	7	8
13.	6	7	10

Game outcome C MEAT - T			
ESCo	Min	Opt	Max
1.	5	6	7
2.	5	6	7
3.	6	7	9
4.	6	6	6
5.	4	5	6
6.	2	5	5
7.	6	6	6
8.	6	7	8
9.	7	7	7
10	4	5	6
11.	5	6	7
12.	6	6	7
13.	5	6	7
14.	2	3	5
15.	6	8	9

Game outcome D MEAT - ESCo			
ESCo	Min	Opt	Max
1.	8	9	10
2.	5	6	7
3.	6	8	10
4.	9	9	9
5.	7	8	9
6.	6	6	8
7.	8	8	8
8.	6	7	8
9.	8	9	10
10	7	8	9
11.	7	8	9
12.	8	9	10
13.	6	7	8
14.	7	8	9
15.	6	8	9

Overall triangular fuzzy numbers *Criterion 4*			
Game outcome A	**LP - T**		
consultant	**Min**	**Opt**	**Max**
	1	3,538462	2
Defuzzified number			2,1795

Game outcome B	**LP - ESCo**		
consultant	**Min**	**Opt**	**Max**
	2	5,076923	3
Defuzzified number			3,3590

Game outcome C	**MEAT - T**		
consultant	**Min**	**Opt**	**Max**
	2	5,615385	2
Defuzzified number			3,2051

Game outcome D	**MEAT - ESCo**		
consultant	**Min**	**Opt**	**Max**
	5	7,384615	7
Defuzzified number			6,4615

Game outcome A	LP - T		
ESCo	Min	Opt	Max
	1	3,666667	1
Defuzzified number			1,8889

Game outcome B	LP - ESCo		
ESCo	Min	Opt	Max
	1	6,133333	1
Defuzzified number			2,7111

Game outcome C	MEAT - T		
ESCo	Min	Opt	Max
	2	5,933333	5
Defuzzified number			4,3111

Game outcome D	MEAT - ESCo		
ESCo	Min	Opt	Max
	5	7,866667	7
Defuzzified number			6,6222

Impact criterion 5

Initial investment costs estimation

Game outcome A LP - T

consultant	Min	Opt	Max
1.	5	7	8
2.	8	9	10
3.	3	4	5
4.	8	8	8
5.	7	8	9
6.	3	4	6
7.	6	7	8
8.	10	10	10
9.	8	8	8
10	2	3	4
11.	1	2	3
12.	1	1	1
13.	2	3	5

Game outcome B LP - ESCo

consultant	Min	Opt	Max
1.	6	7	9
2.	7	8	9
3.	4	5	6
4.	8	8	8
5.	5	6	7
6.	6	7	8
7.	6	7	8
8.	8	8	8
9.	8	8	8
10	3	3	4
11.	5	6	7
12.	4	5	5
13.	2	3	5

Game outcome A LP - T

ESCo	Min	Opt	Max
1.	8	10	9
2.	1	3	2
3.	7	10	9
4.	1	1	1
5.	7	9	8
6.	4	5	5
7.	7	7	7
8.	8	9	9
9.	10	10	10
10	6	9	8
11.	6	8	7
12.	3	4	4
13.	3	5	4
14.	8	10	9
15.	4	8	6

Game outcome B LP - ESCo

ESCo	Min	Opt	Max
1.	3	4	5
2.	1	2	3
3.	6	9	10
4.	1	1	1
5.	4	5	6
6.	4	4	4
7.	7	7	7
8.	6	7	8
9.	10	10	10
10	6	8	9
11.	6	7	8
12.	3	3	3
13.	4	5	6
14.	1	2	3
15.	4	6	8

Game outcome C MEAT - T			
consultant	Min	Opt	Max
1.	5	7	8
2.	6	7	8
3.	5	6	7
4.	9	9	9
5.	5	6	7
6.	4	5	6
7.	4	5	6
8.	6	6	6
9.	3	4	5
10	4	5	5
11.	6	7	8
12.	3	5	5
13.	4	6	7

Game outcome D MEAT - ESCo			
consultant	Min	Opt	Max
1.	6	7	9
2.	2	3	4
3.	6	7	8
4.	8	8	8
5.	4	5	7
6.	7	8	9
7.	4	5	6
8.	5	5	5
9.	3	3	3
10	6	6	8
11.	7	8	9
12.	5	6	6
13.	6	7	10

Game outcome C MEAT - T			
ESCo	Min	Opt	Max
1.	6	7	8
2.	3	4	5
3.	4	5	9
4.	6	6	6
5.	7	8	9
6.	6	6	6
7.	7	8	8
8.	4	5	6
9.	7	7	7
10	4	5	6
11.	6	7	8
12.	5	8	8
13.	5	6	7
14.	7	8	9
15.	4	6	8

Game outcome D MEAT - ESCo			
ESCo	Min	Opt	Max
1.	3	4	5
2.	3	4	5
3.	5	6	7
4.	9	9	9
5.	3	4	5
6.	4	8	8
7.	8	8	8
8.	3	4	5
9.	6	6	6
10	4	6	8
11.	7	8	9
12.	8	8	9
13.	6	7	8
14.	2	3	4
15.	4	6	8

Overall triangular fuzzy numbers *Criterion 5*			
Game outcome A	**LP - T**		
consultant	**Min**	**Opt**	**Max**
	1	5,692308	1
Defuzzified number			2,5641

Game outcome B	**LP - ESCo**		
consultant	**Min**	**Opt**	**Max**
	2	6,230769	4
Defuzzified number			4,077

Game outcome C	**MEAT - T**		
consultant	**Min**	**Opt**	**Max**
	3	6	5
Defuzzified number			4,6667

Game outcome D	**MEAT - ESCo**		
consultant	**Min**	**Opt**	**Max**
	2	6	3
Defuzzified number			3,6667

Game outcome A	LP - T		
ESCo	Min	Opt	Max
	1	7,2	1
Defuzzified number			3,0667

Game outcome B	LP - ESCo		
ESCo	Min	Opt	Max
	1	5,333333	1
Defuzzified number			2,4444

Game outcome C	MEAT - T		
ESCo	Min	Opt	Max
	3	6,4	5
Defuzzified number			4,800

Game outcome D	MEAT - ESCo		
ESCo	Min	Opt	Max
	2	6,066667	4
Defuzzified number			4,0222

Impact criterion 6

Operating costs estimation

Game outcome A LP - T

consultant	Min	Opt	Max
1.	7	8	9
2.	5	6	7
3.	2	3	5
4.	4	4	5
5.	5	6	8
6.	1	3	4
7.	3	4	5
8.	2	2	2
9.	3	3	3
10	2	3	3
11.	1	2	3
12.	2	2	2
13.	2	3	5

Game outcome B LP - ESCo

consultant	Min	Opt	Max
1.	8	9	10
2.	4	5	6
3.	6	7	8
4.	7	7	7
5.	5	6	8
6.	6	7	9
7.	4	5	6
8.	4	5	6
9.	3	3	3
10	3	3	4
11.	4	5	6
12.	5	5	5
13.	2	3	5

Game outcome A LP - T

ESCo	Min	Opt	Max
1.	1	2	3
2.	7	8	9
3.	4	5	7
4.	1	1	1
5.	1	2	3
6.	4	5	5
7.	6	6	6
8.	1	2	3
9.	10	10	10
10	3	4	6
11.	6	7	8
12.	1	1	2
13.	5	6	7
14.	1	2	3
15.	5	7	9

Game outcome B LP - ESCo

ESCo	Min	Opt	Max
1.	7	8	9
2.	7	8	9
3.	5	7	8
4.	1	1	7
5.	3	4	5
6.	5	8	8
7.	7	7	7
8.	6	7	7
9.	10	10	10
10	4	5	6
11.	7	8	9
12.	2	2	5
13.	5	6	7
14.	8	9	10
15.	5	7	9

Game outcome C MEAT - T			
consultant	Min	Opt	Max
1.	7	8	9
2.	5	6	7
3.	5	6	7
4.	4	4	4
5.	6	8	9
6.	5	6	7
7.	5	6	7
8.	5	5	5
9.	5	6	7
10	4	5	5
11.	6	7	8
12.	3	3	3
13.	5	6	7

Game outcome D MEAT - ESCo			
consultant	Min	Opt	Max
1.	8	9	10
2.	4	5	6
3.	6	7	8
4.	7	8	9
5.	6	8	9
6.	7	8	9
7.	6	7	8
8.	5	5	5
9.	6	7	8
10	6	7	8
11.	7	8	9
12.	6	7	7
13.	6	8	10

Game outcome C MEAT - T			
ESCo	Min	Opt	Max
1.	6	7	8
2.	1	2	3
3.	5	8	9
4.	6	6	6
5.	3	3	4
6.	6	8	8
7.	7	7	7
8.	6	7	7
9.	10	10	10
10	6	8	9
11.	6	7	8
12.	5	5	6
13.	6	7	8
14.	2	3	4
15.	5	7	9

Game outcome D MEAT - ESCo			
ESCo	Min	Opt	Max
1.	8	9	10
2.	1	2	3
3.	5	6	9
4.	9	9	9
5.	8	9	10
6.	6	8	8
7.	7	7	7
8.	6	7	7
9.	10	10	10
10	7	9	10
11.	7	8	9
12.	8	8	9
13.	6	7	8
14.	7	8	9
15.	5	7	9

Overall triangular fuzzy numbers *Criterion 6*			
Game outcome A	**LP - T**		
consultant	**Min**	**Opt**	**Max**
	1	3,769231	2
Defuzzified number			2,2564

Game outcome B	**LP - ESCo**		
consultant	**Min**	**Opt**	**Max**
	2	5,384615	3
Defuzzified number			3,4615

Game outcome C	**MEAT - T**		
consultant	**Min**	**Opt**	**Max**
	3	5,846154	3
Defuzzified number			3,9487

Game outcome D	**MEAT - ESCo**		
consultant	**Min**	**Opt**	**Max**
	4	7,230769	5
Defuzzified number			5,4103

Game outcome A	LP - T		
ESCo	Min	Opt	Max
	1	4,533333	1
Defuzzified number			2,1778

Game outcome B	LP - ESCo		
ESCo	Min	Opt	Max
	1	6,466667	5
Defuzzified number			4,1556

Game outcome C	MEAT - T		
ESCo	Min	Opt	Max
	1	6,333333	3
Defuzzified number			3,4444

Game outcome D	MEAT - ESCo		
ESCo	Min	Opt	Max
	1	7,6	3
Defuzzified number			3,8667

Impact criterion 7

Financing opportunities

Game outcome A LP - T			
consultant	Min	Opt	Max
1.	5	6	7
2.	1	2	3
3.	1	2	3
4.	1	2	2
5.	3	4	5
6.	1	2	3
7.	1	1	1
8.	1	2	2
9.	2	2	2
10	2	2	2
11.	1	1	2
12.	1	1	1
13.	2	3	4

Game outcome B LP - ESCo			
consultant	Min	Opt	Max
1.	5	7	8
2.	8	9	10
3.	7	8	9
4.	8	8	8
5.	4	5	6
6.	4	5	7
7.	1	1	1
8.	5	6	7
9.	2	2	2
10	2	2	2
11.	4	5	6
12.	5	5	5
13.	2	4	5

Game outcome A LP - T			
ESCo	Min	Opt	Max
1.	1	2	3
2.	1	2	3
3.	1	3	8
4.	1	1	1
5.	1	2	3
6.	3	3	3
7.	5	5	5
8.	3	3	3
9.	8	8	8
10	1	2	3
11.	2	3	4
12.	1	1	1
13.	3	4	5
14.	3	4	5
15.	3	5	7

Game outcome B LP - ESCo			
ESCo	Min	Opt	Max
1.	6	7	8
2.	1	2	3
3.	1	5	8
4.	1	1	1
5.	4	5	6
6.	5	7	7
7.	6	6	6
8.	4	4	4
9.	8	8	8
10	1	2	3
11.	6	7	8
12.	3	3	3
13.	4	5	6
14.	7	8	9
15.	3	5	7

