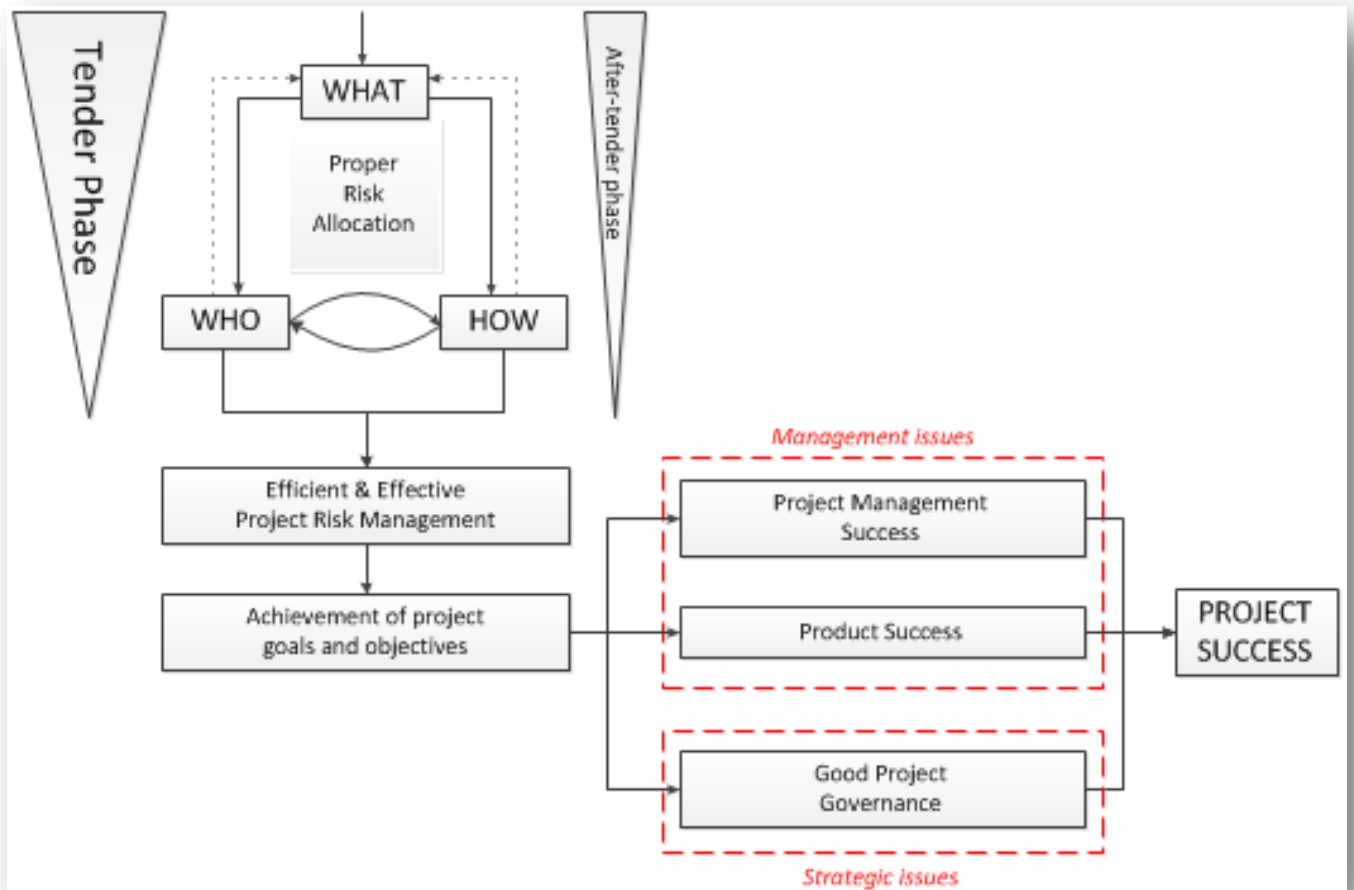


Risk allocation between the private parties in European Public-Private Partnerships for social infrastructure projects



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Preface

This thesis is the result of my graduation research about the risk allocation between private parties in European Public-private partnerships for social infrastructure projects. It is the final hurdle for graduating in the master Construction Management and Engineering from Delft University of Technology.

Reflecting on my research process, I can conclude that it has not always been smooth and painless. I have encountered many challenges throughout my journey towards graduating: e.g. the distance between Delft University of Technology and Munich Re or the dichotomy between the theoretical requirement and the practical one. Yet, here I stand, with my final version in my hands, and I can genuinely say that I am proud of how I have overcome all challenges.

This achievement would not have been possible with certain people. Therefore I would like to grasp the opportunity to thank those devoted people.

First of all, I want to thank my graduation committee. Pieter van Gelder, thank you for being the chair of my graduation committee and supervising me. You constantly encouraged me to keep going and take this research to the next level. Jules Verlaan, thank you for your insight in and feedback on financial or methodological aspects of this research. Mark de Bruijne, thank you for your devoted time. You have reviewed the report multiple times, steering it in the right direction. Our many meetings guided the research and your proposed literature aided in shaping the research.

Secondly, I want to thank my former colleagues at Munich Re for providing the opportunity to conduct my thesis. Thanks to Philipp Reißaus and Franz Vogt, who supervised me throughout my internship, but gave me the freedom to design my research in my own way. The dichotomy between the theoretical requirements and the practical ones has not always been easy to deal with, but you kept me on track. Thank you, Ton van Everdink, for introducing me and making this internship at Munich Re possible. Furthermore, a big thank you to all my former colleagues, who made me feel welcome at Munich Re.

Thirdly, I want to thank all interviewees. Just like any empirical research, the research is impossible without the experts in the field. I am grateful for all the time that they devoted to answering all my questions regarding the case studies and providing me with necessary documents. Furthermore, I want to thank the handful of people that were also willing to take the time to complete the questionnaire. It has been of great help for my research.

And last but not least, I want to thank my family and friends for their unconditional support. Thanks to my dad, who proofread my report, sharpened the reasoning and supported me in overcoming the challenges. Thanks to my mum, for her continuous mental support and taking care of me. Lastly, many thanks to my brothers and my friends for being able to take my mind off of this topic in the times that I was in need of distraction.

Bastiaan van den Broek

Berkel-Enschot, March 2018

Executive summary

In this research, a dichotomy between two different risk approaches is presented. One approach depicts risk management and a subpart of it, risk allocation, to be objective. The other approach contradicts this approach by stating that all stages of risk analysis, including its techniques involve subjectivity (Redmill, 2002). The WRR (2009) confirms that the new risk approach considers ‘normative judgement’ to be involved. The ‘dual nature of risk’, which implies that risks are on the one hand, objectively given, and on the other hand subjective, mental constructs (Klinke & Renn, 2002), is investigated in this research.

This research focuses on investigating the dichotomy between two different risk approaches and compares this dichotomy to risk allocation in practice. Different aspects are discussed such as project objectives, influencing factors, risk allocation criteria and finally the risk allocation process between the private parties in European PPP¹ social infrastructure projects. The following research question is leading throughout the research:

How to allocate risks between the private parties in European Public-Private Partnerships for social infrastructure projects?

First of all, a theoretical framework is constructed about the project objectives, the influencing factors, the risk allocation criteria and the risk allocation process. This forms the basis for three case studies that are conducted. Document reviews and nine semi-structured interviews provide the data for the empirical analysis. A cross-case analysis compares the three cases and the author provided an interpretation of this data. Then, the dichotomy in the theoretical approaches is compared with the empirical results in the comparative analysis. From this analysis, several propositions are formulated, which are validated in an additional questionnaire sent out to experts. Finally, conclusions and recommendations are developed for the risk allocation process, and the measures mentioned in the propositions.

Conclusions and recommendation concerning the risk allocation process

The first conclusion is that in practice the process of risk allocation differs substantially from the theoretical concept. The steps of risk allocation between the private parties in social infrastructure projects in practice appear as follows: 1. Identification of the risks, 2. Analysis and prioritisation of the risks, and 3. Allocation of the risk and determination of the risk response strategy. Step 1 and 2 equal the ‘what’ step of the theoretical concept. Step 3 combines the ‘who’ and ‘how’ step of the theoretical concept. This results in a revised risk allocation concept of the theoretical risk allocation concept, as displayed in below figure 1. The left side depicts the theoretical concept whereas the right side illustrates the revised risk allocation concept developed in this research. The revised risk allocation concept portrays a stepwise process of the risk allocation between private parties in European Public-private partnerships in social infrastructure projects.

¹ Public-private partnership: ‘A contractual arrangement between a public or governmental agency and a private entity that facilitates greater participation by the private entity in the delivery and operation of an infrastructure project, facility or service’ (Schneider & Davis, 2007, p. 2)

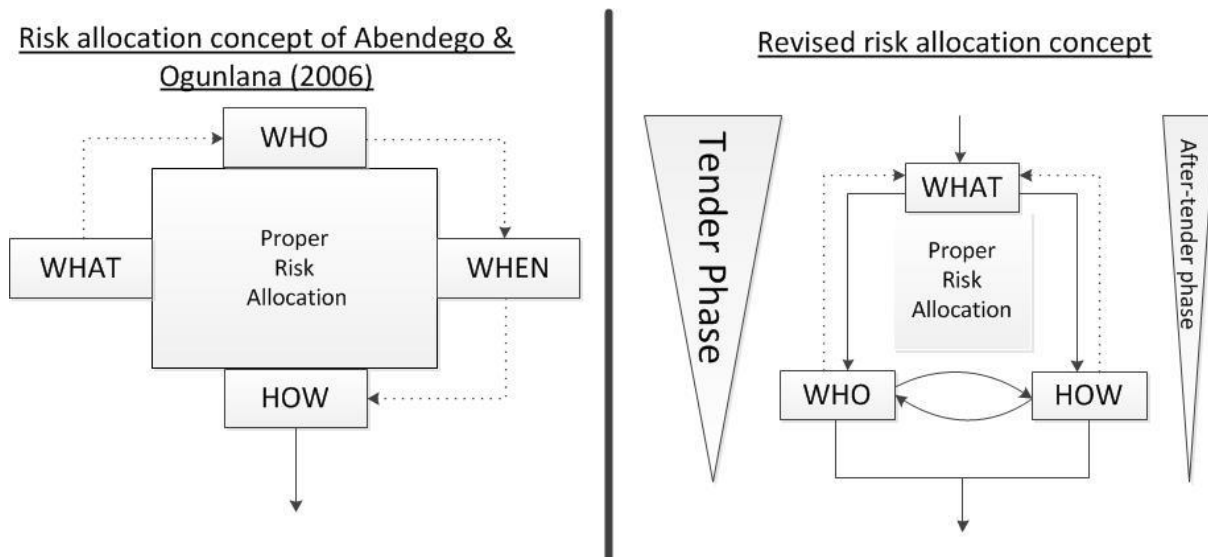


Figure 1: Original and revised risk allocation concept (source: author)

In this revised risk allocation concept, risks are first of all identified, analysed and prioritised in the ‘what’ step. The identified risks are listed in the risk register of the project. The risk analysis is conducted by determining the probability and the impact of the risk on project objectives. By multiplying these values, an overall risk score can be established. Based on these risk scores, the identified risks can be prioritised.

From the first step, there are two possible next steps. These steps concern the determination of the entity that deals with the risk (who) and the methodology of dealing with the risk (how). The research shows that these steps are very interrelated. If one party decides to accept the risk (how), it automatically implies that this party bears the risk (who). This goes vice versa as well, when a party decides they are bearing the risk (who), this implies that they have accepted the risk (how). However, this is not always settled within one iteration between ‘how’ and ‘who’. If a party decides it bears the risk, it can also decide to transfer the risk to another party. This shows that initially the ‘who’ - decision was settled, but by looking at how to deal with it, it is decided to transfer the risk, meaning that the owner of the risk will change.

Risk allocation between private parties in social infrastructure projects is a repetitive process. Furthermore, after deciding on how to deal with risk and who deals with it, residual risk often remains. Therefore, two arrows in the concept have been added, leading back from the ‘who’ and the ‘how’ to the ‘what’ step. These arrows show the iterative character of risk allocation.

The ‘when’ step depicted in the original model by Abendego & Ogunlana (2006) is not a conscious decision. The majority of the risk allocation appears to occur during the tender phase. The number of risks identified, analysed and allocated steadily declines throughout the tender procedure. A triangular shaped object that narrows towards the bottom has been added on the left side of the revised concept in figure 1. This object illustrates the decrease of risk allocated throughout the tender procedure. Also, during other phases of the project life cycle, (unforeseen) risks can occur. These need to be dealt with as well, hence the similarly shaped triangle on the right-hand side of the concept. But when coming closer to the termination of the project, fewer risks occur. Therefore, the breadth of this object decreases towards the bottom. Finally, since the majority of the risks are allocated in the tender phase, this triangle is portrayed bigger than the other one.

The recommendation is that private parties adopt the revised risk allocation concept depicted in figure 1 to allocate risk between the private parties in social infrastructure projects.

Conclusions on objectivity and intersubjectivity in risk allocation

In the case studies, the private parties intend to enhance objectivity in the risk allocation by using statistical models, such as Monte Carlo analysis. However, missing data and inability to perform such analyses prevents complete objectivity. Furthermore, the guiding role of experience throughout the influencing factors, the allocation criteria and the process suggests a high amount of subjectivity. Yet, a nuance has to be made. In regular manager meetings, they share and discuss their experience. Based on that, they take joint decisions to reach consensus and therewith eliminate complete subjectivity. The process of sharing assessments based on experience, discussing it and reaching an agreement about the risk allocation represents an intersubjective way of decision-making for the risk allocation between the private parties. Conclusions and recommendations on how to enhance objectivity and intersubjectivity are explained in the next paragraphs.

Conclusions and recommendations to enhance objectivity in risk allocation

Objectivity in the risk allocation between the private parties can be improved by counteracting the limitations of statistical models. Two limitations are observed during the case studies: lacking skills of employees and missing data. Private parties are recommended to provide training on how to conduct these analyses to counteract the limitation of lacking skills. Secondly, private parties are recommended to jointly develop a database with extensive information about the risk allocation in previous projects to mitigate the limitation of missing data. The data preferably contains all information that is generally inserted in a risk register of a project (probability, impact on project objectives, who bears the risk, how to deal with the risk, residual risk).

However, not all decisions can be made objectively. In that case, this research shows that intersubjective decisions are preferred over subjective ones. Therefore, it is recommended that when decisions cannot be made objectively, they must be made intersubjective.

Conclusions and recommendations to enhance intersubjectivity in risk allocation

The strong influence of trust and commitment on reaching consensus, and thus intersubjectivity is demonstrated. In case 1, the example of a bankrupt private party and in case 2, the late entrance in the tender phase of an important private party shows a high level of trust and commitment between the private parties.

Proposition	<input checked="" type="checkbox"/> / <input type="checkbox"/>
1. Trust between all private parties has a positive effect on reaching consensus on the risk allocation	<input checked="" type="checkbox"/>
2. Commitment of all involved parties has a positive effect on reaching consensus on the risk allocation.	<input checked="" type="checkbox"/>

Table 1: Confirmation or rejection of proposition 1-2

Furthermore, both proposition 1 and 2 are confirmed in the expert validation, supporting the previous statement that trust and commitment positively influence reaching consensus. Therefore, this research recommends that the private parties of a consortium build a trustful relationship and are committed to the project. How to achieve this, is elaborated in the next paragraphs.

Conclusions and recommendations related to trust between private parties

Proposition	✓/✗
3. Clear communication and good information distribution have a positive influence on trust	✓
3a. Using one centralised and digital database has a positive influence on clear communication and good information distribution	✓
3b. Working from one location has a positive influence on clear communication and good information distribution	✓
3c. Forming an integrated project team has a positive influence on clear communication and good information distribution	✓
4. Being open for discussion has a positive influence on trust	✓
5. A clear structure and process has a positive influence on trust	✓
6. Working with private parties that you have worked with before has a positive influence on trust	✓

Table 2: Confirmation or rejection of proposition 3-6

As table 2 shows, the expert validation confirms all propositions. This means that all measures mentioned in proposition 3-6 have a positive influence on trust. Furthermore, the measures in propositions 3a-3c are also confirmed, which demonstrates that using one centralised and digital database, working from one location and forming an integrated project team² have a positive influence on clear communication and information distribution.

Based on the confirmation of these propositions, the following recommendations are made. First of all, the author recommends that private parties in a project communicate clearly and have a good information distribution. In order to achieve this, the author recommends private parties to use one centralised and digital database. Additionally, the author recommends private parties in a project to work from one location and to form one integrated project team.

Furthermore, the author recommends that all private parties in a project are open for discussion. With an open attitude, employees are more approachable and can more easily be trusted, which enhances the process of coming to an agreement regarding the risk allocation.

Additionally, it is recommended that a clear structure and process be applied in the risk allocation between private parties of the project. This means that all parties must be aware of their own responsibilities, the constellation of the consortium and the sequence of activities.

Lastly, when parties have worked together on previous projects, they are more willing to take on additional risk from these parties to complete a project. The author recommends private parties to, where possible, work with parties that they have worked with before to enhance trust.

Conclusions and recommendations related to commitment of private parties

Proposition	✓/✗
7. Sharing goals, benefits and liabilities has a positive influence on commitment	✓
8. Setting clear expectations has a positive influence on commitment	✓
9. Forming an integrated project team has a positive influence on commitment	✓

Table 3: Confirmation or rejection of proposition 7-9

² An integrated project team is a team that is built up by members of all different private parties

Experts confirm that all three propositions (1. sharing goals, benefits and liabilities, 2. setting clear expectations, and 3. forming an integrated project team) have a positive influence on commitment.

This research provides three different ways to share liabilities of a project. The author recommends the private parties in a project to enter into a contract or agreement where one of these three sharing liabilities methods is used. Goals and benefits must also be shared between the private parties.

Secondly, the author recommends all private parties in a project to set clear expectations of the project. This research shows that setting clear expectations enhances commitment.

Lastly, forming an integrated team does not only have a positive influence on clear communication but also influences commitment according to the experts. Once more, the author recommends that all private parties in a project form an integrated project team to enhance commitment.

Conclusions on objectivity and intersubjectivity in the revised risk allocation concept

Feeding the different measures developed in the research back to the revised risk allocation concept shows that different measures affect different steps of this concept. Table 4 gives an overview of which steps of the concept are influenced by which measure.

Objectivity/intersubjectivity	Measures	What	Who	How
Objectivity	Improving statistical models	X		
	Trust	X	X	X
Intersubjectivity	Commitment	X	X	X
	Clear communication and information distribution	X	X	X
	One centralised and digital database	X	X	X
	Working from one location	X	X	X
	Forming an integrated project team	X	X	X
	Openness for discussion	X	X	X
	A clear structure and process	X	X	X
	Working with parties that they have worked with before		X	X
	Sharing of goals, benefits and liabilities		X	X
	Setting clear expectations	X	X	X

Table 4: Measures influencing steps of revised risk allocation concept

This table shows that improving statistical models enhances objectivity in the ‘what’ step of the revised risk allocation concept. Furthermore, trust and commitment improve intersubjective decision-making regarding the risk allocation in all three steps (what, who, how) of the new concept. Clear communication and information distribution and the three measures influencing communication (one centralised and digital database, working from one location, and forming an integrated project team) all influence intersubjectivity in the ‘what’ step, the ‘who’ step and the ‘how’ step of the revised risk allocation concept. This is also the case for openness for discussion and a clear structure and process, which positively influence the complete revised risk allocation concept. If private parties work together with other private parties that they have worked with before, this only influences the ‘who’ and ‘how’ step of the revised risk allocation concept. The same is true for the measure of shared goals, benefits and liabilities. Lastly, setting clear expectations enhances intersubjectivity in all three steps of the revised risk allocation concept.

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Glossary

Communication – ‘A continuous and iterative dialogue between organisation and stakeholders, which is a two-way process that involves both sharing and receiving information about the management of risk’ (ISO, 2009)

Economic infrastructure – ‘The hardware that represents the most recent physical manifestation of humanity’s culture and economy’ (Wellman & Spiller, 2012, p. 2)

Expertise – see understanding

Infrastructure – ‘The system of public works in a country, state or region, including roads, utility lines and public buildings’ (Inderst, 2010, p. 72).

Knowledge/know-how – see understanding

Likelihood (or risk probability) – ‘the probability that a risk factor will actually materialise’ Nicholas & Steyn (2012, p. 358)

Monte Carlo Analysis – ‘A technique that performs a project simulation many times to calculate a distribution of likely results’ (PMI, 2000, p. 203)

Public-private partnership – ‘A contractual arrangement between a public or governmental agency and a private entity that facilitates greater participation by the private entity in the delivery and operation of an infrastructure project, facility or service’ (Schneider & Davis, 2007, p. 2)

Risk – ‘an uncertain event or condition that, if it occurs, has a positive or a negative effect on a project objective’ (PMI, 2000, p. 127)

Construction risk – ‘Risks because of faulty construction techniques and cost escalation and delays in construction’ (Grimsey & Lewis, 2002, p. 111)

Financial risk – ‘Risks arising from inadequate hedging of revenue streams and financing costs’ (Grimsey & Lewis, 2002, p. 111)

Operational risk – ‘Risks due to higher operating costs and maintenance costs’ (Grimsey & Lewis, 2002, p. 111)

Organisational risk – Project-specific risks and all those concerning organisational issues (Roumboutsos & Anagnostopoulos, 2008, p. 11)

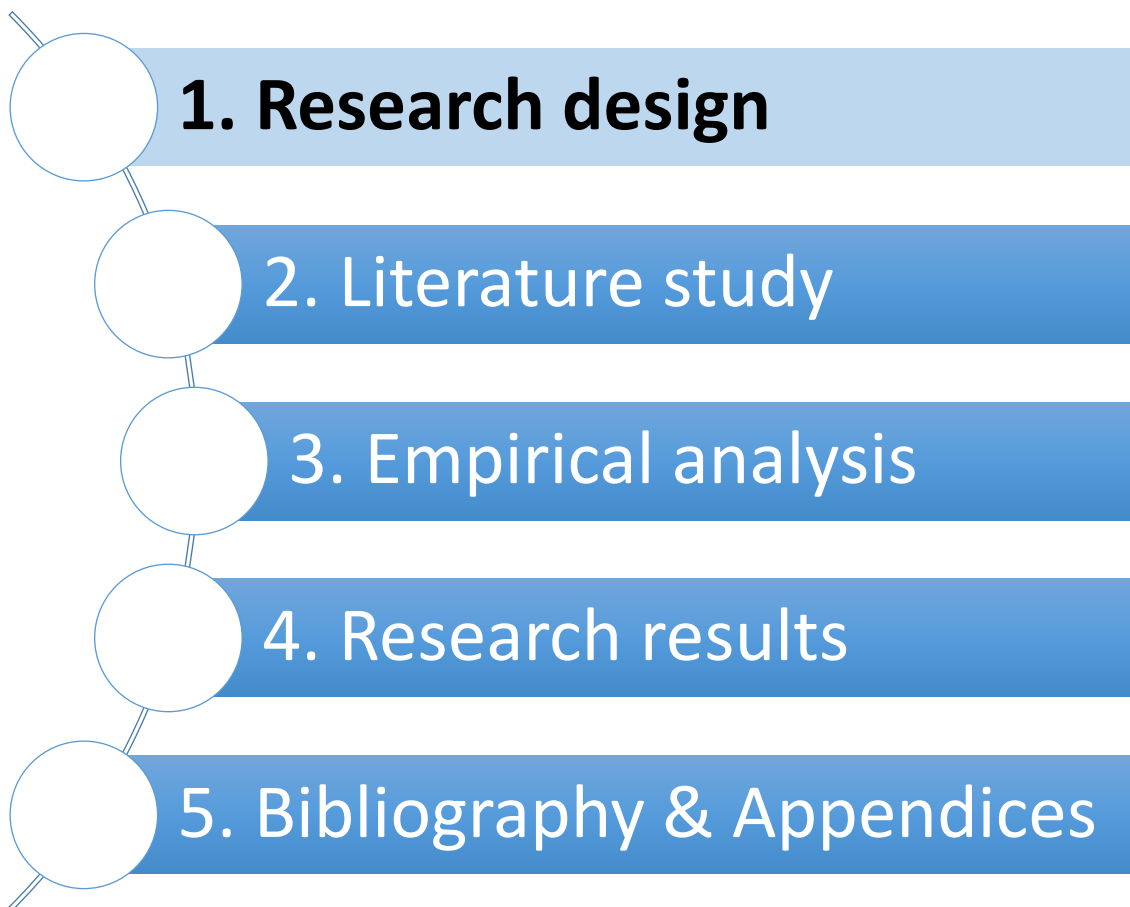
Risk allocation – The definition and division of responsibility associated with a possible future loss or gain and is a fraction of overall risk management (Uff & Odams, 1995)

Risk impact – The result if a risk materialised (Nicholas & Steyn, 2012, p. 360)

Social infrastructure – ‘The institutions and built structures that support such services as health, education, law and justice.’ (Wellman & Spiller, 2012, p. 2)

Special purpose vehicle (SPV) – ‘An SPV, or a special purpose entity (SPE), is a legal entity created by a firm (known as the sponsor or originator) by transferring assets to the SPV, to carry out some specific purpose or circumscribed activity, or a series of such transactions’ (Gorton & Souleles, 2007, p. 1)

Understanding – ‘The ability to understand something; comprehension’ (Oxford Dictionaries, 2017)



1. Introduction

Infrastructure projects in the past only used to be conducted by the government (Davis, 2005). ‘Government has been the principal provider of infrastructure’ (Grimsey & Lewis, 2004, p. 19). Over time, however, there has been a shift from solely public involvement to an increase in private involvement in infrastructure projects. From a public perspective, this is due to several governmental issues, namely (Della Croce & Gatti, 2014, p. 124):’

- Budget constraints
- Past experiments of poor public spending
- Inefficiencies in managing infrastructure on the public side’

Deteriorating economic conditions in the past caused budget constraints for the government, according to Mulder (2013). Furthermore, inefficiencies in managing infrastructure on the public side are caused by ‘distortionary interventions as well as states’ organizational structures, which are highly bureaucratic (Hammami, Ruhashyankiko, & Yehoue, 2006, p. 5). Furthermore, there was the contradiction that public sector investments had to be decreased whereas public facilities and services had to expand and improve (Grimsey & Lewis, 2004).

From the private organisation perspective, there have also been reasons to start investing in infrastructure projects. Infrastructure assets are expected to have a long-term, predictable stream of return that perfectly matches the long-term liabilities of for examples pension funds or insurance companies (Inderst, 2010, p. 73). Secondly, one of the main reasons according to Della Croce & Gatti (2014) is the diversification benefit. Lastly, the higher expectation of higher investment returns has played a role in the shift (Della Croce & Gatti, 2014; Della Croce & Yermo, 2013).

Latterly mentioned reasons led to the fact that in 1992 in Europe, the UK started the Private Finance Initiative (PFI), which initiated private involvement in infrastructure mainly in the form of private investment (Owen & Merna, 1997). This PFI model was developed further in the form of a Public Private Partnership (PPP), which implies a contractual agreement between a public authority and private parties to realise a construction project. The major private party in such agreement is commonly known as a special purpose vehicle (SPV), which ‘provides finance and capital for infrastructure as well as constructing the assets and providing some maintenance and operational services’ (Shaoul, Stafford, & Stapleton, 2012, p. 214). According to Gorton & Souleles (2007, p. 1), ‘An SPV, or a special purpose entity (SPE), is a legal entity created by a firm (known as the sponsor or originator) by transferring assets to the SPV, to carry out some specific purpose or circumscribed activity, or a series of such transactions’. Figure 2 is a graphical representation of parties, which may be involved in an SPV (Baratt, 2016).

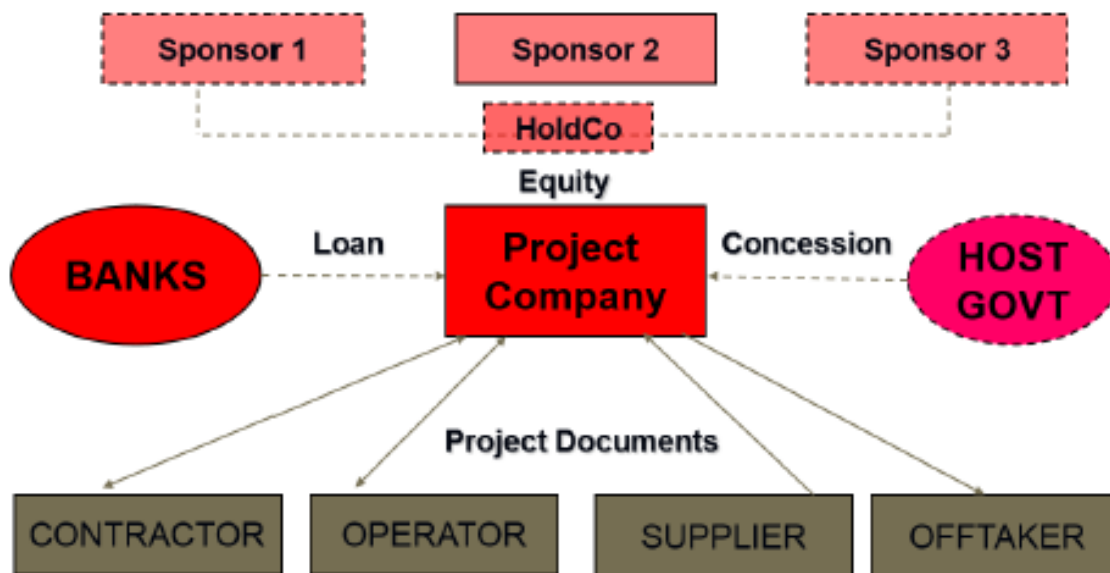


Figure 2: Graphic representation of an SPV (Barratt, 2016)

In this figure, the project company in the centre refers to the SPV. The entities on the bottom are the parties engineering, procuring, constructing, operating, maintaining, supplying to, or taking off the project. These entities generally receive payments in return for their services, hence the two-sided arrow connecting them to the SPV. The host government is the party with who the SPV reaches a long-term concession agreement. Banks insert capital in the form of a loan into the project in return for a recurring, periodic payment. The sponsors, in this case, can have several intentions (Gatti, 2008, p. 4):

- Industrial sponsors: project is linked to their core business;
- Public sponsors: aim for social welfare;
- Contractor/sponsors who develop, build or run the plant³: involved in the realisation (development, construction, operation) of the project
- 'Purely' financial investors: desire return on their investment

Industrial sponsors are companies whose project finance initiatives are linked to the core business. Gatti (2008) gives the example of an integrated gasification combined cycle (IGCC) project, where an oil company transforms the residual product (tar) of this project into energy, acting as industrial sponsor. Public sponsors are typically central or local governments, municipalities or municipalised companies. With the privatisation of realising infrastructure, public sponsors initiate the development of projects like schools, hospitals and prisons, increasing social welfare. Contractors, quite clearly aim to participate in project finance deals: 1. In the initial phase, they participate in handling the design and construction of the plant; 2. During the operational phase, they act as a shareholder of the SPV (Gatti, 2008). Lastly, financial investors participate in project finance deals in order to achieve a substantial return on their investment.

From a private party perspective, the PPP constellation involving an SPV is beneficial. This special formed legal entity protects mother companies from becoming bankrupt, should the project fail unexpectedly. Furthermore, Marques and Berg (2011) claim that PPP projects are more cost-efficient.

The overall (public) benefit from a PPP structure is that it is a long-term, sustainable approach to improve social infrastructure, enhancing the value of public assets and making better use taxpayers' money (Li & Akintoye, 2003). The long-term aspect of PPP agreements emanates typically from the agreements, which have a duration of many years. Furthermore, these agreements consist not only of the construction of

³ In this case, with a plant is referred to a typical power plant project. Project finance was among other first used in power production sectors (Gatti, 2008)

assets on one hand but also of the operation and maintenance, leading to enhanced sustainability of the assets. Where budget constraints on infrastructure initially led to the deterioration of public assets, the PPP constellation ensured that these assets are maintained and the value is enhanced. Lastly, because private parties also get involved in the financing of infrastructure, this leads to the authorities being able to allocate government spending to other public needs. Ke et al. (2010) also acknowledge that PPP's are an effective way to deliver value-for-money public infrastructure, which practically agrees with Abednego & Ogunlana (2006). It underpins that the authority has to invest little money to get high-quality infrastructure.

There are also some challenges with procuring projects using PPP's. First of all, PPP structures are more complex arrangements in terms of documentation, financing, taxation, technical details and sub agreements (Grimsey & Lewis, 2002). Then, as Jin & Zhang (2011, p. 591) state: 'risk allocation in PPP projects is fundamentally different from that in traditional public projects'.

These challenges lead to 9 out of 10 PPP projects suffering from cost overrun, thus not achieving project success according to Flyvbjerg, Skamris Holm and Buhl (2003). Many different authors claim different causes for cost overruns. Flyvbjerg et al. (2003) claim optimism bias and strategic misrepresentations are two major causes. Love et al. (2011) determined technical factors, such as design errors, to be major issues leading to cost overruns. Risk management also plays a crucial role in project success, since risk management in projects is the single most influential factor for project success (Hillson & Simon, 2007). Furthermore, the risk allocation, a part of risk management is a major contributor to project success, according to Marques & Berg (2011) and Chapman (1997). Since risk allocation and risk management are such major influencing factors for project success, these topics will be leading in this research.

2. Research design

2.1 Problem statement

'Risk analysis is often assumed to be objective, and its results – risk values and the decisions based on them – to be correct' (Redmill, 2002, p. 1). Applying quantitative risk analysis methods, such as Monte Carlo, are believed to provide an objective perspective without normative interpretation. According to Hillson (2004, p. 143), 'the output of a simulation model is independent of the person running the analysis, and is not subject to subjective preconceptions and bias'. Furthermore, the risk management models are presented as models that can be applied to any kind of infrastructure project, based on the standardised risk management models presented by e.g. Project Management Institute (PMI) (2002), Nicholas & Steyn (2012), Hillson & Simon (2007) and Chapman (1997). Even though these same authors state that each project is different, differences in projects, environment, objectives etc. should be taken into account. However, the models show no distinctions regarding these factors. In this perception risk analysis is possible to be objectified.

However, many authors argue the correctness of the assumption that risk management is objective. Lowrance (1980) points out that estimates of risk cannot escape containing elements of subjectivity. Vasvari (2015) says that subjectivity cannot be completely excluded from risk management. Redmill (2002) states that risk analysis is a part of risk management and he argues that all stages of risk analysis including the techniques used involve subjectivity. There is uncertainty, considerable scope for human bias, inaccuracy and the need for judgement (Redmill, 2002, p. 1).

The Scientific Council for Government Policy (Wetenschappelijk Raad voor het Regeringsbeleid (WRR), 2009) presents a risk approach differentiating the classical view. A major difference between those models is that the classic risk approach assumes that it is completely based on facts and thus objective, whereas the new approach considers 'normative judgement' to be involved, making it subjective.

Since subjectivity is involved in all steps of risk management (Redmill, 2002), this implies that the complete risk management process is affected by subjectivity. Thus, it is not a completely objective process as described in the classic risk approach. Especially the risk allocation between involved parties, which is an important part of risk management, is a major contributor to project success, according to Marques & Berg (2011) & Murphy (2008). The 'dual nature of risk' implies that risks allocated throughout the risk allocation process are on the one hand, objectively given. On the other hand, allocated risks are subjective, mental constructs (Klinke & Renn, 2002, p. 1076)

Secondly, the classic approach established various lists of risk criteria according to which risks should be allocated (Lam, Wang, Lee & Tsang, 2007; Medda, 2007; Abednego & Ogunlana, 2006; Ng & Loosemore, 2006). These lists provide risk allocation criteria but even these lists are conflicting. Furthermore, these lists of risk criteria are a theoretical view on how to allocate risks. It is observed that in practice the risk allocation is often influenced by economics, commercial requirements, debt financier's requirements, bargaining power and company culture and policies (Ng & Loosemore, 2006, p. 72). The WRR (2009) states that the new risk approach rather uses expertise and experience to allocate risks. 'Risk assessment is the domain of experts' (WRR, 2009, p. 81), where risk assessment is a part of risk allocation. The dichotomy of according to what criteria risks should be allocated is researched in this report.

Lastly, a problem associated with the classic approach, also partly resulting in the introduction of subjectivity in risk allocation is information asymmetry. 'The ways in which information is produced, communicated and distributed largely determines the extent to which it is possible to bear responsibility

for one's own safety' (Wetenschappelijke Raad voor het Regeringsbeleid, 2009, p. 52). This factor amongst other factors influencing (subjectivity of) risk allocation will be examined in this research. Additional factors are addressed in chapter 4.2.1

2.2 Research objectives and research questions

The problem statement states that there are diverging risk approaches. The objective is to investigate how the dichotomy of differing risk approaches, in theory, relates to the risk approach applied in practice. The aim is to contribute to scientific knowledge about the factors influencing risk allocation, the risk allocation criteria and the risk allocation process. Subsequently, a revised risk allocation model will be developed.

This exploratory research aims to gain and provide knowledge about 1) the process of risk allocation, 2) the risk allocation criteria and, 3) the factors influencing risk allocation between the private parties in European PPP for social infrastructure projects. By investigating these different aspects of the risk allocation, also the dichotomy between the subjectivity and objectivity of risk allocation will be addressed.

The objectives that have been stated in latter chapter result in the following research question:

'How to allocate risks between the private parties in European Public-Private Partnerships for social infrastructure projects?'

To guide the research the following sub questions have been determined:

1. What are influencing factors of risk allocation, the risk allocation criteria and how is the risk allocation process between private parties according to theory?
2. What are influencing factors of risk allocation, the risk allocation criteria and how is the risk allocation process between private parties according to practice?
3. Which risk approach do the influencing factors, the risk allocation criteria and the risk allocation process support?

2.3 Demarcation of the research field

First of all, this research will focus on risk allocation in infrastructure projects. According to Ng & Loosemore (2006, p. 66), 'public infrastructure is crucial to support a nation's social, cultural, and economic stability, productivity, development, and prosperity.' Additionally, infrastructure demand is predicted to grow. Therefore a proper risk allocation is needed for successful implementation in particular in this sector to realise future projects, especially for social infrastructure. Social infrastructure, in contrast, is seen to be much more complex than economic infrastructure due to the on-going involvement of the community (Jefferies & McGeorge, 2009). Also, social infrastructure is said to have a strong and considerable impact on the development of the economy, which makes it a very interesting area of research (KPMG, 2012; Casano, Gaiffe, Grolleau & Thebert, 2010). Lastly, PPP project structures have been developed mainly for economic infrastructure. However, there is a new upcoming trend, where PPP's are increasingly used for social infrastructure as well (Casano et al. 2010). Due to its new character and other previously mentioned reasons, this research is going to focus on social infrastructure. The distinction between economic and social infrastructure will be explained further on in this research.

Secondly, since all projects involve a vast amount of risks, not all of these risks can be taken into account in this research. This research only investigates the risks borne by private parties. Therefore, only the risks that Lam et al. (2007), Ng & Loosemore (2006), Bing, Akintoye, Edwards & Hardcastle (2005), Arndt (1998), Wang Tiong, Ting & Ashley (1998), National Treasury of South Africa (2004), Victoria Department of Treasury and Finance (2001), Marques & Berg (2011) and Roumboutsos & Anagnostopoulos (2008) allocate to the private parties are included in this research (see Appendix A). This analysis gives us the following risks:

1. Construction risk: all risks related to the construction of the project,
2. Operational risk: all risks related to the operation of the project, and
3. Organisational risk: all risks related to management and organisation (of the constellation) of the project

A more detailed explanation of these risks is provided in chapter 4.1.3. The lower level risks of these three risk categories are depicted in Appendix B.

Thirdly, globalisation in the construction industry is a trending topic, and ‘the appearance of international contractors was the first move in the globalisation of construction’ (Ngowi, Pienaar, Talukhaba & Mbachu, 2004, p. 138). Stakeholders are increasingly interacting in an international environment, therefore a possibly broad geographical scope should preferably be chosen. Unfortunately, due to limited (financial) means, the scope of this research cannot be extended to a broader geographical context than European projects. Therefore, this research will focus on projects located in Europe and where a European government provides the tender.

2.4 Research outline

This research commenced with an introduction to public-private partnerships chapter one. Then, the research design, covering the problem statement, objectives, research questions, demarcations of the research field and the research outline are covered in chapter two. In chapter three, the methodology of this research is discussed, elaborating on the literature study, the case studies and the expert validation. The literature study is conducted in chapter four. The exploration of each individual case study is presented in chapter five, followed by the cross-case analysis in chapter six. Chapter seven compares the findings from theory and practice in the comparative analysis. Consequently, in chapter eight is dealt with how to achieve intersubjectivity and certain propositions are formulated. These propositions are tested in the expert validation in chapter nine. Chapter 10 feeds the measures validated in the expert validation back to the results of the comparative analysis. The results of this research are presented in the conclusions and recommendations in chapter 11. This research finishes with a discussion, containing limitations and recommendations for further research in chapter 12. Finally, the bibliography and the appendices are covered in chapter 13 and 14.

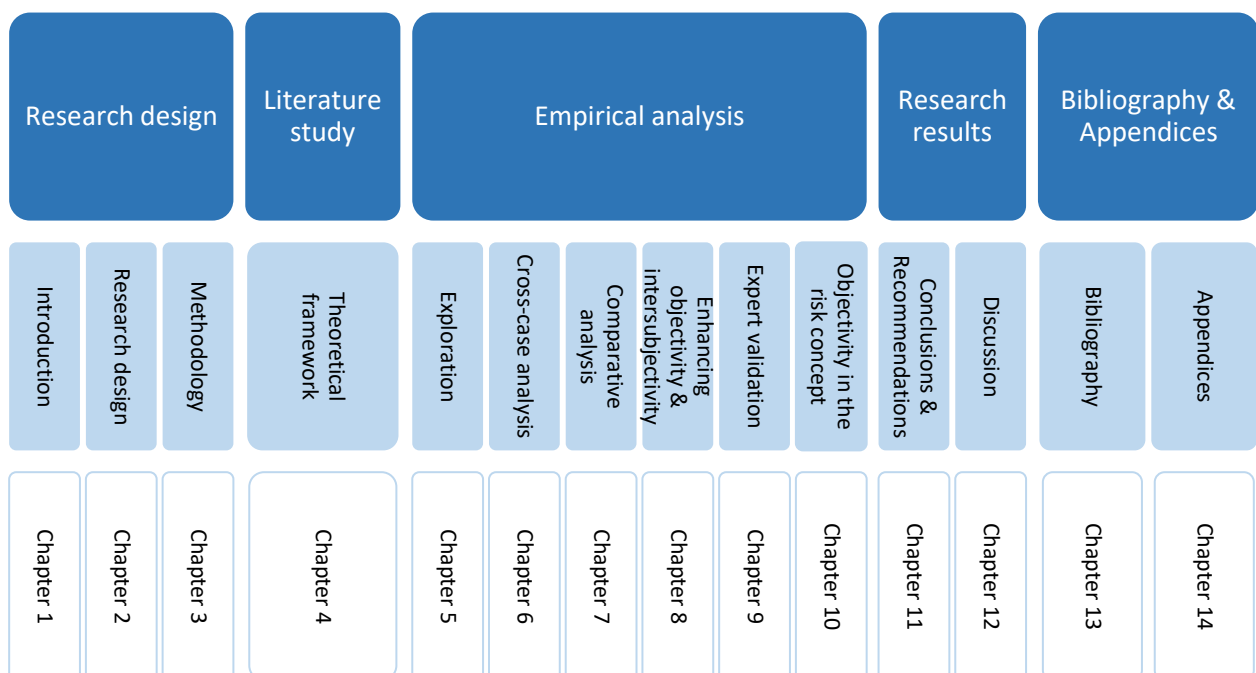


Figure 3: Research outline

3. Methodology

For this research, three different methods of research have been exploited. First of all, a literature study has been conducted in order to acquire profound theoretical knowledge on the subject. Secondly, in the empirical part, the empirical cycle of doing research has been followed. This empirical cycle consists of the following phases (de Groot, 1961, p. 29):

- Phase 1: Observation: Gathering and grouping of empirical data
- Phase 2: Induction: Formulation of propositions
- Phase 3: Deduction: Formulation of ways to test propositions
- Phase 4: Testing: Testing the formulated propositions by new data collection
- Phase 5: Evaluation: Evaluating the results of the testing phase and the formulated propositions

During the case studies, phase 1 is conducted and data is gathered. Then during the comparative analysis, observations regarding the risk allocation process, the allocation criteria and the influencing factors are made. The following chapter translates these observations into propositions, and the way to test the propositions is selected, completing phase 2 and 3. The expert validation chapter covers phase 4, in which the formulated propositions are tested. Phase 5, the evaluation of the proposition ultimately results in the final conclusions and recommendations.

3.1 Literature study

This chapter is conducted to gain knowledge about the different key concepts of this research and to construct a theoretical framework. First of all, the term infrastructure is explained and different kinds of infrastructure are discussed. Then, even though all projects are different, project objectives tend to all have similar objectives, which are explained. Furthermore, ‘project risk is an uncertain event or condition that, if it occurs, has a positive or a negative effect on **a project objective**’ (PMI, 2000, p. 127). Since risks influence the achievement of project objectives, it is important to have a thorough understanding of what risk entails. In order to deal with risks in projects, risk management methods have been developed. Subsequently, since risk allocation is a part of risk management, an introduction to this topic will be given.

The theoretical framework consists of three different parts, which all continue on the topic of risk allocation. First of all, several different influencing factors are discussed. Then, the topic of risk allocation criteria is covered. Lastly, the risk allocation process is discussed.

3.2 Case studies

The choice for the methodology of this research is based on Yin (1994). Yin (1994) identifies several options, including case studies, experiments, surveys, histories, and the analyses of archival information. The choice of the method is based on the following criteria (Yin, 1994, p. 5):⁶

- The type of research question
- The control an investigator has over actual behavioural events, and
- The focus on contemporary as opposed to historical phenomena⁷

Research questions can have many different starting words. Most common examples are who, how, why, what, where, how many or how much. How and why questions are mainly used to conduct explanatory research and mainly use an experiment, a history or a case study. Who, what, where, how much or how many questions mainly use a survey or archival analysis as the preferred type of research. The research question of this research starts with how, thus an experiment, a history or a case study should be conducted.