Game outcome C MEAT - T			
consultant	Min	Opt	Max
1.	5	6	7
2.	4	5	6
3.	1	2	3
4.	4	4	4
5.	4	5	6
6.	4	5	7
7.	6	7	8
8.	5	5	5
9.	5	6	7
10	4	4	4
11.	6	7	8
12.	1	3	3
13.	4	5	6

Game outcome D MEAT - ESCo			
consultant	Min	Opt	Max
1.	5	7	8
2.	8	9	10
3.	7	8	9
4.	9	9	9
5.	4	5	6
6.	6	7	8
7.	6	7	8
8.	6	6	6
9.	6	7	8
10	5	6	6
11.	7	8	9
12.	6	6	6
13.	6	8	10

Game outcome C MEAT - T			
ESCo	Min	Opt	Max
1.	4	6	5
2.	1	3	2
3.	3	8	5
4.	6	6	6
5.	4	6	6
6.	3	8	7
7.	5	5	5
8.	6	6	6
9.	8	8	8
10	3	5	4
11.	3	5	4
12.	8	8	8
13.	5	7	6
14.	4	6	5
15.	3	7	5

Game outcome D MEAT - ESCo			
ESCo	Min	Opt	Max
1.	6	8	7
2.	2	4	3
3.	4	8	6
4.	9	9	9
5.	7	8	8
6.	4	10	7
7.	7	7	7
8.	8	8	8
9.	8	8	8
10	7	9	8
11.	7	9	8
12.	9	9	9
13.	6	8	7
14.	7	9	8
15.	3	7	5

Overall triangular fuzzy numbers *Criterion 7*			
Game outcome A	**LP - T**		
consultant	**Min**	**Opt**	**Max**
	1	2,307692	1
Defuzzified number			1,4359

Game outcome B	**LP - ESCo**		
consultant	**Min**	**Opt**	**Max**
	1	5,153846	1
Defuzzified number			2,3846

Game outcome C	**MEAT - T**		
consultant	**Min**	**Opt**	**Max**
	1	4,923077	3
Defuzzified number			2,9744

Game outcome D	**MEAT - ESCo**		
consultant	**Min**	**Opt**	**Max**
	4	7,153846	6
Defuzzified number			5,7179

Game outcome A	LP - T		
ESCo	Min	Opt	Max
	1	3,2	1
Defuzzified number			1,7333

Game outcome B	LP - ESCo		
ESCo	Min	Opt	Max
	1	5	1
Defuzzified number			2,3333

Game outcome C	MEAT - T		
ESCo	Min	Opt	Max
	1	6,266667	2
Defuzzified number			3,0889

Game outcome D	MEAT - ESCo		
ESCo	Min	Opt	Max
	2	8,066667	3
Defuzzified number			4,3556

Impact criterion 8

Financial plan, cost control & rationality of estimates

Game outcome A LP - T

consultant	Min	Opt	Max
1.	6	8	9
2.	2	3	4
3.	2	3	4
4.	3	4	4
5.	5	5	6
6.	1	2	3
7.	4	5	6
8.	1	2	2
9.	3	3	3
10	1	1	1
11.	1	2	3
12.	3	3	3
13.	2	3	4

Game outcome B LP - ESCo

consultant	Min	Opt	Max
1.	7	9	10
2.	4	5	6
3.	6	7	8
4.	7	8	8
5.	6	7	8
6.	5	6	7
7.	4	5	6
8.	7	7	8
9.	3	3	3
10	1	1	1
11.	4	5	6
12.	4	4	4
13.	2	3	5

Game outcome A LP - T

ESCo	Min	Opt	Max
1.	6	8	7
2.	1	3	2
3.	3	7	5
4.	1	1	1
5.	1	3	2
6.	2	4	4
7.	2	2	2
8.	1	1	1
9.	8	8	8
10	6	8	7
11.	2	4	3
12.	2	4	2
13.	4	6	5
14.	5	9	8
15.	2	5	4

Game outcome B LP - ESCo

ESCo	Min	Opt	Max
1.	7	9	8
2.	1	3	2
3.	4	8	6
4.	1	1	1
5.	6	8	7
6.	3	6	5
7.	2	2	2
8.	4	6	5
9.	8	8	8
10	6	8	7
11.	4	6	5
12.	3	3	3
13.	5	7	6
14.	5	9	8
15.	2	5	4

Game outcome C MEAT - T			
consultant	Min	Opt	Max
1.	6	8	9
2.	6	7	8
3.	4	5	6
4.	3	3	3
5.	6	7	8
6.	3	4	5
7.	6	7	8
8.	6	6	6
9.	5	6	7
10	4	5	6
11.	5	6	7
12.	3	3	3
13.	5	6	7

Game outcome D MEAT - ESCo			
consultant	Min	Opt	Max
1.	7	9	10
2.	8	9	10
3.	7	8	9
4.	8	8	8
5.	7	8	9
6.	7	8	9
7.	6	7	8
8.	7	7	8
9.	6	7	8
10	5	6	9
11.	7	8	9
12.	6	6	6
13.	6	8	10

Game outcome C MEAT - T			
ESCo	Min	Opt	Max
1.	6	7	8
2.	1	2	3
3.	4	6	9
4.	6	6	6
5.	2	3	4
6.	6	7	9
7.	5	5	5
8.	4	5	6
9.	8	8	8
10	6	7	8
11.	4	5	6
12.	5	7	9
13.	5	6	7
14.	5	8	9
15.	5	6	8

Game outcome D MEAT - ESCo			
ESCo	Min	Opt	Max
1.	8	9	10
2.	1	2	3
3.	4	7	9
4.	9	9	9
5.	8	9	10
6.	6	8	9
7.	2	2	2
8.	8	9	9
9.	8	8	8
10	6	7	8
11.	7	8	9
12.	8	8	9
13.	6	7	8
14.	5	8	9
15.	5	6	8

Overall triangular fuzzy numbers *Criterion 8*			
Game outcome A	**LP - T**		
consultant	**Min**	**Opt**	**Max**
	1	3,384615	1
Defuzzified number			1,7949

Game outcome B	**LP - ESCo**		
consultant	**Min**	**Opt**	**Max**
	1	5,384615	1
Defuzzified number			2,4615

Game outcome C	**MEAT - T**		
consultant	**Min**	**Opt**	**Max**
	3	5,615385	3
Defuzzified number			3,8718

Game outcome D	**MEAT - ESCo**		
consultant	**Min**	**Opt**	**Max**
	5	7,615385	6
Defuzzified number			6,2051

Game outcome A	LP - T		
ESCo	Min	Opt	Max
	1	4,866667	1
Defuzzified number			2,2889

Game outcome B	LP - ESCo		
ESCo	Min	Opt	Max
	1	5,933333	1
Defuzzified number			2,6444

Game outcome C	MEAT - T		
ESCo	Min	Opt	Max
	1	5,866667	3
Defuzzified number			3,2889

Game outcome D	MEAT - ESCo		
ESCo	Min	Opt	Max
	1	7,133333	2
Defuzzified number			3,3778

Impact criterion 9

Positive image of company & CSR policy

Game outcome A LP - T			
consultant	Min	Opt	Max
1.	5	6	6
2.	1	2	3
3.	5	6	7
4.	3	3	3
5.	5	5	5
6.	2	3	4
7.	3	3	3
8.	2	2	2
9.	3	3	3
10	3	3	3
11.	1	1	1
12.	3	3	3
13.	5	6	7

Game outcome B LP - ESCo			
consultant	Min	Opt	Max
1.	5	6	7
2.	2	3	4
3.	5	6	7
4.	3	3	3
5.	5	5	6
6.	4	5	6
7.	3	3	3
8.	2	2	3
9.	3	3	3
10	3	3	3
11.	2	2	3
12.	3	3	3
13.	5	6	7

Game outcome A LP - T			
ESCo	Min	Opt	Max
1.	1	2	3
2.	1	2	3
3.	1	4	8
4.	1	1	1
5.	2	3	4
6.	2	2	2
7.	1	1	1
8.	1	1	1
9.	5	5	5
10	2	3	4
11.	2	3	4
12.	2	3	3
13.	3	4	5
14.	2	3	5
15.	2	3	4

Game outcome B LP - ESCo			
ESCo	Min	Opt	Max
1.	4	5	6
2.	1	2	3
3.	1	5	8
4.	1	1	1
5.	5	6	6
6.	4	4	4
7.	1	1	1
8.	3	3	3
9.	5	5	5
10	2	3	4
11.	4	5	6
12.	5	5	5
13.	4	5	6
14.	5	8	9
15.	2	3	4

Game outcome C MEAT - T			
consultant	Min	Opt	Max
1.	5	6	6
2.	5	6	7
3.	5	6	7
4.	3	3	3
5.	5	5	6
6.	4	5	6
7.	3	3	3
8.	4	5	5
9.	5	6	7
10	3	3	3
11.	4	5	6
12.	5	5	5
13.	6	7	8

Game outcome D MEAT - ESCo			
consultant	Min	Opt	Max
1.	5	6	8
2.	6	7	8
3.	5	6	7
4.	3	3	3
5.	6	6	7
6.	4	5	7
7.	3	3	3
8.	5	6	6
9.	6	7	8
10	3	3	3
11.	5	6	7
12.	7	8	9
13.	8	9	10

Game outcome C MEAT - T			
ESCo	Min	Opt	Max
1.	5	6	7
2.	4	5	6
3.	4	5	9
4.	6	6	6
5.	3	4	5
6.	5	8	8
7.	1	1	1
8.	5	5	5
9.	7	7	7
10	7	8	9
11.	4	5	6
12.	5	5	5
13.	4	5	6
14.	5	6	8
15.	4	5	6

Game outcome D MEAT - ESCo			
ESCo	Min	Opt	Max
1.	6	7	8
2.	4	5	6
3.	4	6	9
4.	9	9	9
5.	5	6	6
6.	6	9	10
7.	1	1	1
8.	5	5	5
9.	7	7	7
10	7	8	9
11.	6	7	8
12.	8	8	8
13.	5	6	7
14.	6	8	9
15.	4	5	6

Overall triangular fuzzy numbers *Criterion 9*			
Game outcome A	**LP - T**		
consultant	**Min**	**Opt**	**Max**
	1	3,538462	1
Defuzzified number			1,8462

Game outcome B	**LP - ESCo**		
consultant	**Min**	**Opt**	**Max**
	2	3,846154	3
Defuzzified number			2,9487

Game outcome C	**MEAT - T**		
consultant	**Min**	**Opt**	**Max**
	3	5	3
Defuzzified number			3,6667

Game outcome D	**MEAT - ESCo**		
consultant	**Min**	**Opt**	**Max**
	3	5,769231	3
Defuzzified number			3,9231

Game outcome A	LP - T		
ESCo	Min	Opt	Max
	1	2,666667	1
Defuzzified number			1,5556

Game outcome B	LP - ESCo		
ESCo	Min	Opt	Max
	1	4,066667	1
Defuzzified number			2,0222

Game outcome C	MEAT - T		
ESCo	Min	Opt	Max
	1	5,4	1
Defuzzified number			2,4667

Game outcome D	MEAT - ESCo		
ESCo	Min	Opt	Max
	1	6,466667	1
Defuzzified number			2,8222

Impact criterion 10

Clear & pleasant communication style

Game outcome A LP - T

consultant	Min	Opt	Max
1.	5	6	8
2.	1	2	3
3.	5	6	7
4.	8	8	8
5.	6	6	7
6.	4	5	6
7.	2	2	2
8.	1	1	2
9.	3	3	3
10	3	3	3
11.	3	3	4
12.	3	3	3
13.	5	6	7

Game outcome B LP - ESCo

consultant	Min	Opt	Max
1.	5	6	8
2.	2	3	4
3.	6	7	8
4.	8	8	8
5.	6	6	7
6.	4	5	6
7.	2	2	2
8.	3	3	3
9.	3	3	3
10	4	4	4
11.	4	4	5
12.	3	3	3
13.	5	6	7

Game outcome A LP - T

ESCo	Min	Opt	Max
1.	8	9	10
2.	1	2	3
3.	3	6	7
4.	1	1	1
5.	1	1	1
6.	2	2	2
7.	4	4	4
8.	1	1	1
9.	5	5	5
10	2	3	4
11.	4	5	6
12.	3	3	3
13.	3	4	5
14.	3	5	6
15.	1	3	4