To determine the most adequate type of research from the three options, experiment, history or case study the next criterion stated by Yin (1994) will be examined. This criterion is the level of control of the investigator over actual behavioural events. The experiment, on the one hand, requires control over behavioural events, whereas the history and case study do not. In this research, the investigator will have no control over behavioural events. Risk allocation in infrastructure projects are not within the control of the investigator and thus is this option discarded.

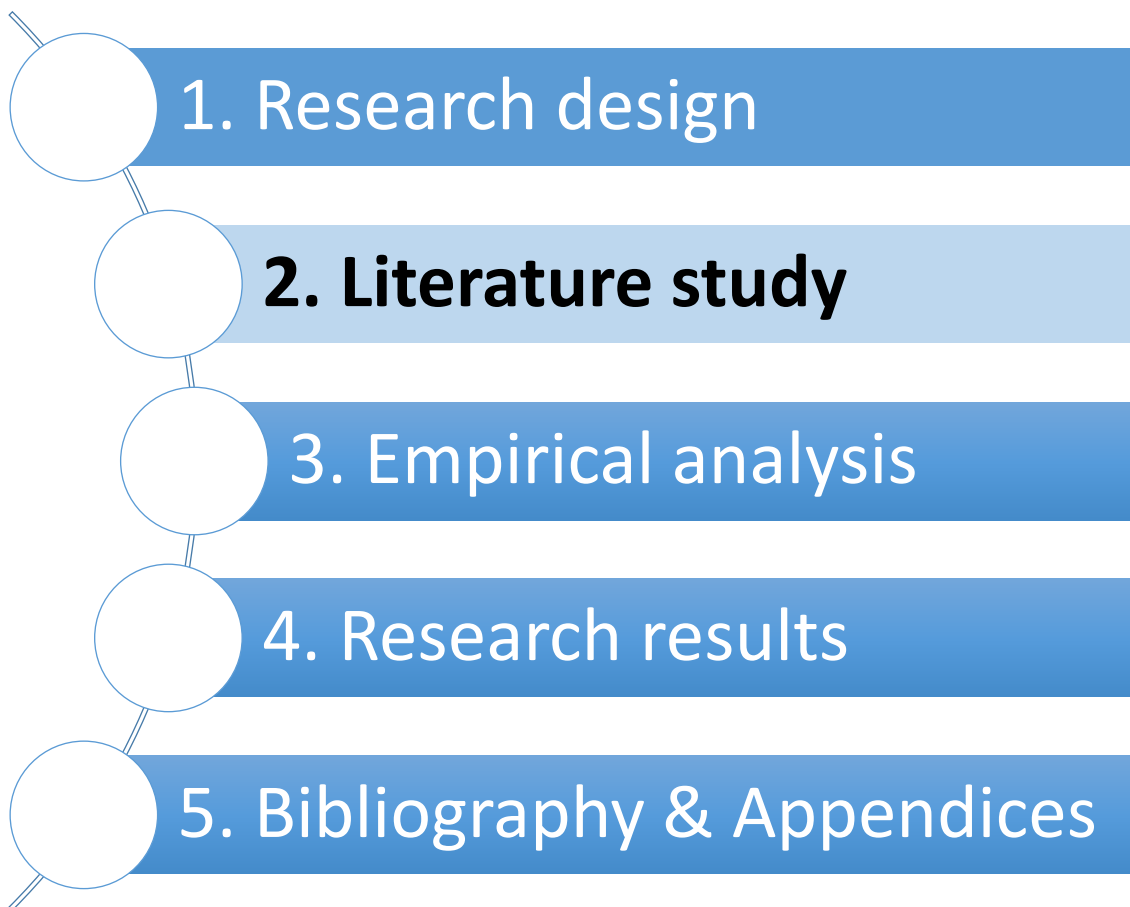
To decide between a history and a case study the time dimension will be taken into account. Does this research focus on contemporary – or historical phenomena? Even though many of the techniques of both types of research are similar, a case study involves two sources of evidence that a history typically does not take into account: direct observation and systematic interviewing. As Yin (1994, p. 8) states: ‘a case study’s unique strength is its ability to deal with a full variety of evidence – documents, artefacts, interviews, and observations – beyond what might be available in the conventional historical study’. Due to the fact that this research will focus on contemporary events, and will most likely use the mentioned sources of evidence, a case study is, in conclusion, the most appropriate type of research for this research.

After the case studies, in order to compare the results obtained from the individual cases, a cross-case analysis is conducted.

3.3 Expert validation

The expert validation seeks to validate the propositions. In this expert validation phase, a questionnaire is sent out to all interviewees of the case studies with Google Forms. With the aid of this questionnaire, the formulated proposition can be evaluated and final conclusions and recommendations can be provided.

The expert validation is conducted to add another iteration to the research process to validate the results. Together with the triangulation of data, this step enhances the validity and reliability of the results.



4. Literature study

4.1 General

4.1.1 What is infrastructure?

Since this research investigates the risk allocation in infrastructure, first of all, it is of importance to know what infrastructure actually is. There are many different articles that describe what infrastructure is. Grimsey & Lewis (2002, p. 108) state that infrastructure provides ‘basic services to industry and households’. Also, it claims infrastructure to be ‘a crucial input to economic activity and growth’ (Grimsey & Lewis, 2002, p. 108). In the OECD glossary, it is known as ‘The system of public works in a country, state or region, including roads, utility lines and public buildings’ (Inderst, 2010, p. 72).

A distinction made in the majority of the literature is between social and economic infrastructure. Social infrastructure comprises the institutions and built structures that support such services as health, education, law and justice.’ (Wellman & Spiller, 2012, p. 2).

Economic infrastructure is known as ‘hardware that represents the most recent physical manifestation of humanity’s culture and economy (Wellman & Spiller, 2012, p. 2). It is considered to be a more extensive type of infrastructure, hence the distinction into several categories according to literature. Casano et al. (2010) distinguish transport, energy, utilities and communication assets as economic infrastructure. Inderst (2010) selects transport, utilities, communication and renewable energy as distinct economic infrastructure classes, which are mentioned again by Inderst & Stewart (2014). Grimsey & Lewis (2004) name energy, transport, water and telecommunications as kinds of infrastructure.

The different kinds of infrastructure mentioned in previous paragraphs have been summarised and categorised in table 5 (Casano et al. 2010; Inderst, 2010; Inderst & Stewart, 2014; Grimsey & Lewis, 2004).

Economic infrastructure				Social infrastructure
Transport	Energy	Utilities	Communication assets	
Bridges	Extraction	Electricity distribution	Satellites	Healthcare facilities (hospitals, senior homes)
Tunnels	Power plants	Gas distribution	Television transmitters	Education facilities (schools, universities)
Toll Roads	Oil and gas pipelines	Water distribution	Cable networks	Defence and judicial buildings (courts, prisons)
Railways/ public transport	Renewable energy (wind power, solar cells)	Water treatment	Mobile phone virtual operators	Administrative buildings (police stations, city halls)
Seaports, airports		Waste treatment	Telephones	Leisure facilities (stadiums, opera house)
Parking		Storage	Transmission	

Table 5: Different kinds of infrastructure

4.1.2 Project objectives

Since the concept of infrastructure has been explained, it is important to elaborate on what infrastructure projects intend to achieve. Therefore, the project objectives will be discussed. To know what objectives are, first of all, a definition is provided. According to the Oxford dictionary (2017), an objective is: ‘a thing aimed at, or sought; a goal’ (Oxford Dictionaries, 2017).

A very common framework to depict project objectives is the triple constraint theory, also known as the iron triangle (Nicholas & Steyn, 2012, p. 9). This theory describes that a project has three objectives, which are: time, quality and cost. The objective time indicates the scheduled period during which the project will be conducted. The quality objective relates to the performance of what the deliverables of the project ought to be, also known as the requirements of the project. The cost is the budget attached to the project itself. Figure 4 gives an overview of the triple constraint theory model.

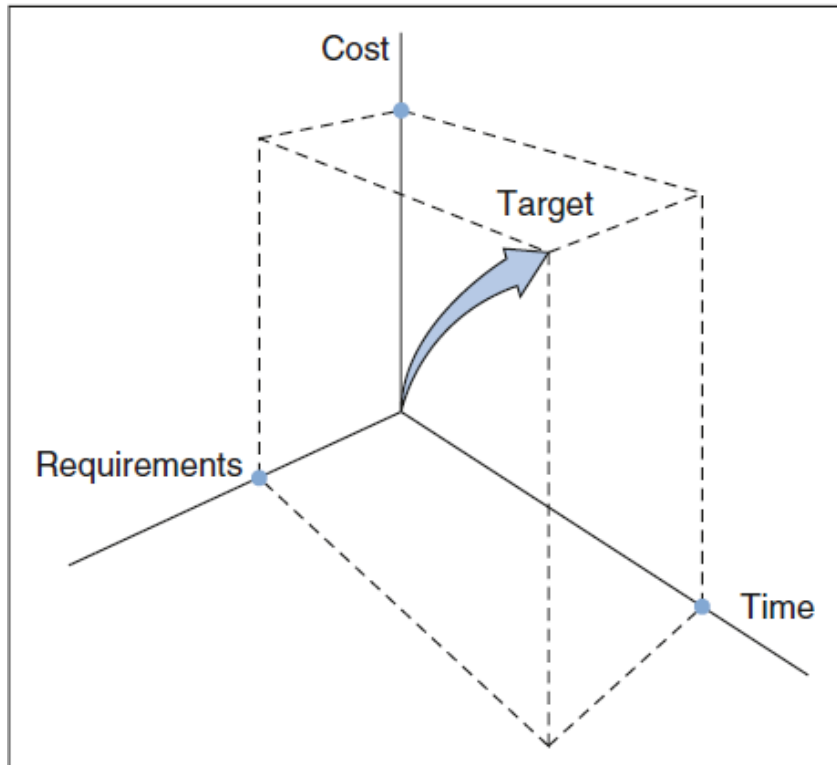


Figure 4: Triple constraint theory model (Nicholas & Steyn, 2012, p. 9)

However, this model encounters severe criticism, like the ‘Good, fast, or cheap? Pick two’-paradigm (Wyngaard, Pretorius & Pretorius, 2012, p. 1993). Good symbolises the quality, fast relates to time and cheap refers to the cost of the project. The aim is for all three constraints of the triple constraint theory to be met, yet in practice, it is often observed that only two of the three can be fulfilled (de Ridder, 2009). For project managers, it often requires a trade-off type of decision, which two factors primarily to focus on.

4.1.3 Risk

This research covers the risk allocation in infrastructure projects. However, risk allocation cannot be understood if the concept risk is not explained, hence this chapter. As PMI (2000, p. 127) states: ‘A risk is an uncertain, future event, that, if it occurs has a negative or positive impact on project promises, where a positive risk is called an opportunity and a negative risk is called a threat’. There is a vast amount of literature covering risks in infrastructure projects. Barratt (2016) distinguishes the following risks: Political risk, construction risk, technology risk, operating risk, input risk, market risk, interest rate risk, exchange risk and counterparty risk. However, since risks are known to be occurring events, the risks framed by Barratt therefore, are not risks but rather risk categories. The terminology relating to risks used in this research will be in line with that commonly used in literature.

In literature, big differences between the methodologies of categorisation of the risks are observed. Even though the majority of the authors agree that the risks should be based on the sources of the risk, there is

not one common, standardised framework to categorise them (Nicholas & Steyn, 2012; PMI, 2000). Ng & Loosemore (2006) determines project risks and general risks, whereas others define risk events related to different sectors (Lam, 1999). Some authors have linked the different risks to the phase of the project, like Casano et al. (2010) or Della Croce (2015). Nicholas & Steyn (2012) state that project risks can be divided into internal and external risks. PMI (2000) specify technical, quality or performance risks, project management risks, organisational risks and external risks as the main categories. Grimsey & Lewis (2004) present nine risk categories, which are regulatory/political risk, construction risk, technical risk, operating risk, revenue risk, financial risk, force majeure risk, environmental risk and projects default. For the international context, Al Khattab et al. (2007) determined political risks, financial risks, cultural risks and natural risks.

Hillson (2004) has presented two acronyms for two clusters of risks:

- SPECTRUM, which stands for Sociocultural, Political, Economic, Competitive, Technology, Regulatory and legal, Uncertainty and Market risks, and
- TECOP, which stands for Technical, Environmental, Commercial, Operational and Political risks.

In general project management, there are some well-known risk categorisation methods as well. A very well-known framework is the PEST analysis, handling the political, economic, social and technological factors. This method can be extended to the PESTLE analysis, including legal and environmental aspects as well (Yüksel, 2012). These are all different ways to use existing categorisations of risks. Hillson (2004) has derived a customised approach from the initial work breakdown structure (WBS) methodology to represent the risk categories in a structured way. This hierarchically organised method breaks down identified project risks into categories and subcategories and eventually depicting the potential causes of project risks. This method is better known as the risk breakdown structure (RBS) (Hillson, 2004). This research focuses on the construction risks, operational risk and organisational risk, which are considered to be level 1 risks. Appendix B provides an overview of the level 1 and level 2 risks that are addressed in this research.

The three risk categories that this research will focus on are construction risk, operational risk and organisational risk. Construction risks are all risks that are related to the construction of the risk. Construction risks can be because of faulty construction techniques, cost escalation or delay in construction (Grimsey & Lewis, 2004, p. 172). Additionally, Barratt (2016) identifies lacking performance as a construction risk. Operational risks are all risks related to the operation of the project. These risks can occur as a result of higher operating costs and maintenance costs (Grimsey & Lewis, 2004, p. 172). Lastly, organisational risk can occur, which are all risks related to the management and organisation (of the constellation) of the project. A major organisational risk is the internal inconsistency of project objectives (PMI, 2000, p. 132).

These three risks have been selected due to several reasons. First and most important of all, as depicted in chapter 2.3, these are risks that all authors allocated to the private parties. Due to the exploratory nature of how to allocate risks between private parties, no ambiguity should exist on whether the private or public party should take this risk. This research completely focuses on the risk allocation between private parties, and the author does not want to have to solve the problem first whether the risk should be allocated to the public or the private party. Secondly, these risks are claimed to be most important. Marques & Berg (2006) value construction risk the highest of all project risks. Furthermore, the duration of the operational risk is much longer than the construction risk. Typical construction is about 3-4 years of a complete lifespan of about 30 years (Ng & Loosemore, 2007). The operation phase covers the resting 26-27 years and is therefore very important. Finally, there is no author directly addressing organisational risk as a

major risk. However, the fact that in many different articles organisational risk recurs, implies that it is indeed an important risk.

4.1.4 Risk management

In order to understand how to deal with risks in projects, several risk management methods have been developed. Hillson & Simon (2007) developed the Active Threat and Opportunity Management (ATOM) model, ISO 31000 (2009) developed a risk management model, PMI (2000) presented a model in the Project Management Body of Knowledge (PMBok) and Chapman (1997) introduced the Project Risk Analysis and Management (PRAM) process. The general ideas of these models are similar and are explained in following paragraphs.

First of all, the process of risk management in the different models is very similar. Even though in different models the steps are named slightly different, the general idea behind the steps is the same. appendix C presents an overview of the different steps of the Active Threat and Opportunity Model (ATOM) (Hillson & Simon, 2007), the risk management model from ISO 31000 (ISO, 2009), the Project Risk Analysis and Management (PRAM) model (Chapman, 1997), and the risk management model from the PMBoK (PMI, 2000). From this comparison, the following steps have been summarised:

1. Initiation: Determine how the risk management approach will be applied
2. Risk identification: Identifying all possible risks
3. Risk analysis: Estimating the probability and impact of the risk on project objectives in order to prioritise
4. Risk response planning: Determine the way to deal with the risk to reduce threats and enhance opportunities
5. Monitoring & review: Detect whether implemented measures are effective and what residual risks arise from these measures

This summary also shows that different terminology is used for the risk analysis. This report refers to risk analysis either as risk assessment or risk analysis.

Secondly, an important similarity is the fact that literature broadly acknowledges that both negative risks (threats) and positive risks (opportunities) should be implemented in the risk management process (Leijten, 2016). Threats should be minimised whereas opportunities should be enhanced.

Thirdly, the general idea of these risk management frameworks can be applied to every project in any organisation. However, the specific risk management approach has to be tailored to every specific project and organisation, as every project is unique and acts in a different environment and every organisation has different objectives and goals (Nicholas & Steyn, 2012; PMI, 2000). This is achieved by conducting a detailed analysis of the projects environment, characteristics and involved stakeholders. Therefore, the methods described have to be scalable to different sizes, industries or types of projects and/or organisations.

Lastly, risk management is not a one-time approach but needs to be constantly monitored, evaluated and adjusted when necessary, as it operates in a dynamic environment. The risk management processes described are iterative processes and need to be evaluated constantly to implement them successfully into the organisation (ISO, 2009).

4.1.5 Risk allocation

As depicted earlier in this research, a part of risk management is the risk allocation. Therefore this chapter addresses the topic of risk allocation.

Risk allocation is the definition and division of responsibility associated with a possible future loss or gain and is a fraction of overall risk management (Uff & Odams, 1995). Marques & Berg (2011), Murphy (2008) and Grimsey & Lewis (2002) have agreed that risk allocation is a major contributor to the success or a major cause for failure of infrastructure projects. Improper risk allocation can have many negative consequences such as cost increases, inefficiencies, lengthy contract negotiations leading to project delays, a non-delivery of value-for-money to the community, and inefficient and ineffective risk management (Ng & Loosemore, 2006; Medda, 2007; Abednego & Ogunlana, 2006).

Many different authors have elaborated on risk allocation between the public and private parties in a PPP. Small distinctions in allocating risks in different countries are made. Bing, Akintoye, Edwards and Hardcastle (2005) discuss the topic of risk allocation in the UK, Rouboutsos & Anagnostopoulos (2008) in Greece, Ke, Wang, Chan & Lam (2010) in China, Abednego & Ogunlana (2006) in Indonesia and Marques & Berg (2011) address risk allocation using a Portuguese case study. Even though in every research a slightly different perspective has been chosen in terms of geographical location, the method of research (survey or case study) or type of industry in which the research was conducted, the main conclusions are congruent. Ke et al. (2010) have made a comparative analysis of results of risk allocations of different pieces of literature. The results of this analysis are included in appendix A and show what risks are typically allocated to which party according to the different authors.

Ng and Loosemore (2006) and some other authors stress the importance to be aware of the limitations of the several models. A major limitation of these models is that they generalise risk allocation (Ng & Loosemore, 2006). This limits the project-to-project basis perspective necessary when allocating risks. Exceptions to these generalised methods are 1. Medda (2007), who uses a game theory approach to construct a final offer arbitration model to resolve disputes about risk allocation, 2. Lam et al. (2007), who use fuzzy logic to construct a decision-making model for risk allocation, and 3. Ng & Loosemore (2006) who address the rationale behind the decisions to be made regarding risk allocation. A slight difference between latter three models is that Medda (2007) is the only constructs a model without testing it in practice. The only article to be found that covers the allocation between private parties of a PPP is the article by Wang et al. (2000). Where other authors only allocate risks between the public and the private party, Wang et al. (2000) provide a risk allocation between the government (public party) and the consortium, lender, insurer, and bond/bank/or insurer (private parties).

4.2 Theoretical framework

Previous chapters have provided a general overview of important topics of this research. However, this research aims to investigate the influencing factors, the risk allocation criteria and the process of risk allocation. Therefore, these different aspects are covered in the next chapters. With the information provided in these chapters, the first sub question can be answered.

4.2.1 Influencing factors

In literature, there are many factors, sometimes called critical success factors that influence risk management and risk allocation (Hendriks, 2016). This chapter will elaborate on the following factors influencing the risk allocation:

- Information distribution and communication
- Understanding of the risk
- Top management support

The choice of these particular is first of all because these are factors returning in the majority of the studied articles. Furthermore, these three factors impact the objectivity of the risk allocation, but this will be discussed for each individual factor in following paragraphs.

The first factors that are going to be investigated are information distribution and communication. Clear communication is considered to be ‘a continuous and iterative dialogue between organisation and stakeholders, which is a two-way process that involves both sharing and receiving information about the management of risk’ (ISO, 2009). This suggests that information distribution is of utmost importance. It is identified by ISO (2009) as a crucial part of risk management whereas lack in proper information dissemination functions as a barrier to effective risk management (ISO, 2009) Moreover, Vasvari (2015) states that the lack of clear communication is a main contributor to subjectivity in risk analysis.

The second factor to be taken into account in this research is understanding of the risk. Understanding may relate to the existence, the nature, form, likelihood and significance of the risks. According to the WRR (2009), lacking information is a major cause of misunderstanding and ambiguity of risks. Smith et al. (2006) state that successful risk management is, for the largest part, depending on the attention, motivation, competence, and knowledge and understanding of the employees. Thus, understanding the risk is essential before allocating and managing it. However, when the people deciding on the risk allocation have no clear understanding of the risk, assumptions need to be made, which makes it subject to normative interpretation (WRR, 2009).

Lastly, support of top management is a major contributor to effective risk management (ISO 2009). Dionne (2013) stated that independent risk management policies not being supported by top management had severely contributed to major financial losses during the financial crisis. It is obvious that top management should support the risk management policies.

Influencing factors, in this case, are factors that can affect the risk allocation process, but they are not a strict requirement. Risk allocation criteria, however, are requirements to allocate a risk to a certain party. A party needs to fulfil the risk allocation criteria in order to bear the risk. An overview of risk allocation criteria is provided in the following chapter.

4.2.2 Risk allocation criteria

In theory, several criteria for risk allocation are provided. First of all, Lam et al. (2007) determine criteria based on previous research by Thompson & Perry (1992), Casey (1979), Kuesel (1979), Barnes (1983) and Abrahamson (1984). Secondly, Medda (2007) defines two criteria. Based on Ward & Chapman (1991),

Edwards (1995) and Flanagan & Norman (1993), Abednego & Ogunlana (2006) discovered several conditions that must be satisfied for proper risk allocation. Lastly, Ng & Loosemore (2006) elaborate on certain criteria. Table 6 presents an overview of the risk allocation criteria acquired from different sources. Furthermore, a summarising column presents an overview of the risk allocation criteria combined from the different authors.

Lam et al (2007)	Medda (2007)	Abednego & Ogunlana (2006)	Ng & Loosemore (2006)	Overview
1. Party must be able to foresee the risk	1. Party must be best able to influence and control the risky outcome	1. A risk should be allocated to the party with the best capability to control the events that might trigger its occurrence	1. Party must be fully aware of the risks they are taking	1. Party must be able to foresee, understand and evaluate (the possible magnitude of) the risk
2. Party must be able to assess the possible magnitude of the consequence of the risk	2. A risk must be borne by the agent able to bear the risk at the lowest cost	2. A risk must be properly identified, understood and evaluated by all parties	2. Party must have the greatest capacity (expertise and authority) to manage the risk effectively and efficiently (and thus charge the lowest risk premium)	2. Party must be best able to influence and/or control the events triggering the occurrence
3. Party must be able to control the risk chance of occurring		3. Party must have the technical/managerial capability to manage the risks	3. Party must have the capability and resource to cope with the risk eventuating	3. Party must be able to sustain or manage the (financial) consequence of the risk
4. Party must be able to manage the risk in case of occurring		4. Party must have the financial ability to sustain the consequences of the risk or to prevent from occurring	4. Party must have the necessary risk appetite to take the risk	4. Risk must be taken by the party with the greatest capacity to bear the risk at the lowest cost
5. Party must be able to sustain the consequences if the risk occurs		5. Party must be willing to accept the risk	5. Party must have been given the chance to charge an appropriate premium for taking it	5. Party must be willing to take the risk
6. Party must benefit from bearing the risk				6. Party must benefit from bearing the risk
7. The premium charged by the risk receiving party is considered reasonable and acceptable for the owner				7. The risk premium is considered reasonable and acceptable for both the bearing party as well as the owner

Table 6: Risk allocation criteria

These criteria are conditions that need to be fulfilled in order to properly allocate the risks. Except for the fourth criterion of the overview, all criteria must be able to be answered with ‘yes’. They are assessed binary. The fourth criterion is assessed quantitatively, where the relation between the capacity and the corresponding costs is taken into account.