Game outcome B LP - ESCo

ESCo	Min	Opt	Max
1.	8	9	10
2.	1	2	3
3.	4	6	7
4.	1	1	1
5.	3	4	4
6.	2	2	2
7.	4	4	4
8.	1	1	1
9.	5	5	5
10	2	6	8
11.	5	6	7
12.	5	5	5
13.	4	5	6
14.	5	8	9
15.	1	3	4

Game outcome C MEAT - T			
consultant	Min	Opt	Max
1.	6	6	9
2.	6	7	8
3.	6	7	8
4.	8	8	8
5.	6	6	7
6.	4	5	6
7.	5	6	7
8.	5	5	5
9.	5	5	6
10	4	4	4
11.	5	6	7
12.	6	7	8
13.	6	7	8

Game outcome D MEAT - ESCo			
consultant	Min	Opt	Max
1.	6	6	9
2.	8	9	10
3.	7	8	9
4.	8	8	8
5.	6	6	7
6.	4	5	6
7.	5	6	7
8.	4	5	6
9.	5	6	7
10	5	6	6
11.	7	8	9
12.	6	7	8
13.	7	8	9

Game outcome C MEAT - T			
ESCo	Min	Opt	Max
1.	8	9	10
2.	3	4	5
3.	5	6	7
4.	6	6	6
5.	2	3	4
6.	3	6	6
7.	4	4	4
8.	7	7	7
9.	10	10	10
10	3	4	5
11.	7	8	9
12.	8	8	9
13.	4	5	6
14.	6	8	9
15.	3	4	5

Game outcome D MEAT - ESCo			
ESCo	Min	Opt	Max
1.	8	9	10
2.	4	5	6
3.	5	6	7
4.	9	9	9
5.	4	5	6
6.	5	5	5
7.	4	4	4
8.	7	7	7
9.	10	10	10
10	2	6	8
11.	7	8	9
12.	6	6	7
13.	5	6	7
14.	7	8	10
15.	3	4	5

Overall triangular fuzzy numbers *Criterion 10*			
Game outcome A	**LP - T**		
consultant	**Min**	**Opt**	**Max**
	1	4,153846	2
Defuzzified number			2,384615

Game outcome B	**LP - ESCo**		
consultant	**Min**	**Opt**	**Max**
	2	4,615385	2
Defuzzified number			2,871795

Game outcome C	**MEAT - T**		
consultant	**Min**	**Opt**	**Max**
	4	6,076923	4
Defuzzified number			4,6923

Game outcome D	**MEAT - ESCo**		
consultant	**Min**	**Opt**	**Max**
	4	6,769231	6
Defuzzified number			5,5897

Game outcome A	LP - T		
ESCo	Min	Opt	Max
	1	3,6	1
Defuzzified number			1,8667

Game outcome B	LP - ESCo		
ESCo	Min	Opt	Max
	1	4,466667	1
Defuzzified number			2,1556

Game outcome C	MEAT - T		
ESCo	Min	Opt	Max
	2	6,133333	4
Defuzzified number			4,0444

Game outcome D	MEAT - ESCo		
ESCo	Min	Opt	Max
	2	6,533333	4
Defuzzified number			4,1778

Impact criterion 11

customer service plan & commitment to support

Game outcome A LP - T

consultant	Min	Opt	Max
1.	6	6	7
2.	1	2	3
3.	5	6	7
4.	8	8	8
5.	6	7	8
6.	3	4	5
7.	2	2	2
8.	1	2	2
9.	3	3	3
10	5	5	5
11.	2	3	3
12.	1	2	2
13.	5	6	7

Game outcome B LP - ESCo

consultant	Min	Opt	Max
1.	6	6	7
2.	1	2	3
3.	4	5	6
4.	7	7	7
5.	5	6	7
6.	3	4	5
7.	1	1	1
8.	1	1	2
9.	2	2	2
10	4	4	4
11.	3	4	5
12.	2	4	4
13.	6	7	8

Game outcome A LP - T

ESCo	Min	Opt	Max
1.	4	5	6
2.	1	2	3
3.	4	5	6
4.	1	1	1
5.	3	4	5
6.	5	5	5
7.	5	5	5
8.	1	1	1
9.	5	5	5
10	2	3	4
11.	3	4	5
12.	3	3	3
13.	4	5	6
14.	1	3	5
15.	2	4	5

Game outcome B LP - ESCo

ESCo	Min	Opt	Max
1.	6	7	8
2.	0	1	2
3.	3	5	6
4.	0	0	0
5.	3	4	5
6.	4	4	4
7.	3	3	3
8.	2	2	2
9.	4	4	4
10	1	3	5
11.	3	4	5
12.	3	3	3
13.	3	4	5
14.	0	2	4
15.	1	3	4

Game outcome C MEAT - T			
consultant	Min	Opt	Max
1.	6	7	8
2.	7	8	9
3.	5	6	7
4.	8	8	8
5.	6	7	8
6.	5	6	7
7.	4	4	4
8.	3	4	5
9.	5	6	6
10	5	6	7
11.	5	6	7
12.	6	7	8
13.	6	7	8

Game outcome D MEAT - ESCo			
consultant	Min	Opt	Max
1.	7	8	8
2.	8	9	10
3.	5	6	7
4.	7	8	8
5.	6	7	8
6.	5	6	7
7.	4	4	4
8.	4	5	6
9.	6	6	7
10	6	7	8
11.	7	8	9
12.	6	7	8
13.	8	9	10

Game outcome C MEAT - T			
ESCo	Min	Opt	Max
1.	6	7	8
2.	5	6	7
3.	5	7	9
4.	6	6	6
5.	3	4	5
6.	5	5	8
7.	6	7	8
8.	5	5	5
9.	8	8	8
10	4	6	8
11.	6	7	8
12.	6	7	8
13.	5	6	7
14.	5	6	8
15.	5	6	7

Game outcome D MEAT - ESCo			
ESCo	Min	Opt	Max
1.	8	9	10
2.	5	6	7
3.	6	7	10
4.	9	9	9
5.	5	6	7
6.	5	7	9
7.	6	6	6
8.	7	7	7
9.	9	9	9
10	5	7	9
11.	6	7	8
12.	6	8	8
13.	5	6	7
14.	5	6	8
15.	5	6	7

Overall triangular fuzzy numbers *Criterion 11*			
Game outcome A	**LP - T**		
consultant	**Min**	**Opt**	**Max**
	1	4,307692	2
Defuzzified number			2,435897

Game outcome B	**LP - ESCo**		
consultant	**Min**	**Opt**	**Max**
	1	4,076923	1
Defuzzified number			2,0256

Game outcome C	**MEAT - T**		
consultant	**Min**	**Opt**	**Max**
	3	6,307692	4
Defuzzified number			4,4359

Game outcome D	**MEAT - ESCo**		
consultant	**Min**	**Opt**	**Max**
	4	6,923077	4
Defuzzified number			4,9744

Game outcome A	LP - T		
ESCo	Min	Opt	Max
	1	3,666667	1
Defuzzified number			1,8889

Game outcome B	LP - ESCo		
ESCo	Min	Opt	Max
	0	3,266667	0
Defuzzified number			1,0889

Game outcome C	MEAT - T		
ESCo	Min	Opt	Max
	3	6,2	5
Defuzzified number			4,7333

Game outcome D	MEAT - ESCo		
ESCo	Min	Opt	Max
	5	7,066667	6
Defuzzified number			6,0222

Impact criterion 12

Experience, availability and certification of technical team

Game outcome A LP - T			
consultant	Min	Opt	Max
1.	4	6	7
2.	1	2	3
3.	5	6	7
4.	8	8	8
5.	6	7	8
6.	3	5	6
7.	2	2	2
8.	2	2	2
9.	3	3	3
10	5	5	5
11.	1	2	2
12.	1	1	1
13.	5	6	7

Game outcome B LP - ESCo			
consultant	Min	Opt	Max
1.	5	6	7
2.	2	3	4
3.	6	7	8
4.	8	8	8
5.	6	8	9
6.	4	6	7
7.	2	2	2
8.	2	3	3
9.	3	3	3
10	5	5	5
11.	3	4	4
12.	2	2	2
13.	5	6	7

Game outcome A LP - T			
ESCo	Min	Opt	Max
1.	6	7	8
2.	1	2	3
3.	4	6	10
4.	1	1	1
5.	2	3	3
6.	1	1	1
7.	5	5	5
8.	3	3	3
9.	9	9	9
10	5	6	7
11.	3	4	5
12.	3	4	5
13.	5	6	7
14.	2	3	5
15.	1	3	4

Game outcome B LP - ESCo			
ESCo	Min	Opt	Max
1.	7	8	9
2.	1	2	3
3.	5	6	10
4.	1	1	1
5.	2	3	4
6.	2	2	2
7.	5	5	5
8.	4	4	4
9.	9	9	9
10	5	6	7
11.	4	5	6
12.	3	4	5
13.	5	6	7
14.	4	5	7
15.	1	3	4

Game outcome C MEAT - T			
consultant	Min	Opt	Max
1.	5	6	8
2.	5	6	7
3.	6	7	8
4.	8	8	8
5.	6	8	9
6.	4	5	6
7.	4	5	6
8.	5	5	5
9.	5	6	6
10	5	6	7
11.	3	5	7
12.	5	6	6
13.	6	6	8

Game outcome D MEAT - ESCo			
consultant	Min	Opt	Max
1.	6	7	9
2.	6	7	8
3.	7	8	9
4.	8	8	8
5.	6	8	9
6.	5	6	7
7.	5	6	7
8.	5	5	6
9.	6	6	7
10	6	6	8
11.	5	6	7
12.	5	6	7
13.	7	8	9

Game outcome C MEAT - T			
ESCo	Min	Opt	Max
1.	7	8	9
2.	5	6	7
3.	6	8	10
4.	6	6	6
5.	2	3	4
6.	5	6	7
7.	6	6	6
8.	6	6	6
9.	9	9	9
10	5	6	7
11.	5	6	7
12.	6	6	7
13.	6	7	8
14.	5	7	8
15.	5	6	7

Game outcome D MEAT - ESCo			
ESCo	Min	Opt	Max
1.	8	9	10
2.	5	6	7
3.	6	8	10
4.	9	9	9
5.	5	6	7
6.	5	8	9
7.	6	6	6
8.	7	7	7
9.	9	9	9
10	5	6	7
11.	5	6	7
12.	8	9	9
13.	6	7	8
14.	7	8	10
15.	5	6	7

Overall triangular fuzzy numbers *Criterion 12*			
Game outcome A	**LP - T**		
consultant	**Min**	**Opt**	**Max**
	1	4,230769	1
Defuzzified number			2,0769

Game outcome B	**LP - ESCo**		
consultant	**Min**	**Opt**	**Max**
	2	4,846154	2
Defuzzified number			2,9487

Game outcome C	**MEAT - T**		
consultant	**Min**	**Opt**	**Max**
	3	6,076923	5
Defuzzified number			4,6923

Game outcome D	**MEAT - ESCo**		
consultant	**Min**	**Opt**	**Max**
	5	6,692308	6
Defuzzified number			5,8974

Game outcome A	LP - T		
ESCo	Min	Opt	Max
	1	4,2	1
Defuzzified number			2,0667

Game outcome B	LP - ESCo		
ESCo	Min	Opt	Max
	1	4,6	1
Defuzzified number			2,2000

Game outcome C	MEAT - T		
ESCo	Min	Opt	Max
	2	6,4	4
Defuzzified number			4,1333

Game outcome D	MEAT - ESCo		
ESCo	Min	Opt	Max
	5	7,333333	6
Defuzzified number			6,1111

Impact criterion 13

Strategic partnerships with technical suppliers

Game outcome A LP - T

consultant	Min	Opt	Max
1.	3	5	6
2.	1	2	3
3.	3	4	5
4.	3	3	3
5.	5	5	6
6.	2	4	5
7.	2	2	2
8.	2	2	2
9.	3	3	3
10	3	3	3
11.	1	1	2
12.	1	2	3
13.	2	2	2

Game outcome B LP - ESCo

consultant	Min	Opt	Max
1.	4	5	6
2.	3	4	5
3.	3	4	5
4.	8	8	8
5.	6	7	7
6.	4	5	6
7.	2	2	2
8.	3	3	4
9.	3	3	3
10	3	3	3
11.	2	3	3
12.	4	5	5
13.	3	3	3

Game outcome A LP - T

ESCo	Min	Opt	Max
1.	1	2	3
2.	1	2	3
3.	1	3	6
4.	1	1	1
5.	1	2	3
6.	2	2	2
7.	6	6	6
8.	1	1	1
9.	5	5	5
10	4	5	6
11.	1	2	3
12.	3	3	3
13.	5	6	7
14.	3	5	7
15.	4	5	6

Game outcome B LP - ESCo

ESCo	Min	Opt	Max
1.	3	4	5
2.	1	2	3
3.	1	4	6
4.	1	1	1
5.	3	4	5
6.	3	5	6
7.	6	6	6
8.	5	5	5
9.	5	5	5
10	5	6	7
11.	2	3	4
12.	6	6	6
13.	6	7	8
14.	5	8	10
15.	4	5	6

Game outcome C MEAT - T			
consultant	Min	Opt	Max
1.	5	6	6
2.	3	4	5
3.	3	4	5
4.	3	3	3
5.	6	7	7
6.	5	6	7
7.	4	5	6
8.	5	5	5
9.	5	6	6
10	3	3	3
11.	3	5	6
12.	5	6	7
13.	4	4	4

Game outcome D MEAT - ESCo			
consultant	Min	Opt	Max
1.	5	6	7
2.	6	7	8
3.	3	4	5
4.	8	8	8
5.	6	7	8
6.	5	7	8
7.	4	5	6
8.	6	6	6
9.	6	6	7
10	3	3	3
11.	5	6	7
12.	6	7	8
13.	5	5	5

Game outcome C MEAT - T			
ESCo	Min	Opt	Max
1.	4	5	6
2.	6	7	8
3.	4	6	8
4.	6	6	6
5.	2	3	4
6.	3	6	7
7.	7	7	7
8.	8	8	8
9.	7	7	7
10	7	8	9
11.	4	5	6
12.	6	6	8
13.	5	6	7
14.	5	7	8
15.	4	5	6

Game outcome D MEAT - ESCo			
ESCo	Min	Opt	Max
1.	4	5	6
2.	6	7	8
3.	4	7	8
4.	9	9	9
5.	4	5	6
6.	4	7	9
7.	3	3	3
8.	9	9	9
9.	9	9	9
10	7	8	9
11.	7	8	9
12.	9	9	10
13.	6	7	8
14.	6	8	10
15.	4	5	6

Overall triangular fuzzy numbers *Criterion 13*			
Game outcome A	**LP - T**		
consultant	**Min**	**Opt**	**Max**
	1	2,923077	2
Defuzzified number			1,9744

Game outcome B	**LP - ESCo**		
consultant	**Min**	**Opt**	**Max**
	2	4,230769	2
Defuzzified number			2,7436

Game outcome C	**MEAT - T**		
consultant	**Min**	**Opt**	**Max**
	3	4,923077	3
Defuzzified number			3,6410

Game outcome D	**MEAT - ESCo**		
consultant	**Min**	**Opt**	**Max**
	3	5,923077	3
Defuzzified number			3,9744

Game outcome A	LP - T		
ESCo	Min	Opt	Max
	1	3,333333	1
Defuzzified number			1,7778

Game outcome B	LP - ESCo		
ESCo	Min	Opt	Max
	1	4,733333	1
Defuzzified number			2,2444

Game outcome C	MEAT - T		
ESCo	Min	Opt	Max
	2	6,133333	4
Defuzzified number			4,044444

Game outcome D	MEAT - ESCo		
ESCo	Min	Opt	Max
	3	7,066667	3
Defuzzified number			4,355556

Impact criterion 14

Delivered energy performance & user comfort

Game outcome A LP - T

consultant	Min	Opt	Max
1.	6	7	8
2.	1	2	3
3.	4	5	6
4.	3	3	3
5.	6	7	7
6.	2	3	5
7.	4	5	6
8.	1	1	2
9.	3	3	3
10	6	7	8
11.	1	1	1
12.	1	2	2
13.	4	5	6

Game outcome B LP - ESCo

consultant	Min	Opt	Max
1.	6	7	9
2.	1	2	3
3.	7	8	9
4.	8	8	8
5.	6	7	8
6.	5	6	8
7.	4	5	6
8.	3	3	3
9.	3	3	3
10	6	7	7
11.	5	6	7
12.	5	6	6
13.	5	6	7

Game outcome A LP - T

ESCo	Min	Opt	Max
1.	1	2	3
2.	1	2	3
3.	4	7	8
4.	1	1	1
5.	2	3	4
6.	2	2	2
7.	5	5	5
8.	2	2	2
9.	6	6	6
10	2	3	4
11.	4	5	6
12.	5	5	5
13.	4	5	6
14.	1	2	3
15.	4	6	8

Game outcome B LP - ESCo

ESCo	Min	Opt	Max
1.	6	7	8
2.	1	2	3
3.	5	8	9
4.	1	1	1
5.	6	7	8
6.	2	4	4
7.	5	5	5
8.	5	5	5
9.	6	6	6
10	2	3	4
11.	4	5	6
12.	6	6	6
13.	6	7	8
14.	5	7	10
15.	4	6	8

Game outcome C MEAT - T			
consultant	Min	Opt	Max
1.	7	8	9
2.	5	6	7
3.	5	6	7
4.	6	6	6
5.	6	7	7
6.	3	4	5
7.	7	8	9
8.	3	3	3
9.	5	6	7
10	8	8	8
11.	5	6	7
12.	3	3	3
13.	6	7	8

Game outcome D MEAT - ESCo			
consultant	Min	Opt	Max
1.	8	9	10
2.	6	7	8
3.	8	9	10
4.	8	8	8
5.	6	8	9
6.	7	8	9
7.	7	8	9
8.	8	8	9
9.	6	7	8
10	9	9	9
11.	6	7	8
12.	6	6	8
13.	7	8	9

Game outcome C MEAT - T			
ESCo	Min	Opt	Max
1.	6	7	8
2.	5	6	7
3.	5	7	8
4.	6	6	6
5.	3	4	5
6.	3	3	6
7.	7	7	7
8.	7	7	7
9.	8	8	8
10	4	5	6
11.	6	7	8
12.	6	7	7
13.	5	6	7
14.	5	6	7
15.	6	8	10

Game outcome D MEAT - ESCo			
ESCo	Min	Opt	Max
1.	8	9	10
2.	6	7	8
3.	5	8	10
4.	9	9	9
5.	7	8	9
6.	2	3	8
7.	9	9	9
8.	8	8	8
9.	8	8	8
10	4	5	6
11.	6	7	8
12.	7	7	7
13.	6	7	8
14.	6	9	10
15.	6	8	10

Overall triangular fuzzy numbers *Criterion 14*			
Game outcome A	**LP - T**		
consultant	**Min**	**Opt**	**Max**
	1	3,923077	1
Defuzzified number			1,9744

Game outcome B	**LP - ESCo**		
consultant	**Min**	**Opt**	**Max**
	1	5,692308	3
Defuzzified number			3,2308

Game outcome C	**MEAT - T**		
consultant	**Min**	**Opt**	**Max**
	3	6	3
Defuzzified number			4,0000

Game outcome D	**MEAT - ESCo**		
consultant	**Min**	**Opt**	**Max**
	6	7,846154	8
Defuzzified number			7,2821

Game outcome A	LP - T		
ESCo	Min	Opt	Max
	1	3,733333	1
Defuzzified number			1,9111

Game outcome B	LP - ESCo		
ESCo	Min	Opt	Max
	1	5,266667	1
Defuzzified number			2,4222

Game outcome C	MEAT - T		
ESCo	Min	Opt	Max
	3	6,266667	5
Defuzzified number			4,7556

Game outcome D	MEAT - ESCo		
ESCo	Min	Opt	Max
	2	7,466667	6
Defuzzified number			5,1556

Impact criterion 15

Application of innovative solutions & optimizations

Game outcome A LP - T

consultant	Min	Opt	Max
1.	3	4	4
2.	1	2	3
3.	3	4	5
4.	5	5	5
5.	5	5	6
6.	3	5	6
7.	2	2	2
8.	1	2	3
9.	3	3	4
10	5	5	6
11.	1	1	1
12.	2	2	2
13.	5	6	7

Game outcome B LP - ESCo

consultant	Min	Opt	Max
1.	3	4	5
2.	4	5	6
3.	7	8	9
4.	7	7	7
5.	6	7	7
6.	4	5	7
7.	2	2	2
8.	2	3	4
9.	3	4	5
10	5	6	7
11.	4	5	6
12.	3	3	4
13.	5	6	6

Game outcome A LP - T

ESCo	Min	Opt	Max
1.	1	2	3
2.	1	2	3
3.	4	6	7
4.	1	1	1
5.	1	2	3
6.	2	2	2
7.	5	5	5
8.	1	1	1
9.	6	6	6
10	4	5	6
11.	1	2	3
12.	6	6	7
13.	4	5	6
14.	1	3	4
15.	3	4	5

Game outcome B LP - ESCo

ESCo	Min	Opt	Max
1.	4	5	6
2.	1	2	3
3.	4	7	8
4.	1	1	1
5.	6	7	8
6.	3	4	5
7.	5	5	5
8.	2	2	2
9.	6	6	6
10	5	6	7
11.	3	4	5
12.	6	6	7
13.	5	6	7
14.	6	7	8
15.	3	4	5

Game outcome C MEAT - T			
consultant	Min	Opt	Max
1.	5	6	7
2.	3	4	5
3.	4	5	6
4.	7	7	7
5.	6	7	8
6.	6	7	8
7.	6	7	8
8.	2	2	3
9.	6	7	8
10	7	7	8
11.	6	7	8
12.	5	6	7
13.	6	7	8

Game outcome D MEAT - ESCo			
consultant	Min	Opt	Max
1.	6	7	9
2.	6	7	8
3.	8	9	10
4.	8	8	8
5.	7	8	9
6.	7	8	9
7.	7	8	9
8.	5	5	6
9.	6	8	8
10	7	8	9
11.	7	8	9
12.	5	6	8
13.	7	8	9

Game outcome C MEAT - T			
ESCo	Min	Opt	Max
1.	3	4	5
2.	5	6	7
3.	4	7	9
4.	6	6	6
5.	2	3	4
6.	3	5	7
7.	6	6	6
8.	4	5	6
9.	8	8	8
10	4	5	6
11.	4	5	6
12.	6	6	7
13.	6	6	7
14.	1	3	4
15.	6	7	8

Game outcome D MEAT - ESCo			
ESCo	Min	Opt	Max
1.	7	8	9
2.	5	6	7
3.	5	8	9
4.	9	9	9
5.	7	8	9
6.	4	6	9
7.	7	7	7
8.	4	5	6
9.	8	8	8
10	6	7	8
11.	6	7	8
12.	6	6	7
13.	6	7	8
14.	7	8	10
15.	7	8	9

Overall triangular fuzzy numbers *Criterion 15*			
Game outcome A	**LP - T**		
consultant	**Min**	**Opt**	**Max**
	1	3,538462	1
Defuzzified number			1,8462

Game outcome B	**LP - ESCo**		
consultant	**Min**	**Opt**	**Max**
	2	5	2
Defuzzified number			3,0000

Game outcome C	**MEAT - T**		
consultant	**Min**	**Opt**	**Max**
	2	6,076923	3
Defuzzified number			3,6923

Game outcome D	**MEAT - ESCo**		
consultant	**Min**	**Opt**	**Max**
	5	7,538462	6
Defuzzified number			6,1795

Game outcome A	LP - T		
ESCo	Min	Opt	Max
	1	3,466667	1
Defuzzified number			1,8222

Game outcome B	LP - ESCo		
ESCo	Min	Opt	Max
	1	4,8	1
Defuzzified number			2,2667

Game outcome C	MEAT - T		
ESCo	Min	Opt	Max
	1	5,466667	4
Defuzzified number			3,4889

Game outcome D	MEAT - ESCo		
ESCo	Min	Opt	Max
	4	7,2	6
Defuzzified number			5,7333