4.2.3 Risk allocation process

Abednego & Ogunlana (2006) developed a concept, a part of which is dedicated to proper risk allocation. They determined four stages that proper risk allocation must entail: 1. What, 2. Who, 3. When and 4. How. This concept is shown in the underlying figure.

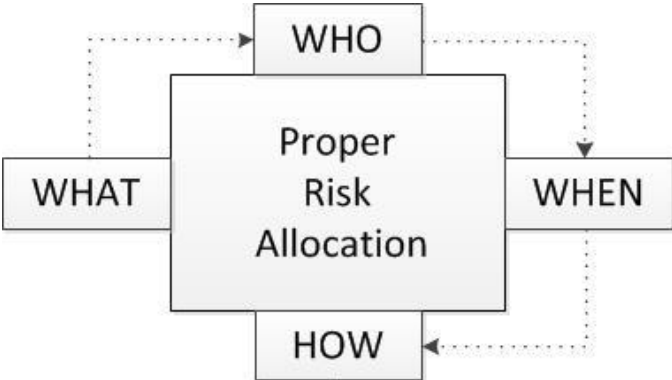


Figure 5: Concept of proper risk allocation (Adapted concept of Abednego & Ogunlana, 2006)

The first stage describes the identification and analysis of risks. The second stage determines which party bears the risk based on the willingness and ability of a party to accept the risk. The third stage deals with the right time to allocate the risk. The fourth stage describes how to deal with the risk. Abednego & Ogunlana (2006) have only studied the risk allocation process from a project owner’s perspective in this article. This implies that the project owner makes these four decisions (what, who, when and how) individually.

The concept of risk allocation is connected to a framework, shown in figure 6. This framework depicts that proper risk allocation has an influence on efficient and effective project risk management. This, in its turn, affects the achievement of project goals and objectives. Achieving project goals and objectives, according to Abednego & Ogunlana (2006) is related to project management success, product success and good project governance. These three aspects ultimately lead to project success.

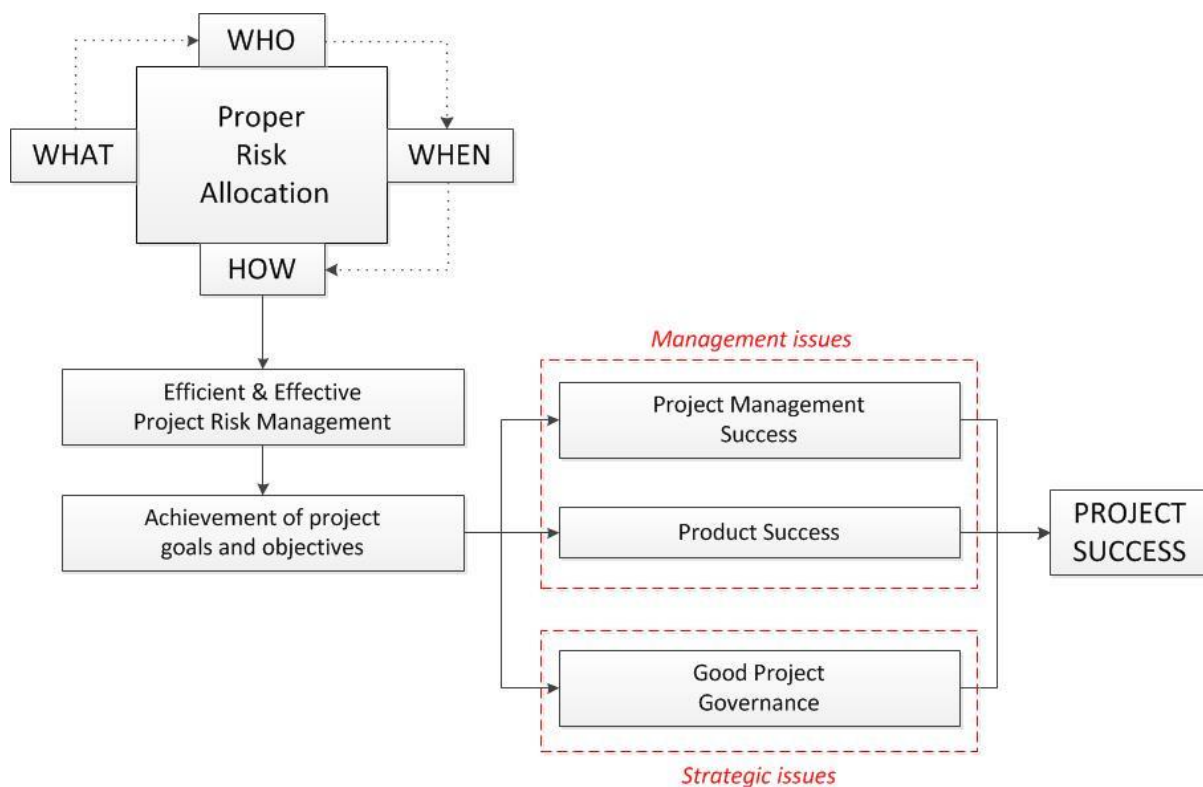


Figure 6: Risk allocation in the context of risk management and project success (Adapted concept of Abednego & Ogunlana, 2006)

Since it has been determined that risk allocation is a part of risk management, the relation between the two will be discussed. Two of the four steps of the risk allocation concept by Abednego & Ogunlana (2006) are similar to several steps of risk management. The ‘what’ step of the allocation concept concurs with the risk identification and risk analysis step of risk management. During this step, risks are identified and possible causes and potential consequences are listed (Hillson, 2004). Furthermore, the effects on project objectives of the risk are analysed and based on that, a prioritisation of risks is made (Nicholas & Steyn, 2012).

The ‘how’ of the risk allocation concept equals the risk response planning of risk management. Hillson (2004, p. 168) depicted four ways how to deal with the risks:

- Avoid: seeking to eliminate uncertainty
- Transfer: transfer ownership and/or liability to a third party
- Mitigate: seeking to reduce the size of the risk exposure to below an acceptable threshold
- Accept: recognizing residual risks and devising responses to control and monitor them

The ‘who’ of the risk allocation concept is not covered at all in the risk management models. As Uff & Odams (1995) determined, risk allocation consists of the definition and division of responsibilities. The definition is covered during the ‘what’. The actual division of the risk, which is covered, in the ‘who’ step of the risk allocation concept, is not covered in the risk management models at all.

Furthermore, the ‘when’, or the time to allocate the risk is depicted in the risk allocation concept by Abednego & Ogunlana (2006) as a decision to be made after it is decided who bears the risk. However, the risk management models state that risk management is a continuous and iterative process, not a decision made at a certain point in time during the process.

4.3 Answering the first sub question (see section 2.2)

In this chapter, first of all, some general theoretical background has been provided by looking at infrastructure, risk and risk management and project objectives. Furthermore, the factors influencing risk allocation, the risk allocation criteria and the risk allocation process have been discussed. This provides the necessary information to answer the first sub question, which is:

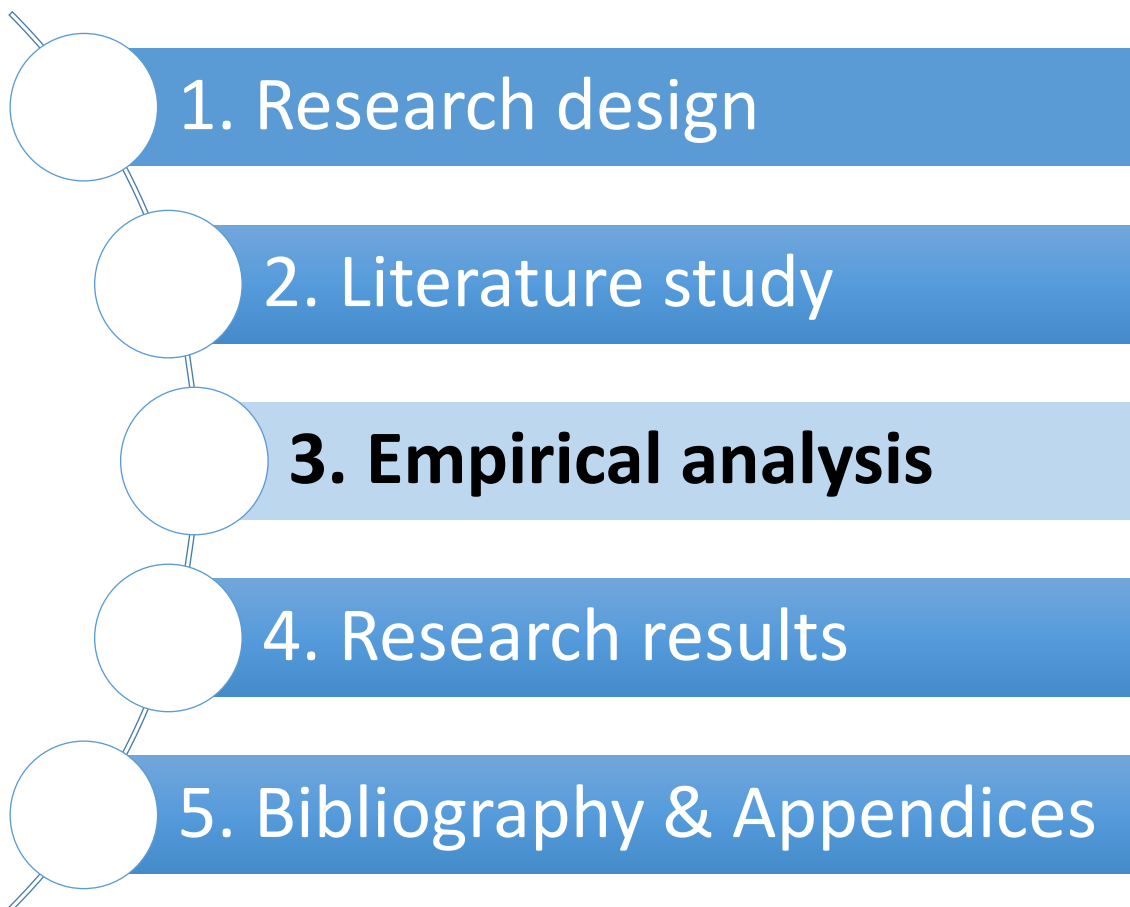
‘What are influencing factors of risk allocation, the risk allocation criteria and how is the risk allocation process between private parties according to theory?’

The theoretical framework as depicted in this chapter shows the influencing factors, the allocation criteria and the process. The influencing factors that are used in this research are communication and information distribution, understanding of risk and top management support.

In theory, many different sources have provided a very elaborate list of risk allocation criteria. All the criteria observed in theory were combined into one final list of risk allocation criteria. This list of the criteria is the following:

- Party must be able to foresee, understand and evaluate (the possible magnitude of) the risk
- Party must be best able to influence and/or control the events triggering the occurrence
- Party must be able to sustain or manage the (financial) consequence of the risk
- Risk must be taken by the party with the greatest capacity to bear the risk at the lowest cost
- Party must be willing to take the risk
- Party must benefit from bearing the risk
- The risk premium is considered reasonable and acceptable for both the bearing party as well as the owner

The process of the risk allocation, in theory, is depicted in figure 5. The first step of this concept concerns the ‘what’. In this step, risks are identified and analysed. The analysis is conducted in order to be able to prioritise risks. Secondly, it needs to be determined who is going to bear the risk. This step actually allocates the risk to a certain party. After that, the timing of the risk allocation, the ‘when’ is established in the next step. In the final step, it is decided on how to deal with the risk. The concept of risk allocation by Abednego & Ogunlana (2006) does imply that the project owner makes decisions regarding the risk allocation individually.



5. Exploration

5.1 Case study methodology

Having selected case studies as the method of research it is required to determine its appropriate implementation. In general, the process of conducting a case study is as follows (Baskarada, 2013, p. 3):

1. Plan: To identify the research questions or other rationale for doing a case study;
2. Design: Defining the unit of analysis and the likely cases to be studied, developing theory/propositions and identifying issues underlying the anticipated study, identifying the case study design, and developing procedures to maintain case study quality;
3. Prepare: Developing skills as a case study investigator, training for a specific case study, developing a case study protocol, conducting a pilot case, and gaining relevant approvals;
4. Collect: Following the case study protocol, using multiple sources of evidence, creating a case study database, and maintaining a chain of evidence;
5. Analyse: Relies on theoretical propositions and other strategies, considers and employs analytic techniques, explores rival explanations, and displays data (facts) apart from interpretations;
6. Share: Focuses on defining the audience, composing textual and visual materials, displaying enough evidence for a reader to reach his or her own conclusions, and reviewing and re-writing until done well

The process is shown in figure 7.

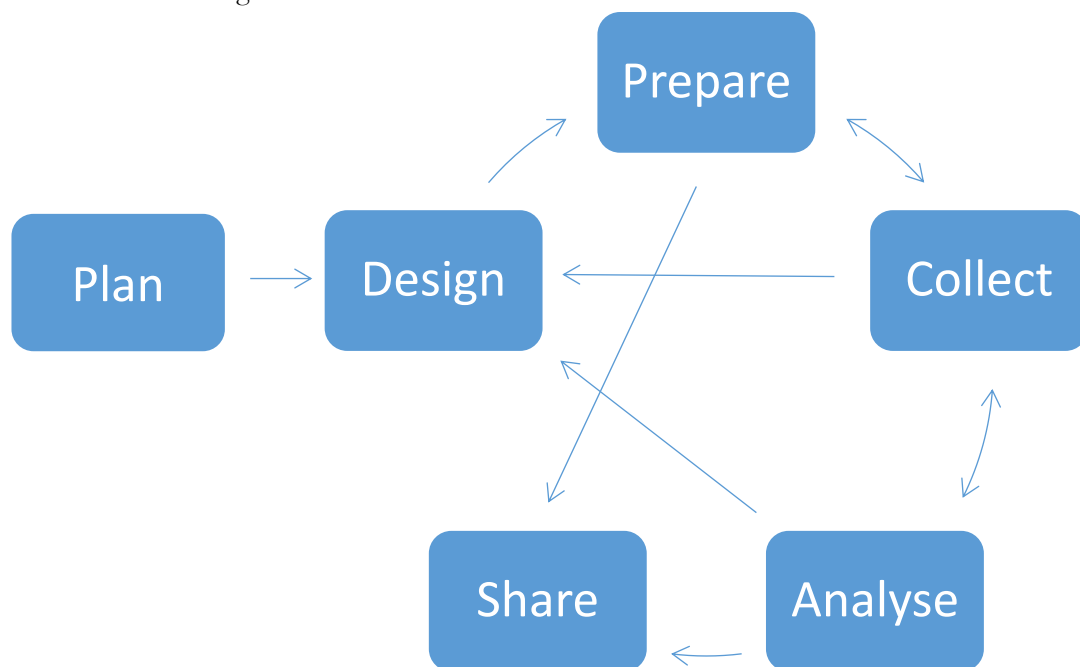


Figure 7: Adapted case study process (Baskarada, 2013)

5.1.1 Plan

The reason for the research, research objective, research question(s), relevance and scope have already been discussed in chapter 2, and are therefore not repeated in this chapter.

Due to the fact that the process of risk allocation between the private parties has never been investigated, this research is of exploratory nature. Seen the exploratory nature of this research, a qualitative research method is most appropriate (Kumar, 2005). In this research, two different methods of qualitative data gathering will be used; document reviews and interviews.

Several advantages emerge when conducting a qualitative analysis. First of all, it enables the researcher to go in-depth and make the analysis very detailed (Baskarada, 2013, p. 2). Another major advantage is that the data collection is an iterative and ongoing process (Baskarada, 2013, p. 12). When new documents arise or interviewees provide valuable new insights these can be implemented in the research. Thirdly, subjective information can be transformed into usable information with the aid of the researchers' interpretation (Verschuren & Doorewaard, 2010, p. 180).

5.1.2 Design

Yin (1994, p. 40) shows four different kinds of case studies based on a 2x2 matrix, with single/multiple case design as one dimension and holistic/embedded approach as the other dimension. Single case or multiple cases talks about the number of cases studied. The second dimension is a little more complicated and comprises the holistic or embedded approach. Holistic entails a single unit of analysis whereas an embedded approach uses multiple units of analysis.

On one hand, this research uses several units of analysis, including the influencing factors, risk allocation criteria and the risk allocation process. Therefore, this research can be labelled as an embedded case study. On the other hand, three case studies will be conducted, making it a multiple-case research. The reason for this is to enhance the external validity of the research. Analytic conclusions will be stronger when they have been found independently from three case studies rather than from one (Yin, 1994, p. 53). Also, the overall generalisability of the research is enhanced with a multiple case study (Yin, 1994, p. 54)

The next question to ask is what kind of replication logic to use. Literal replication, on the one hand, aims to predict similar results in different case studies. Theoretical replication, on the other hand, is to find different contradicting results. The aim of this research is to obtain comparable results about the risk allocation process rather than the testing of two opposing theories. Therefore, literal replication is the preferred choice, the more while this perfectly fits the choice of conducting three case studies since Yin (1994, p. 47) states that 'a few cases would be literal replications'.

Yin (1994, p. 34) further states that four tests have been created to establish the quality of a case study research. These four tests are construct validity, internal validity, external validity, and reliability and are defined as follows:

- Construct validity: establishing correct operational measures for the concepts being studied
- Internal validity: establishing a causal relationship, whereby certain conditions are shown to lead other conditions, as distinguished from spurious relationships
- External validity: establishing the domain to which a study's findings can be generalised
- Reliability: demonstrating that the operations of a study – such as the data collection procedure can be repeated with the same results'

Construct validity and internal validity will be enhanced by a method mentioned by Yin (1994), which is the use of multiple sources, also known as triangulation. Desk research, project documents and interviews are used to gather information, and thus triangulation is safeguarded. Using replication logic in multiple cases enhances the external validity.

This research will apply the embedded multiple-case design to guarantee the external validity and overall generalisability of this research. The reliability of this research will be assured by carefully listing all steps, procedures, methods, assumptions and techniques applied in this research. The case study protocol is written down and a consistent set of initial questions is used for the interviews.

5.1.3 Prepare

The data to be researched are any documents that can be obtained from the projects. Any documents available on public websites are taken into account as well as the documents sent by parties involved in the project. These documents are carefully reviewed and notes are taken. This will form the basis for the exploration part of this research. According to Yin (1994, p. 86), advantages of documentation as a source are 1. They can be reviewed repeatedly, 2. Independent: they are not created for or as a result of the case study, 3. They contain exact details of the case and, 4. They have a broad coverage.

5.1.4 Collect

The first part of the data collection regarding the risk allocation is partly done during the preparation phase, where documents are reviewed. The review of these documents will serve as a profound basis to conduct the interviews. In total 9 interviews will be conducted in a semi-structured way, meaning open and closed questions are used. An interview protocol is set up following a certain order of topics. This protocol can be found in Appendix D. The semi-structured nature gives the opportunity to focus exactly on the research topic and once not completely understood the interviewer can continue asking about incomplete answers or ambiguities (Kumar, 2005). Also, according to Bernard (2013), a semi-structured interview is best used when you won't get more than one chance to interview someone. Since the interviews involve geographically distributed professionals with time restrictions, there will be most likely only one opportunity, hence the choice of semi-structured interviews.

5.1.5 Analyse

The analysis of the gathered data is conducted with the method depicted in the book by Vennix (2011). This method explains how all the relevant information needs to be registered, coded and lastly presented and summarised in a clear way in order to clearly display the results of the research. Since this research uses multiple cases, a cross-case analysis will be conducted.

This research, as earlier depicted, will conduct interviews as a means to register and collect the information. The qualitative analysis will consist of coding, summarising, presenting and displaying the results clearly. After that, the cross-case analysis will show the overall results. The coding will be based on the theoretical framework of the process, criteria and influencing factors that have been acquired in the literature review. This is necessary since Perry et al. (2004) states that (word) tables should be created to display data from individual cases according to some uniform framework. This uniform framework evidently will be the theoretical framework. The tables that are created will be used to summarise, present and display the information clearly and form the underlying arguments of the analysis, which feeds the final conclusions and recommendations. This will be an iterative process since a constant reflection of the findings and theory will provide grip on the researched phenomena (Yin, 1994). Therefore, whenever an interview has been conducted, this will be inserted in the table to display the information enabling reflections. This way there is an iterative process of data collection, analysis and reflection.

5.1.6 Share

The last step of the case study process is the thought of how to share the case study results. The main target audience of this research are academia since the main goal is to contribute knowledge to the topic of risk allocation between private parties. This, in turn, may form the basis for further studies. Other audiences of this research may include the construction industry and especially private parties in PPP's. By investigating the matter, private parties in PPP's might better know how to deal with the risks.

The findings of this research will be presented in a set of conclusions and recommendations that are based on the analyses of the research. This research also leads to a revised risk allocation concept as well as a descriptive framework of the risk allocation process, its influencing factors and the risk allocation criteria.

5.2 Case study selection

In order to find relevant case studies for this research, certain criteria have been applied to find the cases. The criteria for the projects are the following:

- It is a social infrastructure PPP project
- It is a construction project
- Construction has started recently (<3 years)
- Located in Europe

The first criterion is due to the context of this research. First of all, it must be a social infrastructure project. Reasons for this choice have been given in chapter 2.3. Secondly, the project must be a PPP project since this project constellation is a rather innovative way of realising projects and has experienced difficulties regarding the risk allocation. Then, it has to be a construction project. Construction projects tend to be the riskier than projects focussing only on the operation of assets, due to the additional risks in the construction phase (Inderst & Stewart, 2014). Therefore, for projects under construction, a proper risk allocation is even more important in order to successfully complete the project. The third criterion will secure the fact that the risk allocation must have been conducted already, yet it has been done recently, making it easier for the interviewees to remember the risk allocation and how the process went. Even though the importance of the dynamic nature of risk allocation process has been explained before, due to time constraints and the availability of the interview partners, this research can only capture the limited scope of the risk allocation itself. Fourthly, the project has to be situated in Europe. The reason for this is to ensure accessibility to the several different parties of the project. The (financial) means are not sufficient to expand the geography of this research. These criteria have formed the basis for selecting the case studies. This resulted in three projects that could provide all necessary information and also met the criteria. These three projects are:

- Case 1
- Case 2
- Case 3

5.3 Case 1: Benelux

Case 1 describes the design, build, finance, maintenance and operation of a new social infrastructure building located in the Benelux. Figure 8 shows the exact location of the project.