Impact criterion 16

Application of quality control system, policy & certification

Game outcome A LP - T			
consultant	Min	Opt	Max
1.	3	4	5
2.	1	2	3
3.	5	6	7
4.	3	3	3
5.	6	7	8
6.	6	8	9
7.	2	2	2
8.	1	2	2
9.	3	3	3
10	5	5	5
11.	1	2	3
12.	2	2	2
13.	3	4	5

Game outcome B LP - ESCo			
consultant	Min	Opt	Max
1.	4	5	6
2.	1	2	3
3.	5	6	7
4.	3	3	3
5.	6	7	8
6.	6	8	9
7.	2	2	2
8.	1	2	2
9.	3	3	3
10	5	5	5
11.	3	4	5
12.	3	4	5
13.	4	5	6

Game outcome A LP - T			
ESCo	Min	Opt	Max
1.	5	6	7
2.	1	2	3
3.	3	6	10
4.	1	1	1
5.	5	5	5
6.	1	1	1
7.	6	6	6
8.	3	3	3
9.	6	6	6
10	2	3	4
11.	2	3	4
12.	5	5	5
13.	4	5	6
14.	1	3	4
15.	4	5	6

Game outcome B LP - ESCo			
ESCo	Min	Opt	Max
1.	6	7	8
2.	1	2	3
3.	3	7	10
4.	1	1	1
5.	4	4	4
6.	2	2	2
7.	6	6	6
8.	4	4	4
9.	6	6	6
10	2	3	4
11.	3	4	5
12.	5	5	5
13.	5	6	7
14.	6	7	8
15.	4	5	6

Game outcome C MEAT - T			
consultant	Min	Opt	Max
1.	5	6	7
2.	3	4	5
3.	5	6	7
4.	3	3	3
5.	6	7	8
6.	6	8	9
7.	3	3	3
8.	2	3	3
9.	5	6	7
10	6	6	6
11.	4	5	6
12.	4	5	6
13.	5	6	7

Game outcome D MEAT - ESCo			
consultant	Min	Opt	Max
1.	6	7	8
2.	4	5	6
3.	5	6	7
4.	3	3	10
5.	7	8	9
6.	6	8	9
7.	3	3	3
8.	3	4	5
9.	6	7	8
10	8	8	8
11.	5	6	7
12.	4	5	6
13.	7	9	9

Game outcome C MEAT - T			
ESCo	Min	Opt	Max
1.	6	7	8
2.	5	6	7
3.	6	7	10
4.	6	6	6
5.	5	5	5
6.	4	4	4
7.	6	6	6
8.	6	6	6
9.	6	6	6
10	4	5	7
11.	5	6	7
12.	5	5	5
13.	5	6	7
14.	6	7	8
15.	4	5	6

Game outcome D MEAT - ESCo			
ESCo	Min	Opt	Max
1.	8	9	10
2.	5	6	7
3.	6	7	10
4.	9	9	9
5.	6	6	6
6.	5	5	5
7.	6	6	6
8.	6	6	6
9.	6	6	6
10	5	6	8
11.	5	6	7
12.	5	5	5
13.	6	7	8
14.	8	9	10
15.	4	5	6

Overall triangular fuzzy numbers *Criterion 16*			
Game outcome A	**LP - T**		
consultant	**Min**	**Opt**	**Max**
	1	3,846154	2
Defuzzified number			2,2821

Game outcome B	**LP - ESCo**		
consultant	**Min**	**Opt**	**Max**
	1	4,307692	2
Defuzzified number			2,4359

Game outcome C	**MEAT - T**		
consultant	**Min**	**Opt**	**Max**
	2	5,230769	3
Defuzzified number			3,4103

Game outcome D	**MEAT - ESCo**		
consultant	**Min**	**Opt**	**Max**
	3	6,076923	3
Defuzzified number			4,0256

Game outcome A	LP - T		
ESCo	Min	Opt	Max
	1	4	1
Defuzzified number			2,0000

Game outcome B	LP - ESCo		
ESCo	Min	Opt	Max
	1	4,6	1
Defuzzified number			2,2000

Game outcome C	MEAT - T		
ESCo	Min	Opt	Max
	4	5,8	4
Defuzzified number			4,6000

Game outcome D	MEAT - ESCo		
ESCo	Min	Opt	Max
	4	6,533333	5
Defuzzified number			5,1778

Impact criterion 17

Transparancy of work

Game outcome A LP - T			
consultant	Min	Opt	Max
1.	5	6	7
2.	1	2	3
3.	2	3	4
4.	8	8	8
5.	9	9	9
6.	2	3	4
7.	5	5	5
8.	1	2	3
9.	3	4	5
10	6	6	6
11.	1	1	1
12.	3	4	4
13.	6	7	8

Game outcome B LP - ESCo			
consultant	Min	Opt	Max
1.	6	7	8
2.	4	5	6
3.	5	6	7
4.	8	8	8
5.	9	9	9
6.	5	6	7
7.	5	5	5
8.	3	4	5
9.	3	4	5
10	6	6	6
11.	3	4	5
12.	4	5	6
13.	6	7	8

Game outcome A LP - T			
ESCo	Min	Opt	Max
1.	6	7	8
2.	1	2	3
3.	4	6	8
4.	1	1	1
5.	1	2	2
6.	2	2	2
7.	6	6	6
8.	5	5	5
9.	10	10	10
10	6	7	8
11.	4	5	6
12.	1	1	1
13.	4	5	6
14.	5	6	8
15.	3	4	5

Game outcome B LP - ESCo			
ESCo	Min	Opt	Max
1.	7	8	9
2.	1	2	3
3.	5	7	10
4.	1	1	1
5.	3	4	5
6.	3	3	3
7.	6	6	6
8.	5	5	5
9.	10	10	10
10	6	7	8
11.	4	5	6
12.	5	5	6
13.	5	6	7
14.	5	6	8
15.	3	4	5

Game outcome C MEAT - T			
consultant	Min	Opt	Max
1.	7	7	8
2.	2	3	4
3.	5	6	10
4.	8	8	8
5.	9	9	9
6.	6	8	9
7.	8	8	8
8.	2	3	4
9.	6	7	8
10	8	8	8
11.	4	5	5
12.	5	6	6
13.	6	7	8

Game outcome D MEAT - ESCo			
consultant	Min	Opt	Max
1.	7	8	9
2.	6	7	8
3.	8	9	10
4.	8	8	8
5.	9	9	9
6.	7	8	9
7.	8	8	8
8.	5	6	7
9.	6	8	9
10	9	9	9
11.	4	5	6
12.	5	7	8
13.	7	8	9

Game outcome C MEAT - T			
ESCo	Min	Opt	Max
1.	7	8	9
2.	5	6	7
3.	5	8	10
4.	6	6	6
5.	5	6	6
6.	4	5	5
7.	7	7	7
8.	6	6	6
9.	10	10	10
10	6	7	8
11.	5	6	7
12.	5	7	7
13.	5	6	7
14.	6	8	9
15.	5	6	6

Game outcome D MEAT - ESCo			
ESCo	Min	Opt	Max
1.	8	9	10
2.	6	7	8
3.	6	8	10
4.	9	9	9
5.	6	6	6
6.	5	6	7
7.	8	8	8
8.	7	7	7
9.	10	10	10
10	6	7	8
11.	5	6	7
12.	7	7	9
13.	6	7	8
14.	8	9	10
15.	5	6	7

Overall triangular fuzzy numbers *Criterion 17*			
Game outcome A	**LP - T**		
consultant	**Min**	**Opt**	**Max**
	1	4,615385	1
Defuzzified number			2,2051

Game outcome B	**LP - ESCo**		
consultant	**Min**	**Opt**	**Max**
	3	5,846154	5
Defuzzified number			4,6154

Game outcome C	**MEAT - T**		
consultant	**Min**	**Opt**	**Max**
	2	6,538462	4
Defuzzified number			4,1795

Game outcome D	**MEAT - ESCo**		
consultant	**Min**	**Opt**	**Max**
	4	7,692308	6
Defuzzified number			5,8974

Game outcome A	LP - T		
ESCo	Min	Opt	Max
	1	4,6	1
Defuzzified number			2,2000

Game outcome B	LP - ESCo		
ESCo	Min	Opt	Max
	1	5,266667	1
Defuzzified number			2,4222

Game outcome C	MEAT - T		
ESCo	Min	Opt	Max
	4	6,8	5
Defuzzified number			5,2667

Game outcome D	MEAT - ESCo		
ESCo	Min	Opt	Max
	5	7,466667	6
Defuzzified number			6,1556

Impact criterion 18

Technical flexibility of system

Game outcome A LP - T			
consultant	Min	Opt	Max
1.	3	5	6
2.	1	2	3
3.	3	4	5
4.	8	8	8
5.	6	6	6
6.	3	5	6
7.	3	3	3
8.	1	1	1
9.	3	3	3
10	5	5	6
11.	3	4	4
12.	2	2	2
13.	3	4	5

Game outcome B LP - ESCo			
consultant	Min	Opt	Max
1.	4	5	7
2.	1	2	3
3.	3	4	5
4.	8	8	8
5.	7	7	7
6.	3	5	6
7.	3	3	3
8.	2	3	3
9.	3	3	3
10	5	5	6
11.	5	5	6
12.	3	4	4
13.	4	5	6

Game outcome A LP - T			
ESCo	Min	Opt	Max
1.	1	2	3
2.	1	2	3
3.	4	6	7
4.	1	1	1
5.	3	4	5
6.	2	2	2
7.	5	5	5
8.	1	1	1
9.	4	4	4
10	2	3	5
11.	2	3	4
12.	5	5	6
13.	4	5	6
14.	1	3	4
15.	2	3	4

Game outcome B LP - ESCo			
ESCo	Min	Opt	Max
1.	4	5	6
2.	1	2	3
3.	5	6	7
4.	1	1	1
5.	5	6	7
6.	4	6	7
7.	6	6	6
8.	6	6	6
9.	5	5	5
10	4	5	7
11.	4	5	6
12.	5	5	6
13.	5	6	7
14.	1	3	4
15.	3	4	5

Game outcome C MEAT - T			
consultant	Min	Opt	Max
1.	5	6	8
2.	5	6	7
3.	3	4	5
4.	8	8	8
5.	7	7	7
6.	3	5	7
7.	5	5	5
8.	3	4	5
9.	5	6	7
10	6	7	7
11.	5	6	7
12.	5	6	6
13.	5	6	7

Game outcome D MEAT - ESCo			
consultant	Min	Opt	Max
1.	5	7	9
2.	2	3	4
3.	3	4	5
4.	8	8	8
5.	8	8	8
6.	3	5	7
7.	5	5	5
8.	4	5	6
9.	6	7	8
10	9	9	9
11.	6	7	8
12.	6	7	8
13.	6	7	8

Game outcome C MEAT - T			
ESCo	Min	Opt	Max
1.	5	6	7
2.	6	7	8
3.	4	7	9
4.	6	6	6
5.	5	6	6
6.	4	6	9
7.	6	6	6
8.	8	8	8
9.	7	7	7
10	4	6	8
11.	5	6	7
12.	6	6	6
13.	5	6	7
14.	3	4	6
15.	2	3	4

Game outcome D MEAT - ESCo			
ESCo	Min	Opt	Max
1.	5	6	7
2.	6	7	8
3.	4	7	9
4.	9	9	9
5.	6	7	8
6.	4	6	9
7.	7	7	7
8.	9	9	9
9.	7	7	7
10	5	7	10
11.	6	7	8
12.	8	8	9
13.	5	6	7
14.	4	5	7
15.	2	4	5

Overall triangular fuzzy numbers *Criterion 18*			
Game outcome A	**LP - T**		
consultant	**Min**	**Opt**	**Max**
	1	4	1
Defuzzified number			2,0000

Game outcome B	**LP - ESCo**		
consultant	**Min**	**Opt**	**Max**
	1	4,538462	3
Defuzzified number			2,8462

Game outcome C	**MEAT - T**		
consultant	**Min**	**Opt**	**Max**
	3	5,846154	5
Defuzzified number			4,6154

Game outcome D	**MEAT - ESCo**		
consultant	**Min**	**Opt**	**Max**
	2	6,307692	4
Defuzzified number			4,1026

Game outcome A	LP - T		
ESCo	Min	Opt	Max
	1	3,266667	1
Defuzzified number			1,7556

Game outcome B	LP - ESCo		
ESCo	Min	Opt	Max
	1	4,733333	1
Defuzzified number			2,2444

Game outcome C	MEAT - T		
ESCo	Min	Opt	Max
	2	6	4
Defuzzified number			4,0000

Game outcome D	MEAT - ESCo		
ESCo	Min	Opt	Max
	2	6,8	5
Defuzzified number			4,6000

Impact criterion 19

Guarantees provided on availability rate & response time

Game outcome A LP - T

consultant	Min	Opt	Max
1.	5	6	8
2.	1	2	4
3.	6	7	8
4.	8	8	8
5.	8	8	9
6.	2	4	5
7.	2	3	4
8.	1	1	1
9.	3	3	3
10	6	6	6
11.	1	2	3
12.	1	2	4
13.	2	3	4

Game outcome B LP - ESCo

consultant	Min	Opt	Max
1.	6	7	8
2.	2	3	4
3.	6	7	8
4.	8	8	8
5.	8	8	9
6.	6	7	8
7.	2	3	4
8.	2	2	2
9.	3	3	3
10	6	6	6
11.	4	5	6
12.	2	4	4
13.	2	3	4

Game outcome A LP - T

ESCo	Min	Opt	Max
1.	2	3	4
2.	1	2	3
3.	4	6	10
4.	1	1	1
5.	3	4	5
6.	3	3	3
7.	5	5	5
8.	4	4	4
9.	6	6	6
10	6	7	8
11.	4	5	6
12.	5	6	6
13.	4	5	6
14.	1	3	4
15.	2	3	4

Game outcome B LP - ESCo

ESCo	Min	Opt	Max
1.	6	7	8
2.	1	2	3
3.	4	6	10
4.	1	1	1
5.	6	6	6
6.	4	5	7
7.	5	5	5
8.	6	6	6
9.	6	6	6
10	6	7	8
11.	4	5	6
12.	7	7	7
13.	5	6	7
14.	3	5	7
15.	5	6	7

Game outcome C MEAT - T			
consultant	Min	Opt	Max
1.	7	8	9
2.	2	4	5
3.	6	7	8
4.	8	8	8
5.	8	8	9
6.	5	6	8
7.	5	6	7
8.	4	4	5
9.	5	6	7
10	7	8	9
11.	4	5	6
12.	4	5	5
13.	4	5	6

Game outcome D MEAT - ESCo			
consultant	Min	Opt	Max
1.	7	8	9
2.	3	4	5
3.	6	7	8
4.	8	8	8
5.	7	8	9
6.	6	7	9
7.	7	8	9
8.	4	4	5
9.	6	6	7
10	8	9	9
11.	5	6	7
12.	5	7	8
13.	6	7	8

Game outcome C MEAT - T			
ESCo	Min	Opt	Max
1.	4	5	6
2.	6	7	8
3.	6	7	10
4.	6	6	6
5.	5	5	5
6.	4	6	8
7.	5	5	5
8.	6	6	6
9.	6	6	6
10	6	7	8
11.	5	6	7
12.	7	8	9
13.	5	6	7
14.	5	8	9
15.	4	5	6

Game outcome D MEAT - ESCo			
ESCo	Min	Opt	Max
1.	7	8	9
2.	7	8	9
3.	6	8	10
4.	9	9	9
5.	8	9	10
6.	4	5	8
7.	5	5	5
8.	8	8	8
9.	6	6	6
10	6	7	8
11.	5	6	7
12.	7	9	10
13.	6	7	8
14.	6	9	10
15.	7	8	9

Overall triangular fuzzy numbers *Criterion 19*			
Game outcome A	**LP - T**		
consultant	**Min**	**Opt**	**Max**
	1	4,230769	1
Defuzzified number			2,0769

Game outcome B	**LP - ESCo**		
consultant	**Min**	**Opt**	**Max**
	2	5,076923	2
Defuzzified number			3,0256

Game outcome C	**MEAT - T**		
consultant	**Min**	**Opt**	**Max**
	2	6,153846	5
Defuzzified number			4,3846

Game outcome D	**MEAT - ESCo**		
consultant	**Min**	**Opt**	**Max**
	3	6,846154	5
Defuzzified number			4,9487

Game outcome A	LP - T		
ESCo	Min	Opt	Max
	1	4,2	1
Defuzzified number			2,0667

Game outcome B	LP - ESCo		
ESCo	Min	Opt	Max
	1	5,333333	1
Defuzzified number			2,4444

Game outcome C	MEAT - T		
ESCo	Min	Opt	Max
	4	6,2	5
Defuzzified number			5,0667

Game outcome D	MEAT - ESCo		
ESCo	Min	Opt	Max
	4	7,466667	5
Defuzzified number			5,4889

Impact criterion 20

Modifications in legal contract

Game outcome A LP - T			
consultant	Min	Opt	Max
1.	7	7	9
2.	2	3	4
3.	2	3	4
4.	8	8	8
5.	7	7	7
6.	3	5	6
7.	1	1	1
8.	1	1	1
9.	5	6	6
10	5	5	5
11.	1	2	3
12.	2	2	3
13.	2	3	4

Game outcome B LP - ESCo			
consultant	Min	Opt	Max
1.	7	7	9
2.	6	7	8
3.	3	4	5
4.	8	8	8
5.	7	8	8
6.	5	6	7
7.	1	1	1
8.	2	2	2
9.	5	6	6
10	5	5	5
11.	2	3	4
12.	2	5	5
13.	2	3	4

Game outcome A LP - T			
ESCo	Min	Opt	Max
1.	8	9	10
2.	1	2	3
3.	5	6	7
4.	1	1	1
5.	1	1	1
6.	2	2	2
7.	5	5	5
8.	7	7	7
9.	6	6	6
10	4	5	6
11.	3	4	5
12.	9	9	9
13.	2	3	4
14.	2	3	5
15.	4	5	6

Game outcome B LP - ESCo			
ESCo	Min	Opt	Max
1.	8	9	10
2.	1	2	3
3.	5	6	8
4.	1	1	1
5.	2	3	4
6.	4	5	6
7.	5	5	5
8.	7	7	7
9.	6	6	6
10	4	5	6
11.	3	4	5
12.	5	6	7
13.	4	5	6
14.	6	9	10
15.	4	5	6

Game outcome C MEAT - T			
consultant	Min	Opt	Max
1.	6	7	8
2.	5	6	7
3.	4	5	6
4.	8	8	8
5.	7	7	7
6.	3	5	6
7.	1	1	1
8.	1	1	1
9.	6	7	8
10	6	7	8
11.	4	5	6
12.	5	5	5
13.	2	3	4

Game outcome D MEAT - ESCo			
consultant	Min	Opt	Max
1.	6	7	8
2.	7	8	9
3.	5	6	7
4.	8	8	8
5.	7	8	9
6.	5	7	8
7.	1	1	1
8.	5	5	5
9.	6	7	8
10	7	8	9
11.	6	7	8
12.	5	7	8
13.	2	3	4

Game outcome C MEAT - T			
ESCo	Min	Opt	Max
1.	8	9	10
2.	1	2	3
3.	6	7	8
4.	6	6	6
5.	3	4	4
6.	3	5	6
7.	6	6	6
8.	4	4	4
9.	6	6	6
10	4	5	6
11.	4	5	6
12.	5	5	6
13.	4	5	6
14.	5	8	9
15.	4	5	6

Game outcome D MEAT - ESCo			
ESCo	Min	Opt	Max
1.	8	9	10
2.	1	2	3
3.	6	7	8
4.	9	9	9
5.	5	5	5
6.	4	7	8
7.	6	6	6
8.	3	3	3
9.	6	6	6
10	4	5	6
11.	5	6	7
12.	5	5	6
13.	5	6	7
14.	8	9	10
15.	4	5	6

Overall triangular fuzzy numbers *Criterion 20*			
Game outcome A	**LP - T**		
consultant	**Min**	**Opt**	**Max**
	1	4,076923	1
Defuzzified number			2,0256

Game outcome B	**LP - ESCo**		
consultant	**Min**	**Opt**	**Max**
	1	5	1
Defuzzified number			2,3333

Game outcome C	**MEAT - T**		
consultant	**Min**	**Opt**	**Max**
	1	5,153846	1
Defuzzified number			2,3846

Game outcome D	**MEAT - ESCo**		
consultant	**Min**	**Opt**	**Max**
	1	6,307692	1
Defuzzified number			2,7692

Game outcome A	LP - T		
ESCo	Min	Opt	Max
	1	4,533333	1
Defuzzified number			2,1778

Game outcome B	LP - ESCo		
ESCo	Min	Opt	Max
	1	5,2	1
Defuzzified number			2,4000

Game outcome C	MEAT - T		
ESCo	Min	Opt	Max
	1	5,466667	3
Defuzzified number			3,1556

Game outcome D	MEAT - ESCo		
ESCo	Min	Opt	Max
	1	6	3
Defuzzified number			3,3333

Impact criterion 21

Implementation plan

Game outcome A LP - T			
consultant	Min	Opt	Max
1.	3	5	7
2.	1	2	3
3.	4	5	6
4.	8	8	8
5.	5	6	6
6.	4	5	6
7.	6	7	8
8.	1	1	1
9.	3	3	3
10	6	6	6
11.	1	1	1
12.	2	2	2
13.	2	3	4

Game outcome B LP - ESCo			
consultant	Min	Opt	Max
1.	3	5	8
2.	1	2	3
3.	4	5	6
4.	8	8	8
5.	5	6	6
6.	4	5	7
7.	6	7	8
8.	2	2	2
9.	3	3	3
10	6	6	6
11.	2	3	3
12.	3	3	3
13.	3	4	5

Game outcome A LP - T			
ESCo	Min	Opt	Max
1.	4	5	6
2.	1	2	3
3.	3	5	7
4.	1	1	1
5.	2	3	4
6.	2	2	2
7.	6	6	6
8.	1	1	1
9.	5	5	5
10	2	4	6
11.	3	4	5
12.	5	5	5
13.	4	5	6
14.	2	4	5
15.	2	3	4

Game outcome B LP - ESCo			
ESCo	Min	Opt	Max
1.	4	5	6
2.	1	2	3
3.	5	6	8
4.	1	1	1
5.	5	6	6
6.	3	4	5
7.	6	6	6
8.	1	1	1
9.	5	5	5
10	4	6	8
11.	5	6	7
12.	5	5	5
13.	5	6	7
14.	5	6	7
15.	3	4	4

Game outcome C MEAT - T			
consultant	Min	Opt	Max
1.	3	5	7
2.	3	4	5
3.	4	5	6
4.	8	8	8
5.	5	8	8
6.	4	5	6
7.	6	7	8
8.	4	5	6
9.	6	7	7
10	6	6	6
11.	4	5	5
12.	5	5	6
13.	4	5	6

Game outcome D MEAT - ESCo			
consultant	Min	Opt	Max
1.	3	5	8
2.	3	4	5
3.	4	5	6
4.	8	8	8
5.	5	8	8
6.	4	5	7
7.	6	7	8
8.	4	5	6
9.	6	7	8
10	6	6	6
11.	3	4	5
12.	5	6	7
13.	5	6	7

Game outcome C MEAT - T			
ESCo	Min	Opt	Max
1.	6	7	8
2.	7	8	9
3.	5	8	9
4.	6	6	6
5.	2	4	4
6.	3	6	7
7.	9	9	9
8.	8	8	8
9.	5	5	5
10	2	4	6
11.	5	6	7
12.	7	7	7
13.	5	6	7
14.	6	7	9
15.	5	6	7

Game outcome D MEAT - ESCo			
ESCo	Min	Opt	Max
1.	7	8	9
2.	7	8	9
3.	5	8	10
4.	9	9	9
5.	7	8	9
6.	3	6	7
7.	7	7	7
8.	9	9	9
9.	5	5	5
10	4	6	8
11.	7	8	9
12.	8	8	8
13.	6	7	8
14.	7	8	9
15.	6	7	8