Figure 8: Location of case 1 (source: google maps, 2017)

The total cost is around 140 million euro. The constellation of the consortium is shown in figure 9.

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Figure 9: PPP constellation case 1 (Confidential source 2, 2017)

The estimated time schedule is projected in the underlying table:

Milestone	Date
Start of Tender	XX-XX-XXXX
Financial close	XX-XX-XXXX
Preparing execution	XX-XX-XXXX
Start of execution	XX-XX-XXXX
Availability date	XX-XX-XXXX
End of concession	XX-XX-XXXX

Table 7: Milestone schedule case 1

For case 1, the following people have been interviewed:

Role of company	Respondent number
SPV manager and advisor	Respondent 1
Sponsor	Respondent 2
Debt investor	Respondent 3
SPV manager	Respondent 4

Table 8: Interviewees in case 1

5.3.1 General

For the sponsor and the debt investor, the main reason to be involved in the project is to make an adequate return on their investment (Respondent 3, 2017). Adequate, in this case, means that they develop a risk distribution for the risk of credit default to be offset against the expected returns. Credit default implies the risk of the debt investor not getting their investment back at the end of the agreed period of time. The debt investor then assigns a value to the periodical payment to be made to the debt investor that corresponds with the risk of a credit default. The main reason for the SPV manager to participate in the project is to realise the project in compliance with the wishes of the client. Respondent 1 (2017) acknowledged that it is a prestigious project.

Even though the private parties do not agree on what they want to achieve in the project, they do agree that risk allocation is crucial to achieving their objectives. Each of the respondents answered that the way that the risks are allocated is a major contributor to successfully completing projects and also achieving their own objectives.

This project is not very complex. According to confidential source 3 (2014), who provided the lenders technical advisor report, the design and construction are considered to be of relatively low technical complexity. Building information modelling (BIM) and the use of prefabricated material simplified the risk allocation process since many risks have been eliminated using these techniques (Confidential source 3, 2014). BIM as 3D-modelling software enables the design and construction parties to model all steps of the project timeline. Hence, time and cost can be estimated accurately. Modelling the complete timeline of the project, to include both construction and operation phase, decreases the construction as well as the operational risk.

In addition, the circumstance that no existing buildings needed to be demolished meant less complexity and decreased construction risk (Respondent 1, 2017). Furthermore, the complexity of the consortium constellation was fairly low. One major advantage of the constellation of this consortium according to respondent 4 (2017) is the fact that the EPC contractor and the O&M contractor have been merged into one DBMO BV. With this structure, possible dispute between EPC and O&M have been avoided, since they jointly have to come to the best result. For example, they had to decide together what materials to use that are both useful for construction but also easy maintainable, instead of the EPC contractor choosing cheap materials, leaving the O&M most likely with a lot of problems on the long run.

Furthermore, a very flat organisation structure resulted in a simple risk allocation process, since the distance between the different layers was short. Due to the low constellation complexity, organisational risks were minimalised.

5.3.2 Influencing factors

In case 1, all respondents think of risk allocation as a crucial aspect of achieving objectives. However, in terms of influencing factors, the extent of elaboration of the private parties on this topic is highly variable.

5.3.2.1 Communication and information distribution

First of all, information distribution is very important according to all interviewed parties. Respondent 3 even scaled this criterion as a *conditio sine qua non*. If:

1. The kind of information
2. The transparency and the availability of the information, or
3. The independence of the information

had not been adequate, they would not have invested in the project or waited until it would have been fulfilled (Respondent 3, 2017). Secondly, the transparency and availability mean that all information from all parties, including external advisors, must be accessible to the debt investor. Lastly, the independency implies that the information ought not to be biased. Using information from external advisors is considered important for the independency of the information since the external advisors normally do not have a stake in the realisation of the project except for the fees they get paid for their reports.

The origin of the information appears to be very different. Respondent 1 and 2 (2017) both mentioned that several question & answer (Q&A) sessions have led to a very good information distribution and any concerns on the design, build, maintenance or operation of the projects that arose could be solved adequately. These Q&A sessions took place between the authority and the consortium. The consortium then took all the information provided at these sessions back to the DBMO BV, who together with the SPV would include the major concerns from this information into the risk register. Evidently, the risk register did not only contain the risks identified in the Q&A sessions, but also all other risks identified by any of the involved private parties that communicated this to the DBMO and the SPV.

Besides the Q&A sessions, respondent 3 used mainly external sources to acquire his information. Thorough due diligence reports provided by renowned external advisors provided the information needed by the debt investing party. A due diligence is a thorough check about the major risks that can occur on certain aspects in this case 1. Generally, lenders technical advisors (LTA's) develop the due diligence reports and these reports can have several backgrounds. There are due diligences for the financial aspects, insurance due diligence and technical due diligences. The technical due diligence for example, in this case, has been carried out by an international construction and property consultant. All major critical points about the design, ground conditions, construction methods and costs, maintenance and operations, payment mechanism and project agreement are investigated. Advisors, in this case, are renowned external LTA's, which offer technical expertise and many years of experience. As the LTA report states: 'our extensive experience gives us an expert understanding of the particular requirements of this accommodation project, such as the unique operational nature of case 1 and the criticality of the construction programme and availability' (Confidential source 3, 2014).

Good communication and information distribution is very important. The information about the risk is communicated and distributed amongst the private parties, the more competitive the bid can be and the higher the chance is to actually win the bid (Respondent 2, 2017).

5.3.2.2 Understanding of risk

The criterion of understanding of the risk is actually a follow-up on the information distribution according to respondent 1, 2 & 3 (2017). Proper communication normally is the basis for a good understanding of the risks. Especially with the SPV manager, a clear understanding of the impact and the probability of the risk was stressed constantly throughout the complete interview. Again, the Q&A sessions and risk register during the tendering phase have contributed decisively to the understanding of risk. As mentioned in the

previous paragraph, for the debt investor, the LTA reports were the major sources of understanding of the risk. These reports are based on the risk register developed by the project company and give a qualitative score (low, medium, high) on the likelihood and the impact of all major risks. A LTA risk rating is provided and in addition, several notes about the particular risk including the owner of the risk are mentioned.

5.3.2.3 Top management support

The importance of the support by top management was disputed. Respondent 2 (2017) and respondent 4 (2017) indeed considered it to be important. Respondent 3 (2017) said that even though top management was not involved in the risk allocation, their support is always important, especially in case of a conflict. Top management can more effectively put pressure on other parties than regular employees. Respondent 1 (2017) was the only party disagreeing with the statement that support of top management was of influence. Being the SPV manager, respondent 1 was confident that he did not need additional support.

5.3.2.4 Additional influencing factors

Besides the factors that had previously been identified from literature, other factors have been mentioned. First of all, the project agreement between the private parties had to be based on a standardised framework according to respondent 2 (2017). This standardised framework is known as the standard DBFMO contract between authority and SPV and the DBMO contract between SPV and DBMO contractor. Certain risks had to be allocated to certain parties. Respondent 1 (2017) agreed to this by saying: 'All construction risks that are allocated to the SPV by the authority are passed down one to one to the engineering, procurement and construction (EPC) contractor'. This was similar for the operational risks, which were borne by the O&M contractor. The only risk the SPV kept, was the financial risk.

Additionally, respondent 3 (2017) mentioned that market conformity or market standard was important. The investment standard in social infrastructure PPP projects is normally 90% debt investment and 10% equity investment. So, had the proposition been for a debt ratio of 98% and thus an equity ratio of only 2%, they would not have invested because it fails to meet the market standard.

Lastly, commitment from the parties was identified as being of major importance. At some point during the project, one company (Imtech) became bankrupt. However, with the commitment of the other companies, the project was kept on track by actually employing the workers from the newly bankrupt company.

5.3.3 Risk allocation criteria

What became clear right from the beginning is that the parties did not consciously name the risk allocation criteria. Even after repeated explanation of what risk allocation criteria are and inquiry whether the respondents used any, the answer remained no.

However further throughout the interview, especially when talking about the process, it became clear that indeed several allocation criteria were used. Criteria that are identified are (Respondent 1, 2017; Respondent 2, 2017; Respondent 3, 2017):

- Expertise/know-how of the risk
- Cost of keeping or rejecting risk

Expertise of the risk is the knowledge about the probability and the corresponding impact of a risk and is very similar to the understanding of the risk. The second criterion is the trade-off type of decisions, accept or reject the risk. Accepting the risk means a certain monetary reward but if the risk materialises, that party

has to bear the costs. Rejecting the risk means foregoing the reward, but equally not having to bear the potential consequence. The trade-off that has to be considered is the potential reward against bearing the potential consequence of a risk.

5.3.4 Risk allocation process

In the following paragraphs, the four steps of the risk allocation concept will be addressed, following the questions what, who, when and how.

5.3.4.1 What

The first step is to decide what risks need to be allocated. The majority of the risks are identified in the standardised DBMO contract that the SPV and DBMO contractor sign. During Q&A sessions between the consortium and the authority, additional risks are addressed. During open dialogue sessions, these risks are then discussed and well-founded solutions can be reached (Confidential source 4, 2012). Open dialogue sessions are negotiations with representatives of potential consortia and the authority on the statement of requirements ('programma van eisen'). Unrealistic requirements bring along unbearable risks for the consortia and are therefore not acceptable. If for example the timeline and the final deadline are not feasible, based on a BIM model the final deadline can be postponed. In that case, possible solutions would include e.g. to grant additional time or financial compensation, but multiple solutions are possible.

However, not all risks can be foreseen, and unforeseen risks must be dealt with as well. One major example of an unforeseen risk was the ground risk. The authority was asked to conduct ground research in order to determine the state of the ground. After winning the contract, the ground conditions seemed much worse than the DBMO had expected on beforehand, and therefore the DBMO claimed compensation for the lack of research. The consequences of unforeseen risks were borne by the party that was initially responsible for them. However, they tried to mitigate new potential risks as much as possible. As stated in the project documentation, in weekly work and coordination meetings the practical aspects between the various disciplines were discussed.

After identifying the risks, all the risks were listed in a risk register. Then, both the probability and impact were assessed semi-quantitatively (high/medium/low) and based on that they were prioritised. Behind closed doors, the small group of consortium managers (kernteam) assigned a score to both the impact and the probability based on their experience. Previous projects that the managers were involved in were looked at and discussed to see whether similar risks have been dealt with before to determine the risk scoring.

Also, in order to determine the risk of delay, Monte Carlo simulations have been used (Confidential source 3, 2014). This statistical method models various different scenarios where small variables are slightly changed to determine project delay in different scenarios (Hillson, 2004).

5.3.4.2 Who

The second step is to establish who decides and who bears what risk. The majority of the risks have been allocated based on the standardised contracts. The standardised DBFMO contract used by the authority left little room for negotiation but allocated the majority of the risks related to the design, build, finance, maintenance and operation to the SPV. This SPV allocated all DBMO risks to the DBMO contractor, including the ground risk, the planning risk, construction risk and permitting risk. This is supported by the statement in the Heads of Terms, Design, Build, Maintenance and Operations Contract between the SPV and the DBMO BV: 'The contract will be back to back with the Project Agreement, in other words pass all of the design, construction, maintenance, operations and related obligations and risks assumed by the

project company under the project agreement to the DBMO contractor, including without limitation all obligations in relation to permits, planning, consents and approvals in respect of the design and construction process under the project agreement' (Confidential source 1, 2014).

Since the DBMO BV consists of multiple parties, within these parties the risks must be allocated as well. The most important criterion to allocate within the DBMO (or to subcontract) is understanding of the risk. An example for this is the square of the project, which is designed by an architect that is specialised in landscape architecture and urban planning (Confidential source 5, 2018). This architect is much more experienced with this particular part of the project, hence the choice of the DBMO to outsource it.

Many interviewees also mentioned that the pricing played a very important role to decide who took the risk. Often these two criteria are related, since the party with the most elaborate understanding of the risk, is best able to deal with the risk and therefore can price the risk at the lowest rate (Respondent 9, 2017).

According to respondent 2 (2017), there are always risks that someone should take that they originally did not want to take. This, in the end, concurs with the fact that commitment to the project and the risk allocation is necessary to achieve objectives.

5.3.4.3 When

Thirdly, the timing of risk allocation is discussed. There was overall consensus on this aspect. All interviewees immediately agreed separately that there is not one specific point for the risk allocation process. Evidently, the majority of the risks are identified based on the specific, standardised DBMO contract. But, throughout the whole procurement process risks were identified, prioritised and allocated. Due to the fact that multiple Q&A sessions were organised, the risks that were not immediately identified from the beginning were allocated as they emerged. The risk allocation process was seen as a continuous and iterative process throughout the complete tender phase and beyond.

5.3.4.4 How

Fourthly, the question of how the risks were dealt with must be answered. This step of the risk allocation process is very closely linked to the question of who should take the risk. There is a relation between the level of risk taken by a party and the position in the supply chain. The sponsor took no risk, instead, they transferred all risk to other parties. The SPV manager, also high in the supply chain, passed down the risks they were unwilling to take to the DBMO BV, except for the organisational risks. They kept these risks since they are specialised in dealing with those risks, and even hired consultants to advise them in these risks.

The DBMO contractor was allowed to subcontract specific works to subcontractors. However, the SPV did not want to be involved in that, as the contract states: The subcontracts will be directly between the DBMO contractor and the aforementioned subcontractors. The SPV, albeit higher in the supply chain remained the right to approve subcontracts. Subcontracts for essential works even required approval of the authority, showing the contractual leverage of the authority.

Respondent 3 (2017) mentioned that as a debt investor he has actually no influence on the risk allocation process. He states that generally, a project company asks debt investors (typically some 50) to get involved in the project under predetermined conditions. These conditions include the return on the investment for the debt investor. Each debt investor then has the choice to accept the conditions, and make the investment or reject the conditions and not get involved. They based their decision on the information provided to them in the different LTA reports.

5.4 Case 2: Benelux

This project comprises the design, construction, finance, operation and maintenance of a new social infrastructure building in the Benelux. For clarification, a map of the location is added.

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Figure 10: Location of case 2 (source: google maps, 2017)

The total cost of the project is approximately 215 million euro.

The constellation of the consortium is presented in figure 11.



Figure 11: PPP constellation case 2 (Confidential source 6, 2015)

This project has the following schedule:

Milestone	Date
Start of Tender	XX-XX-XXXX
Financial close	XX-XX-XXXX
Start of execution	XX-XX-XXXX
Availability date	XX-XX-XXXX
Completion date	XX-XX-XXXX
End of concession	XX-XX-XXXX

Table 9: Milestone schedule case 2

For this case the following people of the following parties have been interviewed:

Role of company	Respondent number
SPV manager and advisor	Respondent 5
Sponsor	Respondent 6
Debt investor	Respondent 3
Subcontractor	Respondent 7
Contractor	Respondent 8

Table 10: Interviewees in case 2

5.4.1 General

The first thought the SPV manager brought up in the interview, even before any questions were asked, was that this process hadn't followed the regular tender process. The most important deviation was that this tender process lasted for about 18 months, instead of the regular half-year. Respondent 5 (2017) explained that more information about the project was required before making any commitments (Respondent 5, 2017). It was important that parties got to know each other before talking about the project. This because it was felt that starting to talk about risk allocation as the first step usually brings about a negative atmosphere right from the start. The goal was to build a trustful relationship instead of making an anonymous distant business transaction. Different private parties intended to understand each other first before understanding the project. That is why all involved private parties worked from the same office, also enhancing and easing communication (Respondent 7, 2017).

Yet, the project documentation does not signify an uncommonly high amount of trust between private parties. The contracts even give the opposite impression since clauses for penalties and disputes have been included. However, since a standardised DBMO has been used, also seen in other case examples, it appears that these are standard clauses in any contract. Furthermore, the confirmation of multiple respondents independently emphasising that trust was of great importance in the risk allocation process underpins that this indeed played a big role.

Even though the process was relatively people oriented, fewer consortia showed their interest. In the beginning, five parties showed their interest, two of which dropped out due to their opportunistic behaviour when it came to risk allocation. This means that they assessed the risks of the project too optimistic and therefore came to an unrealistic overall assessment. Soon after that, a third party stopped bidding as well. This led to a situation where only two consortia appeared genuinely interested and whose bids were considered.

Similar to the first case, the different parties in this project had also diverging objectives. Respondent 3 and respondent 6 both answered that they mainly wanted a return proportionate to their investment. Also in this project, respondent 3 answered that had the return not be appropriate, they would not have invested. The main objective of the SPV manager is to realise the project. They want to complete a project that is of high quality in accordance with the clients' requirements, but at possibly low costs. The information memorandum, which states that the bids were evaluated both financially and qualitatively, backs this statement. The consortium with the highest combined score of these two factors was chosen as the preferred bidder (Confidential source 6, 2015). For the private parties in this project, risk allocation was of utmost importance to achieve their (differing) goals.

5.4.2 Influencing factors

5.4.2.1 Communication and information distribution

The various parties involved agreed that clear communication is very important. Good communication led to the fact that the SPV got a four months extension of the project. They had good reasons to believe that they were not going to be able to make it in time, and due to clear communication with the authority, the extension was granted (Respondent 7, 2017).

Concerning communication, the importance of using only one channel was stressed (Respondent 5, 2017). In this case, the SPV was the communication hub. To this end, a digital database was used that all parties could access (Respondent 5, 2017).

The sources of information were different. The debt investor mainly used external sources to assess potential investment (Respondent 3, 2017). In total, six different advisors have been appointed to assist the consortium and potential lenders in the due diligence process. There were two legal advisors (one for lenders and one for the consortium), a technical advisor, an insurance advisor, a tax & accounting advisor and a model auditor (Confidential source 6, 2015). The consortium and other private parties partially relied on the information from these external studies too, however, a lot of useful additional information was provided in Q&A sessions. The consortium would attend these Q&A sessions with the authority, and register the information acquired in their digital database. This also worked the other way around. Parties wanting to know something from the authority posed their questions to the SPV, in order for the SPV to take them to the Q&A sessions. The SPV worked as a communication channel between the authority and the DBMO contractor.

Furthermore, the fact that all parties have been working from one central office enhanced internal communication (Respondent 7, 2017). The barrier to talk to each other and discuss issues was much easier to overcome than when all parties work from their own offices from different locations.

Additionally, the fact that the sponsor and the one party of the DBMO contractor had previously worked together in 'case 1' made that initially, the parties knew what to expect from each other and how to effectively communicate together.

5.4.2.2 Understanding of risk

Clear communication and good information distribution about the probability and the impact of risks have also in this project led to a better understanding of the risk. When all available information is transferred to the parties dealing with the risk they have a much better understanding of the risk. This was reinforced by the 18-month initiation period, which ensured sufficient time for research and a very good know-how of all risk involved (Respondent 5, 2017).

5.4.2.3 Top management support

For respondent 5, support of top management was not of importance for the risk allocation. However, for the majority of the respondents, support of top management indeed was important. There is a potential issue however with top management support. Since the granularity of information generally gets lower further up the management hierarchy, top management is seen to often base their decisions on gut feeling, experience underpinned by good advice (Respondent 8, 2017).

5.4.2.4 Additional influencing factors

In the interviews conducted for this project, several other factors have been identified that influence the risk allocation. The first factor is the openness towards other parties, especially to discussions (Respondent 5, 2017; Respondent 7, 2017). Throughout the complete tender process this has played a very important role and due to the openness of all parties, even changes to the original agreement could be agreed on. Respondent 5 (2017) gave the best example of this by mentioning the risk of asbestos that initially was taken by the contractor, as it is included as such in a 'standardised DBFMO framework'. However, due to bad previous experience with asbestos in other projects, they were opposing to take that risk. Due to the openness of all parties, multiple discussions were held regarding this topic. It has been a separate topic on the agenda of meetings of the managers of the SPV and the DBMO and the time was taken to discuss this topic extensively. Eventually, the SPV communicated this to the authority and in the end, the authority agreed to partially cover the risk of discovering asbestos (Respondent 8, 2017). Another example of openness for discussion concerns the bicycle lane (Respondent 5, 2017). Initially, it had to stay open throughout the complete project. However, since construction works need to be done very close to that lane, it could endanger cyclists. After discussion with all parties, it was agreed that during certain moments of the day the lane could indeed be closed.

Secondly, a clear structure and process are of paramount importance (Respondent 5, 2017). The 'how' is key in the process and everybody needs to know what they are doing. Originally, the consortium started with another facility company whose motto was 'the client is king'. When asked how they were going to implement that they could not give an adequate answer. This has been one of the major reasons to change to the current facility company. If everyone knows what they are doing and is open for discussion, this leads to trust between the parties (Respondent 5, 2017). If the parties are willing to go into discussion about certain topics, the chance of a successful risk allocation increases. This has been confirmed by the interview with the subcontractor, who acknowledged that trust between the management members led to a high level of commitment of all involved parties (Respondent 7, 2017). The fact that the managers of the consortium themselves made that statement is one thing. However, the fact that subcontractors noticed this as well gives the impression that this *modus operandi* is shared between all parties. Furthermore, besides the regular formal meetings, this project was initiated with an informal meeting between the current managers of the SPV.

Lastly, since the debt investor has been the same for both of the projects, some kind of market conformity is necessary for a proper risk allocation (Respondent 3, 2017). The debt investor would not have invested in this project if the debt/equity investment ratio of this project had not been approximately 90/10.

5.4.3 Risk allocation criteria

Once more, expertise and know-how, also known as understanding of the risk are mentioned as a criterion for risk allocation by respondent 3, 5, 6 and 8 (2017). Another criterion mentioned is that a party should only take those risks that they are able to influence (Respondent 7, 2017; Respondent 8, 2017). The ability to influence the risk relates to the possibility to change the probability of the risk, its impact or both. An example for this is the DBMO contractor taking all risk related to 'ankering elements' (in Dutch groutankers). These formed the basis for a solid foundation of the project. The DBMO contractor minimised the probability of incorrectly implementing the anker elements by regular quality checks (Confidential source 6, 2015). Since the debt investor was the same party as in case 1, the pricing of the risk was mentioned as a criterion as well (Respondent 3, 2017).

5.4.4 Risk allocation process

The tender procedure took 18 months in total, consisting of three phases. The first phase reduced the five initial consortia to three consortia. Then, in the second phase, the shortlisted consortia were invited to submit an indicative bid. In the final third phase, the Best and Final Offers (BAFO) offers were submitted after which the preferred bidder was announced. The project in case 2 was initiated in this way to gain trust and enhance cooperation (Respondent 7, 2017). When risks are addressed as the first topic of discussion, this will lead to friction and frustration, since the parties do not know each other yet (Respondent 5, 2017). They do not know what to expect from each other or how they are going to solve their own issues and risks. Therefore, the design should be established first and based thereon, the risk allocation, instead of the other way around (Respondent 5, 2017). The risk allocation process will be elaborated further in the following order: the what, the who, the when and the how of the process.

5.4.4.1 What

The first step of the risk allocation process is to determine what risks need to be addressed. Most of the risks were identified in the standardised DBMO contract and during the associated Q&A sessions. Furthermore, brainstorm sessions with the managers and advisors of the project revealed many risks that needed to be handled.

All risks were then put in a risk register and prioritised, in principle based on probability*impact. Respondent 8 (2017) however, stated that in practice if the risk had a low probability, it was not taken into account at all. The estimation of both of these factors was conducted based on experience. The due diligence reports assessed the private parties capabilities based on the experience they had in comparable previous projects.

Certain risks, such as for example the risk of delay of the project, were projected with the Monte Carlo simulation or non-statistical financial analysis techniques like best – and worst case scenarios (Respondent 8, 2017). In the LTA agreement, it was stated that there was a 20% chance that the scheduled availability date would be exceeded by two days (Verniers, 2016). But for respondent 8 (2017), Monte Carlo is an ambiguous way of assessing risks. In practice, it often appears that people using Monte Carlo methods do not know how to use them. It is too abstract for daily risk analysis. If Monte Carlo simulations are fed with nonsense, the results will be nonsense as well (Respondent 8, 2017).

5.4.4.2 Who

Throughout the whole process, any employee from any company involved in the project was allowed to name risks that in his or her eyes should be addressed. The fact that any employee of the project, be it manager or engineer could identify risks minimises the chance of risks being missed. Engineers are able to foresee completely different risks than managers may do.

With this approach, the majority of the risks have been addressed. Yet, always risks remain that have not been covered, that were not seen as a threat, or that have simply been forgotten. Top management of the consortium would address how to handle these risks. It was also stated, that if risks kept coming back to the board members meetings, that must mean that they were important. A good example of this is the amount of daylight in the basement in case 2. In the design phase, no real solution could be thought of, but it kept coming back and back. Even more important was that at some point the authority was threatening with penalties, should the problem not be handled. Because this risk kept coming back they discussed this risk multiple times in the monthly ‘stuurgroep’ meeting. The difficulty was first of all, that it concerned floor -1, meaning that only little daylight is admitted. Secondly, there was the issue of multiple guidelines. European standards of minimal amount of daylight in these type of projects differ from the

Benelux standards. They also had to think about the operational period, meaning that if windows get dirty, they block more daylight, making it even darker. The stuurgroep, after long and multiple meetings about this issue, decided to accept this risk during the tender phase and find a solution after the BAFO.

The traditional separation between EPC and O&M has been avoided by combining them into a separate DBMO contractor, based on the standardised DBMO contract. This meant that the majority of risks were allocated based on the standard contract. The DBMO then had to decide whether to take the risk with the parties within the consortium or to subcontract it. Respondent 3 (2017) mentioned the example of networking cables. The contractor is not sufficiently specialised enough and will outsource this work package to a subcontractor with plenty of experience. The open process that has been used has led to a situation where no risks were allocated to a party that did not want to take the risk. Especially, due to the existing trust within the consortium, parties were not hesitant to jump in and take additional risk in cases where it could not be borne by other parties (Respondent 7, 2017).

5.4.4.3 When

Respondent 5 (2017) and respondent 7 (2017) stated that this process was different from regular tender procedures and that the design had been the first priority of the project. Only after the design had been completed the risk allocation was determined. After the design phase, whenever a risk was identified, it should be dealt with straight away. Various Q&A sessions show that it was a continuous and iterative process throughout the tender process, starting after the design.

5.4.4.4 How

Finally, the 'how' question has to be answered. In this case, the 'how' was the most important part of the complete allocation process. Crystal clear understanding and communication of expertise relating to the risk formed the basis for a mutual agreement of the risks. 'It is essential to know how to deal with the risk' according to respondent 5 (2017). The interviewees were even convinced, that once risks have emerged but it is clear how they are to be dealt with, they were not called risks anymore.

Indeed, the risks of the DBMO contract were automatically passed on to the DBMO contractor, after which they could decide whether to keep it or outsource it to subcontractors. Due to proper dialogue, the risk allocation had been successfully implemented, with all parties aligned and behind the plan. Anomalies in this DBMO contract, like the risk of asbestos, in this case, had been transferred from the contractor partly back to the authority. The authority agreed to partially accept the risk due to the fact that the risk allocation process was mainly built on commitment and trust.

5.5 Case 3: British Isles

Case 3 concerns the design, build, finance and maintenance of different social infrastructure buildings on the British Isles.

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Figure 12: Locations of case 3 (source: google maps, 2017)

The total costs are estimated at 135 million euro.

The structure of the agreement is shown in figure 13.



Figure 13: PPP constellation case 3 (Confidential source 7, 2015)

The overall project timeline is as follows:

Milestone	Date
Start of tender	XX-XX-XXXX
Financial close	XX-XX-XXXX
Start of execution	XX-XX-XXXX
Availability date	XX-XX-XXXX
End of concession	XX-XX-XXXX

Table 11: Milestone schedule case 3

For this project, only one interview has been conducted with the following role:

Role of company	Respondent number
SPV manager	Respondent 9

Table 12: Interviewees in case 3

5.5.1 General

On the one hand, clearly, the SPV’s objectives were to successfully handover the projects and get a financial return for a long-term gain. On the other hand, the first thing the respondent mentioned when talking about the objectives was that this project was to keep a strong foothold of PPP projects in the British Isles. It was a prestigious ‘CV-project’ that was used to build a relationship with the authority since there is a tendency that the authorities’ leverage is growing. The risk transfer has developed disadvantageous for the private parties and the overall contracts have severely changed over the last couple of years. As respondent 9 (2017) states: ‘the balance is struck between the authority and the private parties’.

5.5.2 Influencing factors

5.5.2.1 Communication and information distribution

This factor was an important factor for the SPV manager. It is considered a cornerstone for understanding of risks.

5.5.2.2 Understanding of risk

Understanding is based on experience, previous contracts, surveys and conditional reports. All these sources of information need to be communicated to obtain a proper understanding of the risk. The sponsor acted as a silent stakeholder and only participated by providing capital (Respondent 9, 2017). The contractor will carry out all the design, development, operation and maintenance. Therefore, internal communication systems enabled employees of any subsidiary to contribute information to the internal database. Another way of acquiring information and understanding of risks is through their sister companies. As a large multinational they have access to a large network of expertise on issues that arise, and they make sure to use this network whenever needed.

5.5.2.3 Top management support

Also in this project, support of top management is of major importance. When the authority is putting pressure on the private parties, it is of utmost importance that the top management deals with these situations (Respondent 9, 2017).

5.5.2.4 Additional influencing factors

The first factor that came to mind was that legal advice and experience are the main influencing factors for the risk allocation (Respondent 9, 2017). Legal advice has been obtained through due diligence reports. Experience has been acquired throughout earlier projects. Also, the experience from other subsidiaries in the international network has been used.

5.5.3 Risk allocation criteria

Although the response was that no risk allocation criteria were used during the process, in the course of the interview it became clear that influence on the impact or the probability of the risk is crucial. 'Risk is fine as long as you have some kind of control over it' (Respondent 9, 2017).

5.5.4 Risk allocation process

Initially, when the SPV saw the tender documents, all clauses were assessed. The employees of the SPV added known clauses and the according risks in the risk register. The authority, based on the leverage they have over the private parties, could freely add new clauses to the contract with the consortium (Respondent 9, 2017). Clauses that were newly added to the contract, in comparison with previous projects were summarised. The clauses were then assessed and the risks that resulted from those clauses were added to the existing risk register. It was crucial to get an appropriate understanding of all clauses and risks. The SPV then shared all the risks with the EPC – and O&M contractor. The EPC and O&M then had two options. Firstly, they could accept the risk on their own books. Secondly, they could try to pass it back to the authority, but if that were not possible they would have to keep it and see how they could mitigate it. The SPV mainly functioned as a connecting party between the authority and the EPC, but in the end, it did not take any risks at all. All DBMO risks were shifted to the EPC and O&M contractor, as also confirmed by the Information Memorandum (Confidential source 7, 2015).

5.5.4.1 What

The 'what' in this process has been determined based on experience, legal advisors and assessments. By using as many sources as possible, the SPV tried to identify as many risks as possible. Due to the stiff contractual relationship with the authority, unforeseen risks were allocated to the private parties. In order to avoid these circumstances, the consortium chose to identify as many risks as possible.

From all sources, risks were summarised in a risk register. A prioritisation of the risks was then practised by using the so-called 'traffic light system'. As the name implies, it uses the colours, red, orange and green to indicate the impact and the probability. This was mainly done using experience and information from the external sources. In the Information Memorandum (IM) distributed by confidential source 7 (2015), the involved parties were listed with a list of all the projects they had carried out in the past, thereby demonstrating the experience they had in PPP projects.

There were two issues that were very difficult in this project. First of all, the fact that seven different projects in seven different locations were done simultaneously was a major issue. Secondly, the provision of main utilities was a crucial aspect. The utility company was going to cause a delay but by putting concerted pressure on this company, the authority and the SPV helped to mitigate the risk.

5.5.4.2 Who

Who took the risks was very straightforward. As mentioned earlier, all risks that were not taken by the authority were passed down to the SPV, and from the SPV to either the EPC contractor or the O&M contractor. The sponsor did not accept any risks at all. A sponsor is much more difficult to replace than a constructing party (Respondent 9, 2017). In this project, the degree to which a party can be replaced influences the amount of risk they were prepared to take. In this case, the authority passed down the risks based on the leverage they have.

5.5.4.3 When

The interviewee reported that the risks were going to be identified throughout the whole bidding process. However, it was stressed that the risk register should be developed as soon as possible. 'The earlier you know, the earlier you can deal with them' (Respondent 9, 2017). Throughout the interview, it was noticed that the 'when' decision is not a conscious decision. Risks are allocated whenever they are identified but not at one single point in time. It is a continuous process throughout the complete tender process.

5.5.4.4 How

Lastly, the SPV dealt with all the risks in the same way; they passed all of them on to either the EPC or the O&M. The EPC would then try to either pass it back to the authority or mitigate the risk. One example of this is the archaeology of the sites. Some of the projects were constructed in 'Viking land' where old artefacts could have resided. They mitigated this risk by agreeing to take the risk up to €100.000,- and allocate the remaining risk back to the authority, which in this case was accepted by them. However, this was merely an exception. For the majority of the risks, the authority would add them to the contract, and the EPC or O&M would have to deal with it. The SPV just functioned as a switch between the authority and the EPC or O&M contractor.

6. Cross-case analysis

The figures in this chapter depict the cross-case analysis that has been conducted. The different respondents have been presented on the vertical axis. On the horizontal axis of the figures, different statements about the project objectives, factors influencing the risk allocation, the risk allocation criteria and lastly the risk allocation process are presented. The cells portray which respondent has agreed with which of the statements.

6.1 General

6.1.1 Cross-case analysis

First of all, when looking at the project objectives, many different objectives arose throughout all projects. What became clear is that certain types of stakeholders often had similar project objectives. This meant that investors and sponsors mainly wanted to achieve an appropriate return on the risk that they were taking. For the contractors, the main objective of their projects was to realise a profit. This was the case for all three projects, where those stakeholders merely wanted to make revenue on their projects. For the consortia, the contractors, the SPV managers and consultants these projects generally aimed to establish their good reputation. These projects were seen as prestigious projects and the named stakeholders pitched these projects to work on their curriculum. To establish this, the objective of the consortia, contractors and SPV managers was to comply with the wishes of the client. Especially in the third case, this was of major importance since the relationship between the private parties and the authority was perceived as very stiff and difficult. All interviewees confirmed that for their particular objective, risk allocation was crucial.

Respondent\factor		Project objectives				Influence of risk allocation for achieving project objectives is important
		Proportionate return for risk	Revenue	Prestigious project/ build on reputation	Comply with clients wishes	
Case 1	Respondent 1	-	-	X	X	X
	Respondent 2	X	-	-	-	X
	Respondent 3	X	-	-	-	X
	Respondent 4	-	X	X	-	X
Case 2	Respondent 5	-	-	X	X	X
	Respondent 6	X	-	-	-	X
	Respondent 3	X	-	-	-	X
	Respondent 7	-	X	X	X	X
	Respondent 8	-	X	X	X	X
Case 3	Respondent 9	-	X	X	X	X

Figure 14: Cross-case analysis of the project objectives

6.1.2 Interpretation

Different types of stakeholders in the projects had diverging project objectives. The sponsor and the debt investor mainly wanted to achieve a periodical stream of return on their investment in addition to their

investment being paid back at the end of the project. This can be interpreted as the main focus of these stakeholders being on cost since both the sponsor and debt investor will want to secure their return and investment. Subsequently, the payback period of the investment should be according to plan or even shorter. Respondent 3 (2017) reasoned that by keeping costs low, his return would be safer. Also, the chance of bankruptcy and the debt investor therewith eventually not seeing his money back decreases when costs remain low.

However, the SPV managers, advisors and contractors had different objectives throughout the projects. These parties mainly wanted to realise a prestigious project to build on their reputation and, especially for respondent 9 (2017), to comply with the wishes of the client. The wishes of the client were translated to the program of requirements (in Dutch programma van eisen). Since the clients' main focus was to construct a high-end project, in order to comply with these wishes, the contractors, SPV managers and their advisors needed to focus on quality. Unsurprisingly, the authority sought to have the highest-quality for the lowest price, but as respondent 5 (2017) said, the authority would be willing to pay more to achieve a certain quality instead of decreasing quality for a lower price.

The contractors in the cases mentioned that revenue was another objective, simply to sustain their business. Once more, their focus was mainly on quality, since they knew that once a certain level of quality would be reached, they would earn their revenue. Thus, the debt investor and the sponsor mainly focussed on costs, to sustain their periodical return and decrease the payback period of their investment. The contractors, SPV managers and advisors of the consortia mainly focused to build a high-quality construction. But throughout all projects, the different type of stakeholders had similar objectives.

Even though the timely construction has not been mentioned by any of the parties, this does not mean this is not of importance for the project. The timely construction was monitored with the aid of a Gantt chart. During several of the interviews in the office of the managers, a printed Gantt chart filling a big part of the wall caught the attention of the author. This shows the importance of monitoring the progress for the managers. Especially, since the delays led to consequences for the SPV in terms of penalties as laid down in the contract between the client and the SPV. Therefore, in order to avoid being penalised, progress was monitored with the Gantt chart. The fact that none of the respondents acknowledged the time aspect can be explained by the fact that the client is probably the main driver behind this aspect. Penalties in the contract show the importance of the timely aspect for the client. But, since this research focuses on risk allocation between private parties, no authority has been interviewed, and therefore this aspect did not come up in the interviews.

There is a close relation between cost, quality and timely completion of the project. Time and costs are related in the sense that if the project delays, this will probably lead to higher costs since penalties will apply and keeping all (human) resources up-and-running for a longer time brings along additional expenses. On the other hand, if costs are increased by for example hiring more resources, the time needed could potentially be decreased. Also, if the client demands higher quality, this will probably result in higher costs or longer time to complete the project, while vice versa time and costs can be decreased when the client accepts a lower quality of the work.

Furthermore, all respondents agreed on the fact that the risk allocation played a very important role in achieving their differing project objectives. In terms of actually winning the contract, risk allocation is important. Allocating risks to the 'best parties' enables them to make an offer with the optimal

quality/price ratio in accordance with the clients' wishes. Yet, if the project is not awarded, no project objectives will be achieved by any party, as they will not have a project to realise.

Another reason why risk allocation contributes to achieving project objectives is that it closely relates to trust and commitment. The way in which it relates to these aspects, however, differs between the different projects. In case 1, an adequate risk allocation led to trust and enhanced commitment. Due to the clear risk allocation, all parties were aware of their own responsibilities. Without a clear risk allocation, every risk bears the potential of becoming contentious. Therefore, the more risks are clearly allocated, the less possibility for a later disagreement occurs. If people can rely on each other for not unexpectedly shifting risks to other parties (in discordance with the agreement), this enhances trust and commitment. Also, when all parties know which party is responsible for which aspect of the project, it is easier to identify the proper cooperation party.

In case 2, trust and commitment have led to an adequate risk allocation, instead of the other way around. The process of this case has been different, and as various respondents have acknowledged, the process aimed to build trust between the parties first. As respondent 7 (2017) said, risks and the risk allocation are sensitive topics. They can destroy relations before they are even built. Therefore, commitment and trust need to be established first, before starting to talk about risks. When parties trust the other party, they are more willing to 'take one for the team', meaning that they are willing to partly take over risks from other parties. And if parties are willing to take over risk from other parties, this shows that these parties are committed to completing the project. This has been crucial, since case 2 probably would not have been realised if parties had not been willing to take over risks from each other (Respondent 7, 2017).

This shows that the relation between trust and commitment, and the risk allocation is bilateral. On the one hand, an adequate risk allocation increases commitment and trust. On the other hand, trust and cooperation influence the risk allocation in a positive way. Trust and cooperation, however, no matter in which way related to risk allocation have a positive effect on achieving project objectives, as depicted both in case 1 and 2.

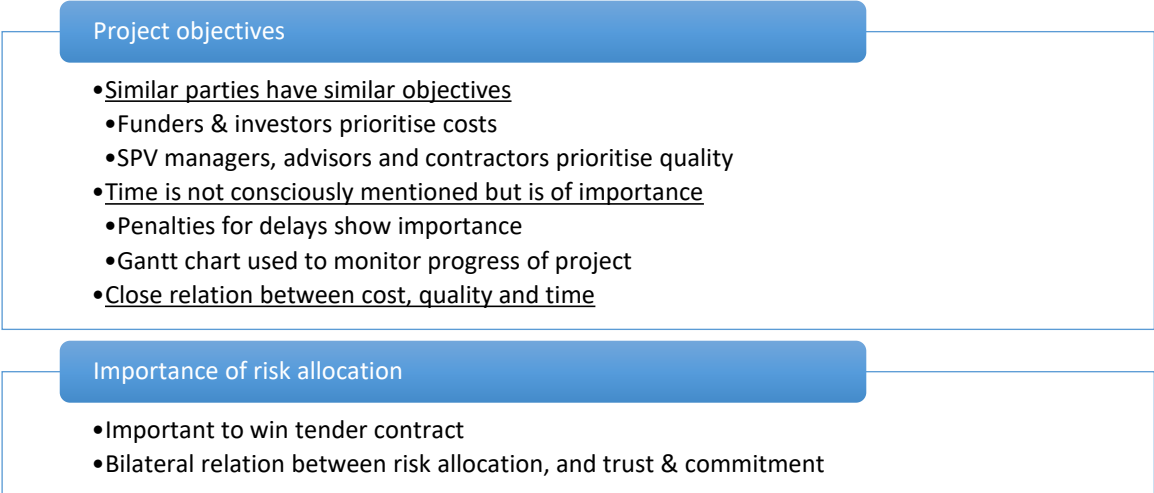


Figure 15: Summary of the cross-case analysis of the project objectives and the importance of risk allocation

6.2 Influencing factors

6.2.1 Cross-case analysis

6.2.1.1 Communication and information distribution

When looking at the influencing factors, clear communication and information distribution were crucial factors to all respondents. The debt investor even determined several criteria that the information had to fulfil before making the decision whether to invest or not.

Several interviewees acknowledged that, in order to control the distribution of information, one communication channel should be used. In case 2, this one communication channel was a digital database where information on the probability and the impact of risks could be shared (Respondent 5, 2017). In case 1, this was Sharepoint, which is collaboration software developed by Microsoft.

Furthermore, the managers of the consortium had (bi)-weekly meetings to exchange and discuss relevant information (Confidential source 1, 2014). Relevant information, in this case, included the risks with the highest priority, determined by their risk score (impact*probability). Clear communication got all private parties involved and got them on the same page regarding the project. In case 2, all private parties involved were located in the same office in order to enhance communication (Respondent 7, 2017).

6.2.1.2 Understanding of risk

All interviewees except for one agreed that understanding of the risk was very important. In order to allocate risk, understanding of for example the likelihood and the impact of the risks needed to be acquired. A lot of this understanding of the risks did exist but needed to be communicated. Therefore, proper understanding of the risk often resulted from clear communication and information dissemination according to the most respondents.

When looking at the origin of know-how of the risk, experience was named as the most important factor contributing to expertise. Understanding how a risk works was best acquired by having seen the risk over and over again. If a risk had been observed in multiple previous projects by a manager, it was very likely that this manager would be better able to estimate the component of a similar risk in a similar project than a manager that had never observed it before (Respondent 9, 2017). In case 3, many of the risks' estimations were based on their own experience or experience from one of their sister companies that have come across similar risks.

The second main source of knowledge of the risk was external sources. This ranged from surveys to legal advice but also covered dialogue sessions with the authority to be able to understand and implement for example all known project requirements.

6.2.1.3 Top management support

Lastly, there was a dichotomy in the question whether support of top management influenced the risk allocation or not. Two of nine respondents did not rate it as important for the risk allocation while the other seven did say it influenced the allocation. Many of the respondents mentioned that support of top management was especially important in conflict situations. Top management can make a bigger impact in a discussion about the risk allocation (Respondent 3, 2017).

Respondent\factor		Influencing factors						
		Other factors						
		Commitment	Standardised framework	Market conformity	Openness for discussion	Trust	Clear structure and process	Experience
Case 1	Respondent 1	X	X	-	-	X	X	X
	Respondent 2	-	X	-	-	-	-	X
	Respondent 3	-	X	X	-	-	-	X
	Respondent 4	-	X	-	-	-	-	-
Case 2	Respondent 5	X	X	-	X	X	X	X
	Respondent 6	-	X	-	-	-	-	X
	Respondent 3	-	X	X	-	-	-	X
	Respondent 7	X	X	-	X	X	-	-
	Respondent 8	-	X	-	-	-	-	X
Case 3	Respondent 9	-	-	-	-	-	-	X

Figure 16: Cross-case analysis of the in literature depicted influencing factors

6.2.1.4 Additional influencing factors

Besides the factors described in this research, according to the interviewees, several other factors have influenced the risk allocation. Two factors that were mentioned by the vast majority of the respondents are, first of all, experience of risk allocation in previous projects, and secondly a standardised framework according to which risk was allocated. With this framework, the standardised DBFMO contract was meant. This is the contract between the authority and the SPV. The SPV used the same contract (except for the financial risks) for the DBMO contractor based on a standardised DBMO contract. Nowadays, this contract is a very advanced contract form and has a very standardised risk allocation about especially the financial risk, construction & operational risks and the organisational risks.

Other factors that have been named by at least two or three respondents were: commitment to the project, market conformity, openness for discussion, trust, and a clear structure and allocation process. If all parties were committed to the project, they were more willing to ‘take one for the team’. This meant that, if necessary, they were willing to take some additional, unforeseen risks in order to realise the project. However, this also worked the other way around, that if the parties were not committed to the project, this would affect the risk allocation negatively.

Respondent/factor		Influencing factors						
		Other factors						
		Commitment	Standardised framework	Market conformity	Openness for discussion	Trust	Clear structure and process	Experience
Case 1	Respondent 1	X	X	-	-	X	X	X
	Respondent 2	-	X	-	-	-	-	X
	Respondent 3	-	X	X	-	-	-	X
	Respondent 4	-	X	-	-	-	-	-
Case 2	Respondent 5	X	X	-	X	X	X	X
	Respondent 6	-	X	-	-	-	-	X
	Respondent 3	-	X	X	-	-	-	X
	Respondent 7	X	X	-	X	X	-	-
	Respondent 8	-	X	-	-	-	-	X
Case 3	Respondent 9	-	-	-	-	-	-	X

Figure 17: Cross-case analysis of the additional influencing factors

6.2.2 Interpretation

6.2.2.1 Communication and information distribution

First of all, all parties agreed that information dissemination and clear communication is a major influencing factor for the risk allocation. Respondent 3 (2017) named three criteria for the quality of information:

1. The kind of information
2. The transparency and the availability of the information, or
3. The independence of the information

These three criteria have been named as the most important criteria for the debt investors. The kind of information the debt investors acquire is typically from external sources. LTA reports give the debt investor an insight into the majority of the aspects of the project, such as construction aspects, financing

structures, insurance aspects and so on. Secondly, since these reports are specially written for prospective lenders, they are well accessible to potential debt investors. Thirdly, the independency of the information is also being secured by the fact that external, independent companies compose these LTA reports. However, the companies do their research and write their reports based on all information provided by the project managers. This implies that there is a certain bias to the information that LTA reports show. If, for example, the consortium shares information selectively, the external advisor is not able to draw up an unbiased report based on that information.