Overall triangular fuzzy numbers *Criterion 21*			
Game outcome A	**LP - T**		
consultant	**Min**	**Opt**	**Max**
	1	4,153846	1
Defuzzified number			2,0513

Game outcome B	**LP - ESCo**		
consultant	**Min**	**Opt**	**Max**
	1	4,538462	2
Defuzzified number			2,5128

Game outcome C	**MEAT - T**		
consultant	**Min**	**Opt**	**Max**
	3	5,769231	5
Defuzzified number			4,5897

Game outcome D	**MEAT - ESCo**		
consultant	**Min**	**Opt**	**Max**
	3	5,846154	5
Defuzzified number			4,6154

Game outcome A	LP - T		
ESCo	Min	Opt	Max
	1	3,666667	1
Defuzzified number			1,8889

Game outcome B	LP - ESCo		
ESCo	Min	Opt	Max
	1	4,6	1
Defuzzified number			2,2000

Game outcome C	MEAT - T		
ESCo	Min	Opt	Max
	2	6,466667	4
Defuzzified number			4,1556

Game outcome D	MEAT - ESCo		
ESCo	Min	Opt	Max
	3	7,466667	5
Defuzzified number			5,1556

Impact criterion 22

Maintenance plan & monitoring

Game outcome A LP - T			
consultant	Min	Opt	Max
1.	5	6	7
2.	1	2	3
3.	5	6	7
4.	8	8	8
5.	4	5	5
6.	3	4	5
7.	2	2	2
8.	1	1	1
9.	3	3	3
10	5	6	7
11.	1	2	2
12.	2	2	2
13.	5	6	7

Game outcome B LP - ESCo			
consultant	Min	Opt	Max
1.	6	7	8
2.	3	4	5
3.	7	8	9
4.	8	8	8
5.	5	6	6
6.	7	8	9
7.	2	2	2
8.	3	3	4
9.	3	3	3
10	5	7	7
11.	3	4	4
12.	5	5	5
13.	5	6	7

Game outcome A LP - T			
ESCo	Min	Opt	Max
1.	4	5	6
2.	1	2	3
3.	3	5	8
4.	1	1	1
5.	5	5	5
6.	2	2	2
7.	6	6	6
8.	1	1	1
9.	5	5	5
10	4	5	6
11.	3	4	5
12.	4	5	5
13.	4	5	6
14.	1	2	4
15.	4	5	6

Game outcome B LP - ESCo			
ESCo	Min	Opt	Max
1.	4	5	6
2.	1	2	3
3.	4	6	8
4.	1	1	1
5.	5	5	5
6.	4	5	6
7.	5	5	5
8.	5	5	5
9.	5	5	5
10	4	6	7
11.	4	5	6
12.	5	5	5
13.	5	6	7
14.	7	8	10
15.	5	6	7

Game outcome C MEAT - T			
consultant	Min	Opt	Max
1.	5	6	7
2.	5	6	7
3.	5	6	7
4.	8	8	8
5.	5	5	5
6.	4	5	6
7.	4	5	6
8.	2	3	4
9.	5	6	6
10	6	7	7
11.	4	5	6
12.	5	5	5
13.	6	7	8

Game outcome D MEAT - ESCo			
consultant	Min	Opt	Max
1.	6	7	7
2.	6	7	8
3.	7	8	9
4.	8	8	8
5.	5	6	6
6.	7	8	9
7.	4	5	6
8.	5	6	7
9.	6	6	7
10	8	9	9
11.	4	5	6
12.	7	8	9
13.	7	8	9

Game outcome C MEAT - T			
ESCo	Min	Opt	Max
1.	5	6	7
2.	6	7	8
3.	5	7	8
4.	6	6	6
5.	4	4	4
6.	2	5	6
7.	8	8	8
8.	6	6	6
9.	5	5	5
10	4	5	6
11.	6	7	8
12.	6	6	7
13.	5	6	7
14.	5	6	8
15.	6	7	8

Game outcome D MEAT - ESCo			
ESCo	Min	Opt	Max
1.	6	7	8
2.	6	7	8
3.	5	7	8
4.	9	9	9
5.	6	6	6
6.	3	5	7
7.	7	7	7
8.	8	8	8
9.	5	5	5
10	5	7	9
11.	7	8	9
12.	6	6	7
13.	6	7	8
14.	8	9	10
15.	7	8	9

Overall triangular fuzzy numbers *Criterion 22*			
Game outcome A	**LP - T**		
consultant	**Min**	**Opt**	**Max**
	1	4,076923	1
Defuzzified number			2,0256

Game outcome B	**LP - ESCo**		
consultant	**Min**	**Opt**	**Max**
	2	5,461538	2
Defuzzified number			3,1538

Game outcome C	**MEAT - T**		
consultant	**Min**	**Opt**	**Max**
	2	5,692308	4
Defuzzified number			3,8974

Game outcome D	**MEAT - ESCo**		
consultant	**Min**	**Opt**	**Max**
	4	7	6
Defuzzified number			5,6667

Game outcome A	LP - T		
ESCo	Min	Opt	Max
	1	3,866667	1
Defuzzified number			1,9556

Game outcome B	LP - ESCo		
ESCo	Min	Opt	Max
	1	5	1
Defuzzified number			2,3333

Game outcome C	MEAT - T		
ESCo	Min	Opt	Max
	2	6,066667	4
Defuzzified number			4,0222

Game outcome D	MEAT - ESCo		
ESCo	Min	Opt	Max
	3	7,066667	5
Defuzzified number			5,0222

Impact criterion 23

Risk management plan

Game outcome A LP - T			
consultant	Min	Opt	Max
1.	3	4	7
2.	1	2	3
3.	3	4	5
4.	8	8	8
5.	4	4	5
6.	2	3	4
7.	2	2	2
8.	1	1	1
9.	3	4	4
10	5	5	5
11.	1	2	4
12.	2	2	2
13.	4	5	6

Game outcome B LP - ESCo			
consultant	Min	Opt	Max
1.	4	5	7
2.	2	3	4
3.	6	7	8
4.	8	8	8
5.	4	5	6
6.	5	6	7
7.	2	2	2
8.	3	3	4
9.	4	4	5
10	5	5	5
11.	2	3	4
12.	4	4	4
13.	4	5	6

Game outcome A LP - T			
ESCo	Min	Opt	Max
1.	6	7	8
2.	1	2	3
3.	4	6	10
4.	1	1	1
5.	3	4	5
6.	1	2	4
7.	6	6	6
8.	1	1	1
9.	6	6	6
10	5	6	9
11.	2	3	4
12.	3	3	4
13.	3	5	6
14.	2	3	4
15.	2	3	4

Game outcome B LP - ESCo			
ESCo	Min	Opt	Max
1.	7	8	9
2.	1	2	3
3.	4	7	10
4.	1	1	1
5.	4	5	6
6.	2	3	3
7.	6	6	6
8.	3	3	3
9.	6	6	6
10	5	6	9
11.	3	4	5
12.	4	4	5
13.	5	6	7
14.	7	8	10
15.	2	3	4

Game outcome C MEAT - T			
consultant	Min	Opt	Max
1.	5	6	8
2.	6	7	8
3.	4	5	6
4.	8	8	8
5.	4	4	5
6.	2	3	4
7.	5	5	5
8.	2	2	3
9.	6	8	8
10	5	6	7
11.	4	5	6
12.	6	6	7
13.	5	6	7

Game outcome D MEAT - ESCo			
consultant	Min	Opt	Max
1.	5	6	8
2.	7	8	9
3.	7	8	9
4.	8	8	8
5.	4	5	6
6.	5	6	7
7.	5	5	5
8.	4	5	6
9.	7	8	9
10	7	8	8
11.	4	5	6
12.	6	6	7
13.	6	7	8

Game outcome C MEAT - T			
ESCo	Min	Opt	Max
1.	6	7	8
2.	6	7	8
3.	5	8	10
4.	6	6	6
5.	3	4	5
6.	3	5	7
7.	8	8	8
8.	6	7	8
9.	6	6	6
10	5	6	9
11.	4	5	6
12.	6	6	6
13.	5	6	7
14.	4	5	6
15.	5	6	7

Game outcome D MEAT - ESCo			
ESCo	Min	Opt	Max
1.	8	9	10
2.	6	7	8
3.	5	8	10
4.	9	9	9
5.	6	7	8
6.	4	6	7
7.	8	8	8
8.	7	8	8
9.	6	6	6
10	6	9	10
11.	5	6	7
12.	6	7	8
13.	6	7	8
14.	8	9	10
15.	5	6	7

Overall triangular fuzzy numbers *Criterion 23*			
Game outcome A	**LP - T**		
consultant	**Min**	**Opt**	**Max**
	1	3,538462	1
Defuzzified number			1,8462

Game outcome B	**LP - ESCo**		
consultant	**Min**	**Opt**	**Max**
	2	4,615385	2
Defuzzified number			2,8718

Game outcome C	**MEAT - T**		
consultant	**Min**	**Opt**	**Max**
	2	5,461538	3
Defuzzified number			3,4872

Game outcome D	**MEAT - ESCo**		
consultant	**Min**	**Opt**	**Max**
	4	6,538462	5
Defuzzified number			5,1795

Game outcome A	LP - T		
ESCo	Min	Opt	Max
	1	3,866667	1
Defuzzified number			1,9556

Game outcome B	LP - ESCo		
ESCo	Min	Opt	Max
	1	4,8	1
Defuzzified number			2,2667

Game outcome C	MEAT - T		
ESCo	Min	Opt	Max
	3	6,133333	5
Defuzzified number			4,7111

Game outcome D	MEAT - ESCo		
ESCo	Min	Opt	Max
	4	7,466667	6
Defuzzified number			5,8222

G. Fuzzy numbers of preference levels per game outcome per respondent

Preferences per game outcome
Validation question

Game outcome A LP - T			
consultant	Min	Opt	Max
1.	1	1	1
2.	1	2	3
3.	5	6	7
4.	1	1	1
5.	3	5	6
6.	4	6	7
7.	3	3	3
8.	8	9	10
9.	3	3	3
10	3	5	5
11.	1	3	5
12.	3	5	7
13.	3	3	3

Game outcome B LP - ESCo			
consultant	Min	Opt	Max
1.	2	3	4
2.	6	7	8
3.	1	3	5
4.	3	3	3
5.	4	5	7
6.	6	7	8
7.	3	4	5
8.	2	3	4
9.	3	3	3
10	5	7	7
11.	5	6	7
12.	4	6	7
13.	1	3	7

Game outcome A LP - T			
ESCo	Min	Opt	Max
1.	1	2	3
2.	2	3	4
3.	1	5	6
4.	1	1	1
5.	1	3	5
6.	1	2	3
7.	5	5	5
8.	1	3	4
9.	1	3	5
10	2	4	5
11.	1	2	3
12.	1	2	3
13.	1	3	5
14.	1	3	5
15.	7	8	9

Game outcome B LP - ESCo			
ESCo	Min	Opt	Max
1.	3	4	5
2.	2	3	4
3.	1	3	4
4.	6	6	6
5.	5	7	9
6.	5	7	9
7.	5	5	5
8.	5	6	7
9.	5	6	7
10	5	5	5
11.	3	4	5
12.	3	3	6
13.	3	5	7
14.	7	9	10
15.	3	4	5

Game outcome C MEAT - T			
consultant	Min	Opt	Max
1.	5	6	7
2.	6	7	8
3.	5	7	8
4.	5	5	5
5.	5	6	7
6.	6	7	8
7.	5	6	7
8.	5	6	7
9.	8	9	9
10	7	7	7
11.	3	4	7
12.	5	7	8
13.	1	1	7

Game outcome D MEAT - ESCo			
consultant	Min	Opt	Max
1.	8	9	10
2.	8	9	10
3.	5	7	9
4.	7	9	10
5.	5	7	8
6.	5	6	7
7.	6	7	8
8.	8	9	10
9.	8	9	9
10	9	9	9
11.	5	8	9
12.	5	7	8
13.	1	3	9

Game outcome C MEAT - T			
ESCo	Min	Opt	Max
1.	5	6	7
2.	7	8	9
3.	7	9	10
4.	9	9	9
5.	3	3	3
6.	5	7	9
7.	7	8	9
8.	6	7	8
9.	7	8	9
10	5	8	10
11.	4	5	6
12.	3	3	5
13.	3	7	9
14.	5	7	9
15.	3	4	7