Furthermore, clear communication was enhanced through multiple methods. First of all, digital databases were used in order to be able to share all information on risks. For instance, the risk register was shared in this database with the purpose to make it accessible for all people from all parties involved. Another method to enhance communication was, just like in case 2, to have the complete project team work from one location. Even though different companies were involved, all employees worked from the same office. This was done to shorten communication channels, both to ease the planning of formal meetings as well as to enhance informal discussions about the project.

6.2.2.2 Understanding of risk

Understanding of the risk has also been acknowledged as a major influencing factor. Many respondents mentioned that this factor is a result of good information dissemination. If information about risks is distributed properly, better understanding arises throughout all private parties. Understanding of the probability and impact of the risk can be based on many aspects. Three main sources of understanding about the impact and the probability can be mentioned:

1. Experience
2. External sources (LTA's, surveys etc.)
3. Statistical modelling methods (Monte Carlo analysis)

External sources as depicted in previous chapters, mainly use experience to understand risks. The quality of a party conducting an external assessment is based on the number of previous projects they have assessed, showing that experience is a major factor. Lastly, statistical modelling methods have been used to assess risks. Monte Carlo simulations or best-and worst-case models have been used. The restriction of these models, however, must be addressed as well. Respondent 8 (2017) mentioned two restrictions regarding these methods. One restriction is the fact that often employees do not possess the right skills to conduct these modelling methods. Also, if the wrong information is used as input, the output will not be accurate.

6.2.2.3 Top management support

Support of top management has been a disputed factor. Several respondents have acknowledged it as an important factor influencing the risk allocation. Other parties seemed not to see how support of top management influences the risk allocation. The parties that did agree with the importance of top management support merely found this an influencing factor in case conflict arises. If ambiguity arises about the risk allocation, pressure from top management on other involved parties often has an advantageous effect on the risk allocation from a perspective of the party where top management is involved. Yet, this statement shows that risk allocation is not always a simple process. Trust and cooperation reduce the potential for conflict but disagreements about the risk allocation can never be eliminated completely.

Previously identified factors

- Information dissemination and clear communication
 - Three criteria for quality of information
 - Digital database and one location enhanced formal and informal communication
- Understanding of risk
 - Results from information dissemination and clear communication
 - Based on experience, external sources and statistical modelling
 - Statistical modelling used, but limitations are acknowledged
- Top management support
 - Disputed factor amongst respondents
 - Mainly important for conflict situations
 - Decreasing information towards top management leads to decisions based on experience and gutfeeling, thus subjective

Figure 18: Summary of the cross-case analysis of the previously identified influencing factors

6.2.2.4 Additional influencing factors

As has been established, experience played a very big role in understanding of the risk. Additionally, many respondents have named experience as an additional influencing factor, once more showing the importance of experience in the allocation process. Other factors that were not included in the theoretical framework for this research included: standardised framework, market conformity, commitment, openness for discussion, trust and a clear structure and process.

The standardised framework is in all cases the standardised DBFMO and DBMO contract. Even though respondent 9 (2017) was not very content with this framework, it was acknowledged that it did give a certain amount of standardisation. However, this standardised framework addresses mainly the overarching risk terms, such as construction risk. The construction risk, as mentioned in the preliminary research, however, can consist of multiple risks. Going into further detail would mean more research and a process completely away from a standardised one. The debt investor also required a market conformity in terms of a certain debt/equity investment ratio. Both the standardised framework and the market conformity show the similarity of the different projects.

Other influencing factors that have been mentioned were, first of all, the openness for discussion. In case 2, this improved the risk allocation by transferring the risk of asbestos from the contractor back to the authority, due to unwillingness by the contractor to take it. Secondly, a clear structure and process were key to achieve project success. Together with openness for discussion, these factors led to trust between the parties.

Additional factors

- Experience
- Standardised framework
- Market conformity
- Commitment
- Openness for discussion
- Clear structure and process
- Trust

Figure 19: Summary of the cross-case analysis of the additional influencing factors

6.3 Risk allocation criteria

6.3.1 Cross-case analysis

Furthermore, the risk allocation criteria have been examined. The majority of the interviewees, when asking the question what criteria had been used, answered ‘none at all’. However, throughout the rest of the interview it became clear that unconsciously they did allocate the risks according to following criteria:

1. The party taking the risk must have understanding of the risk
2. The party taking the risk should have experience with it
3. The party must be able to bear the risk at the lowest cost
4. The party bearing the risk must have control over the risk or must have the ability to influence the risk.

This list of criteria shows that understanding of the risk as well as the experience have not only been determined as an influencing factor but were sufficiently strong to serve as an allocation criterion as well.

Respondent/factor		Risk allocation criteria				
		No direct risk allocation criteria named	Experience	Expertise and know-how	Cost	Control over risk/ability to influence the risk
Case 1	Respondent 1	-	-	X	-	-
	Respondent 2	X	X	X	-	-
	Respondent 3	X	-	X	X	-
	Respondent 4	X	-	-	-	-
Case 2	Respondent 5	-	-	X	-	-
	Respondent 6	X	X	X	-	-
	Respondent 3	X	-	X	X	-
	Respondent 7	-	-	-	-	X
	Respondent 8	-	-	X	-	X
Case 3	Respondent 9	X	-	-	-	X

Figure 20: Cross-case analysis of the risk allocation criteria

6.3.2 Interpretation

As discussed before, initially no allocation criteria were mentioned, even after having repeatedly explained what criteria are and having provided an example. Still, some risk allocation criteria have been identified during the interviews by the author. These criteria were the aspects that the interviewees stated as a must-have for the risk-bearing parties. These four criteria are:

1. The party taking the risk must have understanding of the risk
2. The party taking the risk should have experience with it
3. The party must be able to bear the risk at the lowest cost
4. The party bearing the risk must have control over the risk or must have the ability to influence the risk.

Again in this matter, expertise and know-how of the risk is a requirement for a party to bear the risk. They must have sufficient knowledge of the probability, the impact and how to deal with the risk. This criterion is congruent with the influencing factor 'understanding of the risk'

Furthermore, experience has been named. The parties must have experience in dealing with the risks according to the majority of the respondents. There is ambiguity whether expertise and experience are just factors influencing the risk allocation or actually strict risk allocation criteria, as they have been listed in both categories.

Subsequently, the cost of the risk is a criterion as well. The cost of the risk is related to experience and expertise since the parties that have the most knowledge of the risk can offer the lowest rate (Respondent 9, 2017). This is very important since this can make or break the project. On the one hand, when the party that bears the risk offers it to a price that is too high, there is the chance of the final offer being too expensive for the client, and thus the consortium not winning the contract. On the other hand, if the party offers the risk to a price that is too low, in case the risk occurs they may have to incur high (financial) losses. A very careful consideration has to be made concerning the price to offer the risk and the eagerness to win the tender contract.

Lastly, the party taking the risk must have some kind of control over it. In other words, they must be able to influence the probability or the impact of the risk, or both.

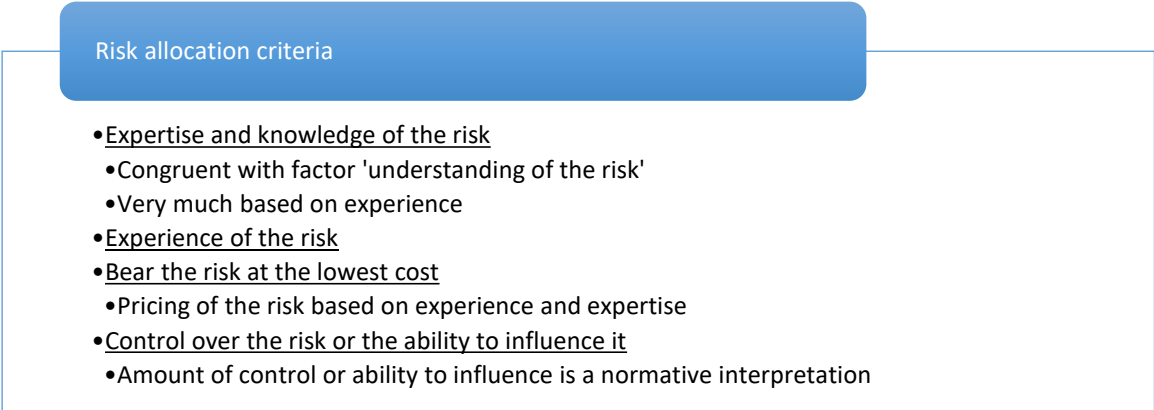


Figure 21: Summary of the cross-case analysis of the risk allocation criteria

6.4 Risk allocation process

6.4.1 Cross-case analysis

6.4.1.1 What

First of all, the 'what' will be discussed. Q&A sessions with the authority were held to validate identified risks from the standardised DBMO contract, but also to identify additional risks that had not been listed before. All risks identified would then be added to the risk register, where these risks were prioritised and analysed based on the product of the impact x probability. However, analysing the different risks was done in different ways in different projects.

On the one hand, statistical models have been used in order to estimate the likelihood and the impact of all risks. However, during the interviews, it became clear that many employees had difficulties using advanced statistical models to make estimations. Respondent 7 (2017) acknowledged that if employees do not fully understand how statistical modelling works or the wrong input is provided, the results will not be reliable. Furthermore, these statistical models have only been used for a limited amount of risks.

On the other hand, for the majority of the risks, estimations have been largely based on non-statistical models. Experience and gut feeling have been a big driver how to estimate the risks. Since no exact estimations could be made to assess the risks, a semi-quantitative scale has been used, ranging from low to high. In the different projects, and amongst the different interviewed parties, a wide variety of most important risks have been identified. These can be seen in figure 22.

6.4.1.2 Who

Secondly, when looking at the 'who' of these projects, several respondents acknowledged the fact that literally everyone is allowed to highlight risks; from the lowest levels of employees up to the highest managers. Risks identified by employees lower in the hierarchy were not rated as urgent as those identified by those of managers, yet if those risks kept coming back, eventually they were taken into account in the management meetings as well (Respondent 1, 2017).

The people deciding about the risk allocation were the managers. During (bi)-weekly meetings, the risks were discussed amongst the managers and they decided on who takes them and how to deal with them. In all three cases, the standardised DBMO contract made sure that a standardised risk allocation was at the basis of the allocation. In case 3, this standardised contract was a strict contract, whereas in case 1 & 2 there has been more room for negotiation regarding the risk allocation. In this allocation, all DBMO risks were passed to the DBMO contractor in case 1 and 2, and to the EPC & O&M contractor in case 3. These parties then had the choice to keep the risk or allocate it to a subcontractor. Financial risks, organisational risks and management risks were allocated to the SPV according to most respondents. But, one interviewee allocated the financial risks to the sponsor.

Respondent/factor		Process								
		What					Who			
		Q&A sessions & Risk register	Prioritised based on impact * probability	Non-statistical methods	Statistical methods	Most important risks	Everyone can propose risks	Sponsor	SPV	DBMO or EPC/O&M
Case 1	Respondent 1	X	X	X	-	Ground conditions & planning risk	X	-	Financial risks	DBMO risks
	Respondent 2	X	-	-	-	Permitting risk	-	-	Financial & management risks	DBMO & permitting risk
	Respondent 3	-	-	-	-	Construction	-	-	-	-
	Respondent 4	-	-	X	X	-	-	-	Financial risks	DBMO risks
Case 2	Respondent 5	X	X	X	-	Planning & Asbestos risk	X	-	Financial risks	DBMO risks
	Respondent 6	X	-	-	-	Asbestos risk	-	-	Financial, management risks & procuring insurance	DBMO risks
	Respondent 3	-	-	-	-	Construction	-	-	-	-
	Respondent 7	X	X	X	-	Incomplete consortium (No EPC)	X	Financial risks	Organisational risks	DBMO risks
	Respondent 8	X	X	X	X	-	X	-	-	DBMO risks
Case 3	Respondent 9	X	X	X	-	Multiple locations + Utility risk	-	-	-	EPC/O&M risks

Figure 22: Cross-case analysis of the risk allocation process (1/2)

6.4.1.3 When

Thirdly, the risks were allocated throughout the complete tender procedure, according to all respondents except one. It was not a conscious decision that at one certain point, risks needed to be allocated but risks were constantly identified, analysed and evaluated. The latter was thus not a one-time event, but a process with an iterative character.

6.4.1.4 How

Lastly, the 'how' has been discussed in the interviews. There were several different ways how to deal with risks according to the respondents. In some cases, the risks have been dealt with using authoritarian power. This can be seen in the case 3. Here the authority, at will entered new clauses into the contracts with the SPV, which the SPV largely just had to accept. In some cases, they were able to mitigate the risks, like for example the risk of archaeological findings. They managed to mitigate the risk to such an extent they were only held liable up to a certain amount if archaeological findings were made.

In the other two cases, the 'how' was mainly dealt with based on experience and on the standardised framework. Many risks were allocated and dealt with based on the framework. This means that there was no discussion on who was going to take the construction risks, since all parties had signed the contract, and therefore agreed to the risk allocation in the contract. This implied that the DBMO contractor had accepted to take the risks. The DBMO contractor, in turn, has the opportunity to outsource parts of these DBMO risks to subcontractors that have more experience in dealing with those risks. Experience has been identified as a factor influencing the risk allocation but at the same time as a risk allocation criterion. This means that experience is of paramount importance in the risk allocation.

For the debt investor in case 1 and 2, how to deal with risk was a pure accept/reject decision. They got all the information they wanted, yet they had no influence on the risk allocation. Based on the information provided, they had to decide whether they wanted to invest or not.

Respondent\factor		Process					
		When		How			
		Continuously during tender phase	After design phase	Allocation based on leverage	Allocation based on experience	Allocation based on standardised framework	Accept/reject decision
Case 1	Respondent 1	X	-	-	X	-	-
	Respondent 2	X	-	-	X	X	-
	Respondent 3	X	-	-	-	-	X
	Respondent 4	-	-	-	-	X	-
Case 2	Respondent 5	X	-	-	X	-	-
	Respondent 6	X	-	-	X	X	-
	Respondent 3	X	-	-	-	-	X
	Respondent 7	-	X	-	-	X	-
	Respondent 8	X	-	-	-	X	-
Case 3	Respondent 9	X	-	X	-	-	-

Figure 23: Cross-case analysis of the risk allocation process (2/2)

6.4.2 Interpretation

6.4.2.1 What

First of all, the question what risks have been identified and their corresponding prioritisation are investigated. There has been a vast amount of ways how risks have been identified, leading to a very extensive list of identified risks. One method how risks have been identified is through the (standardised) contracts. Especially in case 1 and 2 the standardised DBMO contracts have been a major contributor to the risks since many risks have been identified related to the construction, operation and organisation of the project. Because in case 3 the contract used was less standardised than the ones in the other two cases, this contract was perceived as a major source of risks. Mainly due to the stiff relation with the authority, the private consortium would make sure that the contract is checked very thoroughly for potential risks.

Secondly, many risks have been identified based on experience of employees involved in the project. Similar projects conducted in the past have been used in order to identify risks.

Thirdly, expertise has been important to identify risks. If an employee has very good understanding of for example a building process, this employee will be able to identify risks in this particular process much better than a person without this understanding.

Furthermore, many external sources have been used to identify risks. Examples are surveys, assessments, legal advice or due diligence reports. All these risks have been put into a risk register. Although parties often think that all risks are accounted for, it often occurs that risks emerge that had not been identified. Most of the risks can be identified, but the chances are very low that all risks are captured, even after several iterative steps.

In the risk register, the next step has been to prioritise the risks based on their risk score, consisting of the probability * impact. Again, expertise and experience have played a major role in the assessment of the risk scores. For certain risks, such as the risk of a delay, Monte Carlo simulations have been used. Additionally, best – and worst-case scenario analysis has been conducted to determine risk scores of several risks. These have all been added to the risk register and based on the scores the risks have been prioritised. Throughout multiple question and answer (Q&A) sessions with consortia and the authority, the risk identification and assessment could be validated on the basis of information from the authority. This was an iterative process, which continued throughout the tender until the best and final offers (BAFO) were entered.

6.4.2.2 Who

The next question is who took what risks. Again, the (standardised) contracts in the projects played a very important role in the allocation of the risks. The standardised DBMO contracts in case 1 and 2 between the SPV and DBMO BV led to a very standardised risk allocation, where the construction risk and operational risk were passed automatically one-to-one to the DBMO BV. This party then had to decide within the DBMO who should take the risk, a decision based on experience and expertise of the risk. The costs of risk were taken into account here as well. Yet, these aspects are very interrelated, since the parties with the most expertise and experience of the risk are most likely to be able to offer the risk to the lowest price (Respondent 9, 2017). Furthermore, the parties that bore the risk were able to subcontract certain risks, automatically transferring attached risks to the subcontractors. This was done based on experience and expertise. An example that was mentioned is that the DBMO might not know how to construct the cabling of the building, and therefore transfers it to a subcontractor that is specialised in cabling. Another example is the specific inner yard architect that was subcontracted for case 1.

6.4.2.3 When

Thirdly, what can be interpreted from when to allocate the risks is the fact that this process is iterative. Several Q&A sessions have clarified risks included in the risk allocation. Regular meetings were also very important for the risk allocation and show the process' iterative character. Since these Q&A sessions and meetings have been organised throughout the complete tender phase, the risk allocation process has thus been a continuous process.

This iterative and continuous character is very closely linked to the dynamic character of risks. Risks can change very easily, and therefore they need to be continuously identified, assessed, prioritised and allocated. The number of actual risks set out over time shows a strongly declining curve. Especially in case 1 and 3, the majority of the risks are identified, assessed and allocated in the early stages of the project, most likely the tender phase. The number of risks allocated then gradually declines over time. For case 2, this curve is similar, only that it starts after the design phase of the project was completed.

6.4.2.4 How

Lastly how to deal with the risks is addressed. There have been several many how risks have been dealt with in the projects. In case 1 and 2, the main driver how to allocate risks was based on both the standardised framework in combination with experience. The standardised contracts allocated all construction risks to the DBMO contractor. Within the DBMO the parties then had to decide which party took what part of the construction risk, based on their experience. Furthermore, they could decide to outsource several risks to subcontractors, once more solely based on more elaborate experience of these subcontractors.

6.4.2.5 Risk allocation process in practice

The risk allocation process, in theory, is very different from that in practice. In theory, the risk allocation steps consist of: 1. What, 2. Who, 3. When, and 4. How (Abednego & Ogunlana, 2006). According to the interviews that have been held, these steps look completely different in practice. According to the majority of the respondents, the steps are as follows: 1. Identify the risks, 2. Analyse and prioritise the risks, and 3. Allocate risk and determine risk response strategy.

For instance, the debt investor identified risks by commissioning external parties to do research on the risks in the project, in a so-called due diligence. These were analysed and based on that analysis, the debt investor decided whether to invest in the project or not; to accept or reject the risk. Contractors, however, would identify and analyse risks mainly based on their experience of previous projects. These estimations would form the basis to determine how to deal with the risks. Although the procedures have been different for different parties, the general process consisted of the same three steps. Based on the provided information, in underlying figure, a revised concept of the risk allocation concept by Abednego & Ogunlana (2006) is presented. This figure shows the original risk allocation concept developed by Abednego & Ogunlana (2006) on the left and on the right the revised risk allocation concept.

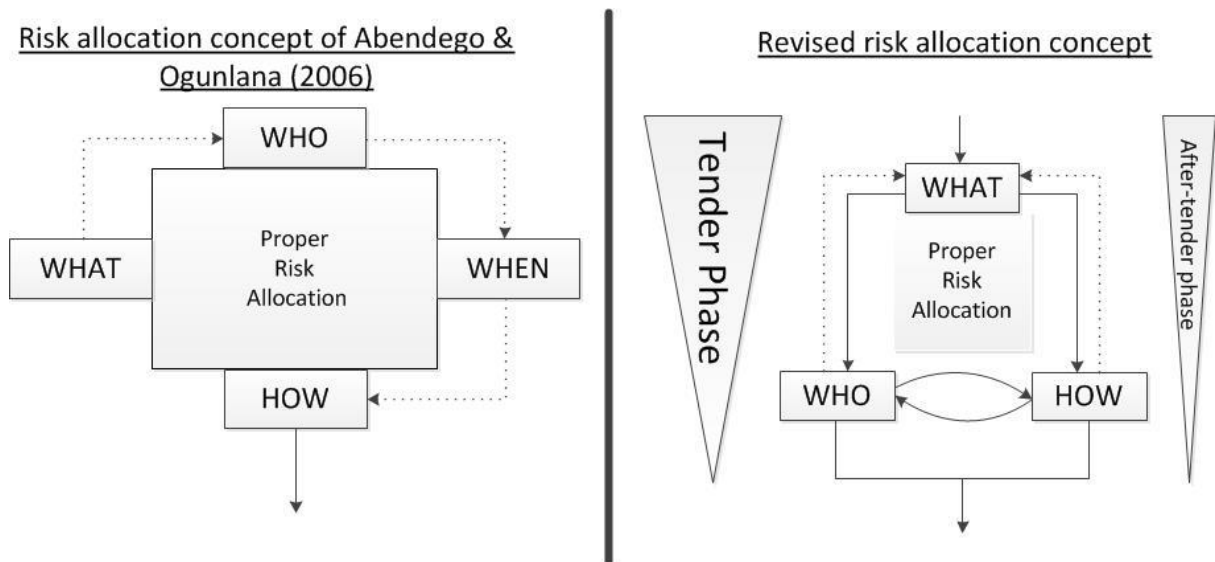


Figure 24: Original and revised risk allocation concept

First of all, the risks are identified, analysed and prioritised in the ‘what’ step. The identified risks are listed in the risk register of the project. The risk analysis is conducted by determining the probability and the impact of the risk on project objectives. By multiplying these values, an overall risk score can be established. Based on these risk scores, risks can be prioritised in this step.

From the first step, there are two paths to the next step. The interviews showed that the ‘how’ and ‘who’ step are very interrelated. If one party decides to accept the risk (how), it automatically implies that this party bears the risk (who). This goes vice versa as well, when a party decides they are bearing the risk (who), this implies that they have accepted the risk (how). However, this is not always automatically settled within one iteration between ‘how’ and ‘who’. If a party decides it bears the risk, it can also decide to transfer the risk to another party. This shows that initially the ‘who’ - decision was settled, but by looking at how to deal with it, it is decided to transfer the risk, meaning that the owner of the risk will change as well.

The fact that (bi-) weekly meetings were held to discuss the risk allocation between private parties of the project shows the repetitive character of risk allocation. Furthermore, after deciding on how to deal with risk and who deals with it, residual risk often remains. Due to these two reasons, two arrows in the concept have been added, leading back from the ‘who’ and the ‘how’ to the ‘what’ step. These arrows show the repetitive character of risk allocation.