Game outcome D MEAT - ESCo			
ESCo	Min	Opt	Max
1.	7	8	9
2.	7	8	9
3.	7	9	10
4.	9	9	9
5.	5	7	9
6.	7	9	10
7.	7	8	9
8.	8	9	10
9.	8	9	10
10	7	9	10
11.	7	8	9
12.	7	9	9
13.	5	7	9
14.	7	9	10
15.	5	7	8

Overall triangular fuzzy numbers *preferences per outcome*			
Game outcome A	**LP - T**		
consultant	**Min**	**Opt**	**Max**
	1	4	1
Defuzzified number			2,00

Game outcome B	**LP - ESCo**		
consultant	**Min**	**Opt**	**Max**
	1	4,615385	3
Defuzzified number			2,87

Game outcome C	**MEAT - T**		
consultant	**Min**	**Opt**	**Max**
	1	6	5
Defuzzified number			4,00

Game outcome D	**MEAT - ESCo**		
consultant	**Min**	**Opt**	**Max**
	1	7,615385	7
Defuzzified number			5,21

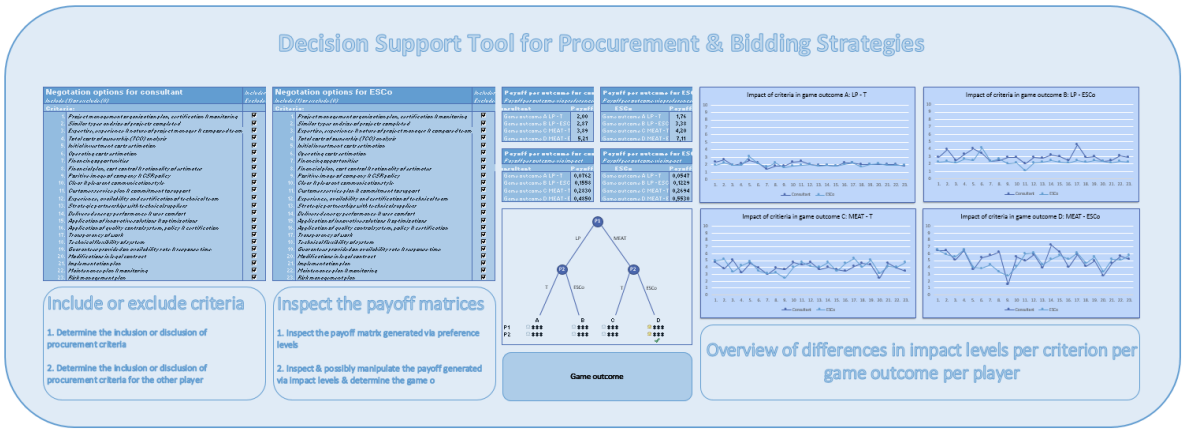
Game outcome A	LP - T		
ESCo	Min	Opt	Max
	1	3,266667	1
Defuzzified number			1,76

Game outcome B	LP - ESCo		
ESCo	Min	Opt	Max
	1	5,133333	4
Defuzzified number			3,38

Game outcome C	MEAT - T		
consultant	Min	Opt	Max
	3	6,6	3
Defuzzified number			4,20

Game outcome D	MEAT - ESCo		
consultant	Min	Opt	Max
	5	8,333333	8
Defuzzified number			7,11

H. Decision support tool



Left part:

Negotation options for consultant *Include (1) or exclude (0)*	*Include/ Exclude*
Criteria:	
1. *Project management organization plan, certification & monitoring*	☑
2. *Similar types and size of projects completed*	☑
3. *Expertise, experience & nature of project manager & composed team*	☑
4. *Total costs of ownership (TCO) analysis*	☑
5. *Initial investment costs estimation*	☑
6. *Operating costs estimation*	☑
7. *Financing opportunities*	☑
8. *Financial plan, cost control & rationality of estimates*	☑
9. *Positive image of company & CSR policy*	☑
10. *Clear & pleasant communication style*	☑
11. *Customer service plan & commitment to support*	☑
12. *Experience, availability and certification of technical team*	☑
13. *Strategic partnerships with technical suppliers*	☑
14. *Delivered energy performance & user comfort*	☑
15. *Application of innovative solutions & optimizations*	☑
16. *Application of quality control system, policy & certification*	☑
17. *Transparancy of work*	☑
18. *Technical flexibility of system*	☑
19. *Guarantees provided on availability rate & response time*	☑
20. *Modifications in legal contract*	☑
21. *Implementation plan*	☑
22. *Maintenance plan & monitoring*	☑
23. *Risk management plan*	☑

Negotation options for ESCo *Include (1) or exclude (0)*	*Include/ Exclude*
Criteria:	
1. *Project management organization plan, certification & monitoring*	☑
2. *Similar types and size of projects completed*	☑
3. *Expertise, experience & nature of project manager & composed team*	☑
4. *Total costs of ownership (TCO) analysis*	☑
5. *Initial investment costs estimation*	☑
6. *Operating costs estimation*	☑
7. *Financing opportunities*	☑
8. *Financial plan, cost control & rationality of estimates*	☑
9. *Positive image of company & CSR policy*	☑
10. *Clear & pleasant communication style*	☑
11. *Customer service plan & commitment to support*	☑
12. *Experience, availability and certification of technical team*	☑
13. *Strategic partnerships with technical suppliers*	☑
14. *Delivered energy performance & user comfort*	☑
15. *Application of innovative solutions & optimizations*	☑
16. *Application of quality control system, policy & certification*	☑
17. *Transparancy of work*	☑
18. *Technical flexibility of system*	☑
19. *Guarantees provided on availability rate & response time*	☑
20. *Modifications in legal contract*	☑
21. *Implementation plan*	☑
22. *Maintenance plan & monitoring*	☑
23. *Risk management plan*	☑

Include or exclude criteria

1. Determine the inclusion or disclusion of procurement criteria

2. Determine the inclusion or disclusion of procurement criteria for the other player

Inspect the payoff matrices

1. Inspect the payoff matrix generated via preference levels

2. Inspect & possibly manipulate the payoff generated via impact levels & determine the game o

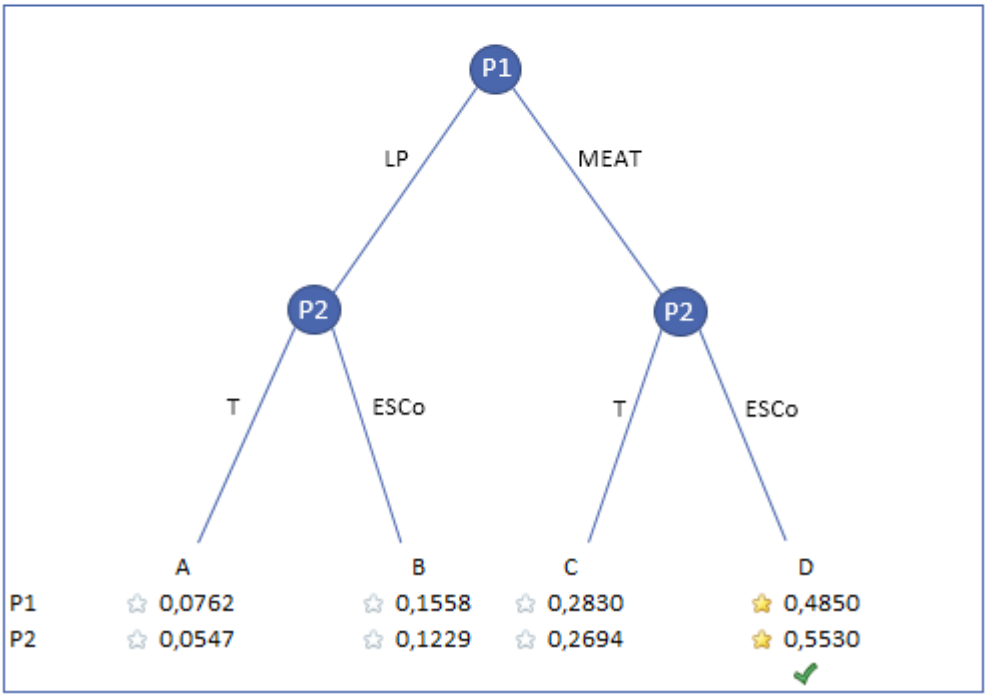
Middle part:

Payoff per outcome for consultant *Payoff per outcome via preference*	
consultant	Payoff
Game outcome A LP - T	2,00
Game outcome B LP - ESCo	2,87
Game outcome C MEAT - T	3,89
Game outcome D MEAT - ES	5,21

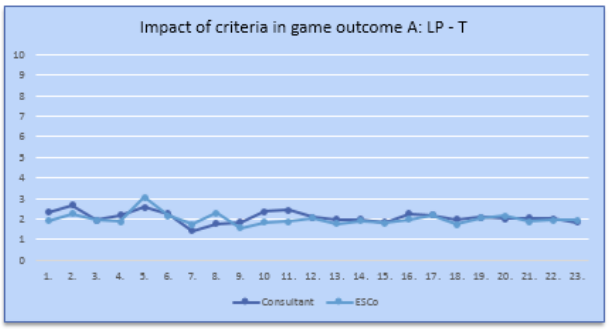
Payoff per outcome for ESCo *Payoff per outcome via preference*	
ESCo	Payoff
Game outcome A LP - T	1,76
Game outcome B LP - ESCo	3,38
Game outcome C MEAT - T	4,20
Game outcome D MEAT - ES	7,11

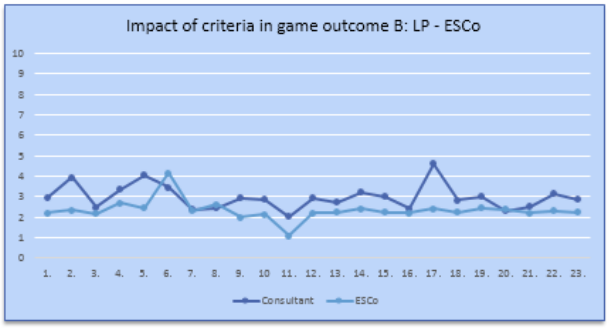
Payoff per outcome for consultant *Payoff per outcome via impact*	
consultant	Payoff
Game outcome A LP - T	0,0762
Game outcome B LP - ESCo	0,1558
Game outcome C MEAT - T	0,2830
Game outcome D MEAT - ES	0,4850

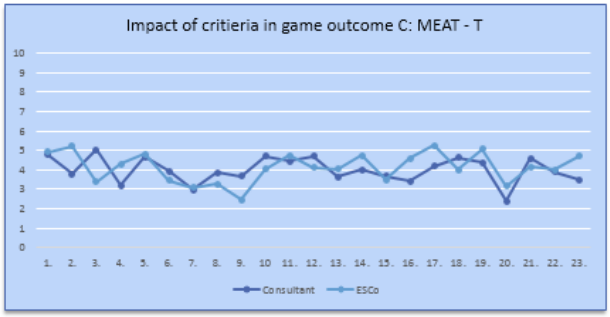
Payoff per outcome for ESCo *Payoff per outcome via impact*	
ESCo	Payoff
Game outcome A LP - T	0,0547
Game outcome B LP - ESCo	0,1229
Game outcome C MEAT - T	0,2694
Game outcome D MEAT - ES	0,5530

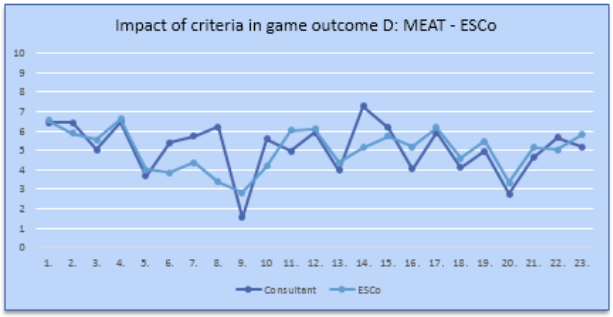


Right part:









Overview of differences in impact levels per criterion per game outcome per player