The ‘when’ step is not a conscious decision. The majority of the risk allocation appears to occur during the tender phase as acknowledged by almost all respondents. The amount of risks identified, analysed and allocated steadily declines throughout the tender procedure. A triangular shaped object that narrows towards the bottom has been added on the left side of the revised concept in figure 24. This object illustrates the decrease of risk allocated throughout the tender procedure. Also during other phases of the project life cycle, (unforeseen) risks can occur. These need to be dealt with as well, hence the similarly shaped triangle on the right-hand side of the concept. But the closer to the termination of the project, the fewer risks occur. Therefore, the breadth of this object increases towards the bottom. Finally, since the majority of the risks are allocated in the tender phase, this triangle is portrayed bigger than the other one.

The revised concept in its original context is presented in figure 25.

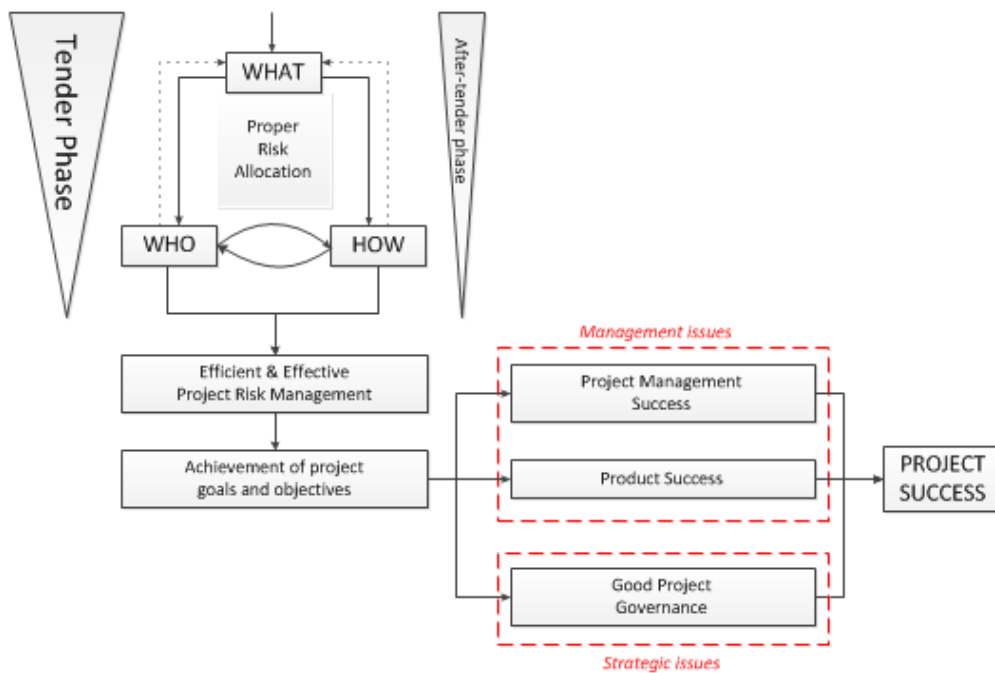


Figure 25: Revised risk allocation concept in its original context (source: author)

Risk allocation process

- **What**
 - Risks identified through standardised contracts, experience, expertise, external sources, Q&A sessions
 - Listed and prioritised in risk register based on probability*impact
- **Who**
 - Based on standardised contracts, experience and expertise and cost of risk
- **When**
 - Continuous and iterative process of identifying, prioritising and allocating risk, mainly throughout tender procedure
- **How**
 - Based on standardised framework in combination with experience
- **Risk allocation in practice:**
 1. Identify risks
 2. Analyse and prioritise risks
 3. Allocate risks and determine risk response strategy

Figure 26: Summary of the cross-case analysis of the risk allocation process

6.5 Answering the second sub question (see section 2.2)

Since the case studies and the cross-case analysis have been completed, a clear view of the influencing factors, the risk allocation criteria and the risk allocation process in practice has been obtained. Herewith, the second sub question can be answered. The second sub question is:

‘What are influencing factors of risk allocation, the risk allocation criteria and how is the risk allocation process between private parties according to practice?’

6.5.1.1 Influencing factors

For the communication and information distribution, the debt investor applied three criteria to enhance the quality of information. Furthermore, a digital database and working from one location increased formal and informal communication. It was also acknowledged that understanding of the risk results from clear communication. The largest part of understanding of the risk was based on experience and external sources. Statistical modelling techniques were also used but posed two major limitations. These limitations were first of all, that employees did not have the right skills and understanding to perform such an action. Secondly, missing data resulted in employees having to use their own interpretation to compensate for the missing data. Top management support was a disputed factor amongst the respondents. The interviewees that did consider this an important factor, found it mainly important in conflict situations.

Other additional factors that were named during the interviews are a standardised framework, market conformity, experience, commitment, openness for discussion, a clear structure and process and trust. A standardised framework referred to the standard DB(F)MO contracts. Market conformity was mainly for the debt investor, who stated that the debt/equity investment ratio should be around 90/10 for him to invest. Experience stands for having conducted similar projects in the past. Commitment means that people should be willing to ‘take one for the team’ in order to complete the project. Openness for discussion shows the willingness to enter negotiations regarding the risk allocation. A clear structure and process imply that every party knows their own responsibilities, the sequence of the activities and the constellation of the project. Trust, implies trust between the different private parties

6.5.1.2 Risk allocation criteria

The risk allocation criteria that have been identified in the case studies are expertise and knowledge of the risk, experience, cost and control over the risk. Expertise and knowledge of the risk is congruent with understanding of the risk, initially identified as an influencing factor and very much based on experience. Experience is reflected by the number of times that a similar project has been conducted before. The cost criterion means that the party should bear the risk at the lowest cost. The pricing of the cost is important since the final offer made, should for competitive reasons be at the lowest possible cost and therefore the risks need to be priced at the lowest possible cost. Lastly, the control over the risk indicates the ability to influence the impact or the probability of the risk. The party taking the risk should be able to influence at least one of these two aspects.

6.5.1.3 Risk allocation process

In the case studies, the risks have been identified through standardised contracts, experience, external sources, expertise and Q&A sessions. The identified risks were then listed in the risk register and prioritised based on the risk score, consisting of the probability*impact. Who took the risks was also based on the standardised contracts, experience, expertise and the cost of the risk. The risk response strategy was mainly determined based on experience.

The risk allocation process in practice looked as follows: 1. Identify risks 2. Analyse and prioritise risks, 3. Allocate risks and determine risk response strategy. The first two steps equal the ‘what’ step of the theoretical process. Allocating the risk and determining a risk response strategy is the same as the ‘who’ and ‘how’ step. With this knowledge, the author has constructed a revised concept, which is presented in below figure. A detailed explanation of this model is provided in chapter 6.4.2.5.

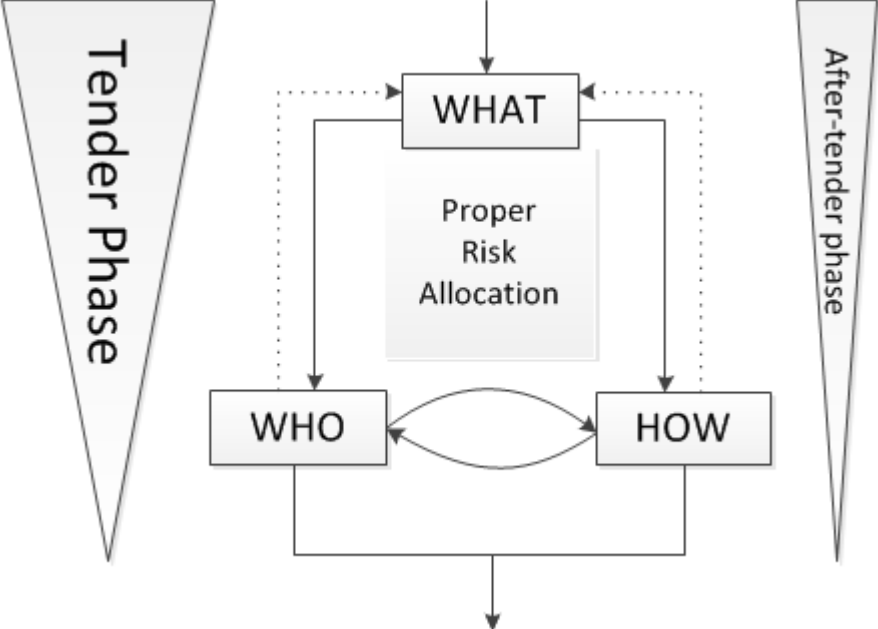


Figure 27: Revised risk allocation concept

7. Comparative analysis

7.1 General

The empirical analysis of this research has portrayed that certain type of stakeholders has certain main objectives. The ‘financial’ parties such as the sponsor and the debt investors want the project to be built at the lowest possible cost, enabling higher cash flows and a shorter payback period of the investment. Parties such as the SPV managers, contractors or advisors mainly focus on the quality of the project, on the one hand, to comply with the clients’ wishes and on the other hand to build on their reputation by constructing a high-quality and prestigious project. However, there is no party that said that they put their focus on the timely completion of the project.

The triple constraint theory depicts that a project generally has three objectives: quality, cost and time. Yet, Wyngaard et al. (2012) illustrated that in practice only two of the three constraints of this model are met.

Theory and practice, in this case, are in line. All interviewed parties have their focus either on costs or on quality, but no party has the focus on the timely completion of the project. The assumption can be made, that if throughout a project no attention is paid to achieving a timely completion of the project, the chance is fairly high that this constraint will not be met. The result is that indeed only two of the three constraints are met (assuming that the other two constraints indeed will be achieved). This confirms the criticism of the triple constraint theory depicted in the theoretical framework.

Furthermore, in theory, risk allocation was identified as a major contributor to project success (Marques & Berg, 2011), which was confirmed in practice. The bilateral relation between risk allocation and trust and commitment has been depicted in this research. A clear risk allocation decreased the potential for conflict and made parties more willing to ‘take one for the team’. This increased the potential of achieving (two of the three) project objectives.

7.2 Influencing factors

7.2.1.1 Communication and information distribution

First of all, theoretical risk approaches acknowledged the importance of clear communication of information. A lack of proper information distribution functions as a barrier to risk management (ISO, 2009). In the empirical part, clear communication and information distribution have been found crucial. It does not only improve the risk allocation but according to respondent 8 (2017), not exchanging information about risks increases risk. Both in literature and in practice, the importance of sharing information is acknowledged. Yet, Vasvari (2015) stated that lack of clear communication leads to subjectivity in the risk analysis.

In these cases, it would be assumed that information distribution has increased objectivity (Respondent 7, 2017). Yet, digging a little deeper would suggest the opposite. ‘Risk information first needs to be the right information for the purpose at hand and then it needs to be communicated effectively’ (Redmill, 2002, p. 27-28). The fact that the majority of the information being shared is based on experience and thus subjective meant that the information dissemination increased subjectivity in the process. This supports the new risk management approach, which emphasizes the role of subjectivity in risk management and risk allocation. Only under the condition that the shared information is objective, would make this factor an objective factor.

7.2.1.2 Understanding of risk

Subsequently, lacking information is a major cause to misunderstanding of risks (WRR, 2009). This has been confirmed by the empirical research. Most respondents agreed to the fact that clear communication leads to an increased understanding of risk, which is the second researched influencing factor.

Multiple sources have been used to acquire understanding of the risk. Firstly, statistical modelling techniques such as Monte Carlo have been applied to enhance objectivity in the process. Generally, these methods give a more accurate estimation of reality than experience since this method performs a project simulation multiple times and a distribution of likely results is calculated (PMI, 2000). Monte Carlo enables to give a more accurate estimation due to the high amount of iterations. Yet, limitations of using these models are lacking skills of employees and missing input data, leading to employees using experience to fill gaps in the data. If the input of the model is nonsense, the output will be nonsense as well (Respondent 8, 2017). This complies with the acronym 'GIGO' developed by Redmill (2002), which stands for 'garbage in, garbage out'. The limitations of these models made the results from these models highly subjective.

Secondly, a lot of information has been based on external information, such as legal advice, due diligence reports, condition reports and so forth. Due to the external nature of the reports, the consortium could consider these sources as objective. However, much of this external information is based on experience and previous projects, rendering it rather subjective, also for the consortium.

Lastly, a lot of understanding about the impact and probability of the risk has directly been based on experience by the assessing parties. Evidently, this made it very subjective as well.

Although different techniques were tried to enhance an objective understanding of the risk, the majority remained subjective because it has mainly been based on experience. The fact that mainly qualitative methods have been used based on experience showed much subjectivity. Vasvari (2015, p. 43) confirmed that: 'qualitative analysis should be particularly mindful of the effect of subjective factors, and be sceptical of results'. This research has demonstrated the high amount of subjectivity in the qualitative analysis and confirmed the thoughts of the new risk approach.

7.2.1.3 Top management support

Top management has been found an influencing factor in theory. In practice it mainly was important in conflict situations, to put more pressure on opposing parties. Yet, due to highly aggregated information available to top management, managers had less understanding of the risks. This led to managers having to make their decisions based on gut feeling and experience, which resulted in very subjective decisions from top management and again supports the new risk approach. This again backs the argument that information distribution is a very important factor for the risk allocation and that information distribution eliminates subjectivity, provided that the information is objective.

7.2.1.4 Additional influencing factors

Subsequently, the respondents have identified other influencing factors. Some factors are a standardised framework and market conformity. A standardised framework and market conformity standardise the risk allocation. Even though the projects are very different, the same type of contracts is used and similar debt/equity investment ratios are required. This resembled the classical risk approach to the extent that the risk allocation process is a standardised process and it does not involve any conscious decision on how to allocate the risk. However, going into further detail, it showed that only risk categories based on this framework were allocated and that for actual, lower level risks no standardised risk process existed. This is more in line with the new risk approach.

The other factors that have been identified fully support the new risk approach. These factors were experience, commitment, openness for discussion and trust. Experience is not based on facts but an interpretation. The other three factors deluded from making decisions based on facts but instead by ‘taking one for the team’. This made these factors very subjective and therefore in favour of the new risk approach. By being committed to the project, a party is probably more willing to accept a higher amount of risk to enable to realise the project than parties that are not committed. The same accounts for openness for discussion and trust. When parties are open for discussion and trust other parties in terms of the risk allocation, they are more likely to accept (higher) risk than when they do not trust each other at all.

Classical risk approach	New risk approach
<ul style="list-style-type: none"> • <u>Standardised framework (risk categories)</u> • <u>Market conformity</u> 	<ul style="list-style-type: none"> • <u>Communication and information distribution</u> • <u>Understanding of risk</u> • <u>Top management support</u> • <u>Experience</u> • <u>Commitment</u> • <u>Openness for discussion</u> • <u>Trust</u> • <u>Standardised framework (risks)</u>

Figure 28: Comparative analysis: influencing factors

7.3 Risk allocation criteria

As depicted in chapter 4.2.2, in theory, there were many different risk allocation criteria. However, when looking at the empirical part of this research, a much smaller and very subjective list of risk allocation criteria has been identified. These criteria include:

1. The party must be able to understand the risk
2. The party taking the risk should have experience with it
3. The party must be able to bear the risk at the lowest cost
4. The party bearing the risk must have control over the risk or must have the ability to influence the risk.

At first glance, three out of four criteria could be considered objective and thus, supporting the classical risk approach. Only experience is very subjective, as it is merely an interpretation. However, going one level deeper showed that all four criteria confirmed the new risk approach.

Expertise of the risk does not necessarily have to be subjective. When understanding is based on facts, this results in objectivity and therefore supports the classical risk approach. Yet, when it is based on experience this becomes subjective. As was seen in the cases, understanding was mainly based on experience and therefore it supports the new risk approach.

Then, the ability to influence the risk is questionable. When asked as a simple yes or no question it can be answered objectively. However, the amount of control over risk makes it more subject to subjectivity. It is difficult to determine who has more control over it. And is it better to have control over the impact or over the probability? These again are normative interpretations, hence making it subjective.

Lastly, the cost is the only objective criterion in this list. It is a simple fact if one number is higher than the other. The process towards determining that number is in these cases often subjective. If the pricing of the risk depends on the experience and expertise of the parties pricing it, it will be a subjective matter, since both have been scaled as subjective.

Classical risk approach	New risk approach
	<ul style="list-style-type: none"> • <u>Understanding of the risk</u> • <u>Experience</u> • <u>Cost of the risk</u> • <u>Control over the risk</u>

Figure 29: Comparative analysis: risk allocation criteria

7.4 Risk allocation process

7.4.1.1 What

As shown in previous chapters, all steps of the risk allocation involved a vast amount of subjectivity. The ‘what’ step, including the identification and prioritisation of risks was based a lot on experience of employees. The identification of risks was based on the standardised contracts and experience. Using a standardised framework for the majority of the risks is a good step for objectifying the risk identification as much as possible. It forms a basis for a standard risk list, but as was acknowledged, this is merely an identification of the risk categories. The actual risks need to be individually identified after that. Since this is done based on experience and expertise, this makes it subjective and thus supporting the new risk approach. Yet, as Lowrance (1980, p. 8) said: ‘we simply commit the sin of pride when we think we have been so smart as to have forestalled absolutely every possibility of failure’, meaning that never all risks can be identified. Even with all the experience in the world, unforeseen risks will always remain.

Assessing the risks has been based on both statistical models, such as Monte Carlo analysis. The fact that Monte Carlo simulations have been used to determine the risk score has meant that to a certain degree that subjectivity has been eliminated. However, the shortcomings of the models have been identified, and even though it has been tried to eliminate subjectivity, the shortcomings of the models have still resulted in subjective estimations of the probability and the consequences of the risks. The shortcomings include the inability to apply statistical models and lacking data leading to incorrect input into the model. Non-statistical methods, such as the use of external sources (legal advice, due diligence reports, surveys) or experience have also been applied. Experience of employees guided the assessment of the risks showing that the risk assessment is subjective. The fact that experience was the major driver for prioritising the risks shows that the assessment was merely an opinion. It was attempted to eliminate this subjectivity by using multiple external sources, yet this external information is merely based on experience as well, meaning that it is still a normative judgement.

7.4.1.2 Who

Then, who takes the risk was very much based on the standardised contracts as well as understanding of the risk and experience. The use of standardised contracts implies the elimination of normative interpretation and thus subjectivity. However, this was mainly for risk categories, and not for the actual risks. Who took the actual risks was still based on understanding of the risk and experience, hence subjective decisions and therefore supporting the new risk approach

7.4.1.3 When

Thirdly, the time to allocate the risks has proven to be a continuous process. An iterative process throughout the complete tender phase was determined when allocating the risks. The iterative and continuous character of the risk allocation enables the private parties to cope with the dynamic nature of risk. Risks are subject to change, and for this reason, the process needs to be continuous and iterative. This aspect is acknowledged by both risk approaches and therefore, it supports both approaches.

7.4.1.4 How

Lastly, how to deal with risks was determined. Once more, this decision was mainly guided by the standardised framework and experience. The major risk categories were allocated to the DBMO contractors based on the standardised contract. These parties could decide to accept the risk or to transfer it to a party with more experience, and therefore being able to price it at a cheaper rate. Since this decision was based on experience it was a subjective decision. As noted, the whole process of risk allocation was dominated by experience and thus, subjective. This is in line with Redmill (2002), who stated that subjectivity is involved in all steps of risk management. Due to the enormous amount of subjectivity involved in the complete risk allocation process, this process confirmed the new risk approach.

Classical risk approach	New risk approach
<ul style="list-style-type: none">• <u>What</u>• When based on <u>accurate</u> statistical modelling, standardised contracts (risk categories)	<ul style="list-style-type: none">• <u>What</u>• When based on experience, external sources, standardised contracts (risks)
<ul style="list-style-type: none">• <u>When</u>	<ul style="list-style-type: none">• <u>Who</u>• <u>When</u>• <u>How</u>

Figure 30: Comparative analysis: risk allocation process

7.5 Answering the third sub question (see section 2.2)

This chapter provides an answer to the third sub question:

Which risk approach do the influencing factors, the risk allocation criteria and the risk allocation process support?

In terms of influencing factors, the standardised framework, known as the DB(F)MO contract, and the market conformity are the only two aspects following the classical risk approach, therewith showing its objective nature. A nuance has to be made since this DB(F)MO contract only accounts for the risk categories. For the actual risks, a subjective decision has to be made regarding the risk allocation, thus making it more in support of the new risk approach. The other influencing factors, communication and information distribution, understanding of the risk, top management support, experience, commitment openness for discussion and trust are subjective interpretations and therefore support the new risk approach.

Although initially the risk allocation criteria could be perceived as objective, in all three researched cases, the conclusion is that the four risk allocation criteria are subjective, and thus supporting the new risk approach. Experience is evidently a subjective matter. Subsequently, the role of experience in understanding, the cost and control of the risk makes them subjective as well.

The process is mostly subjective and supporting the new risk approach. One part that is objective is the identification, assessment, and allocation of the risks based on statistical modelling, under the conditions that employees know how to conduct e.g. Monte Carlo and that they have sufficient data to feed the models. This objective character also applies to the risk categories based on the standardised DB(F)MO contract. Statistical modelling and the standardised contract show a certain degree of objectivity, hence supporting the classical risk approach. However, when these steps are conducted based on experience, expertise, external sources or the actual risks of the DB(F)MO contracts are allocated, this matter turns subjective, and therefore in support of the new risk approach

The dynamic nature of risk requires for the process to be iterative and continuous throughout the complete project. Both risk approaches acknowledge that risks can change and need to be dealt with continuously, therefore the when step is supported by both risk approaches.

Classical risk approach	New risk approach
<ul style="list-style-type: none"> • <u>Influencing factors</u> <ul style="list-style-type: none"> • Standardised framework (risk categories) • Market conformity • <u>Risk allocation process</u> <ul style="list-style-type: none"> • What • Who • When • How 	<ul style="list-style-type: none"> • <u>Influencing factors</u> <ul style="list-style-type: none"> • Communication and information distribution • Understanding of the risk • Top management support • Experience • Commitment • Openness for discussion • Trust • Standardised framework (risks) • <u>Risk allocation criteria</u> <ul style="list-style-type: none"> • Understanding of the risk • Experience • Cost of the risk • Control over the risk • <u>Risk allocation process</u> <ul style="list-style-type: none"> • What • Who • When • How

Figure 31: Comparative analysis: summary

The comparative analysis has shown that the majority of the influencing factors, risk allocation criteria and risk allocation process support the new risk approach. The majority of the aspects have a subjective character, mainly because experience plays such a paramount role in all aspects. As shown in the previous analysis, experience is an influencing factor, a risk allocation criteria, a major driver throughout the complete risk allocation process and lastly, has a big influence on other influencing factors and risk allocation criteria. Within the influencing factors, experience is a major contributor to understanding of the risk. Furthermore, plenty of information about the risks is shared, but the majority of this information is based on experience as well. The interpretations of the impact and probability of the risks in the risk register are mainly based on experience. Experience is also the most important risk allocation criteria according to practice. Other factors such as expertise and cost of the risks are named, yet expertise is mainly based on experience. Furthermore, the complete risk allocation process is strongly influenced by experience. What risks are dealt with is based on similar previous projects, just as who bears the risk, and how it is dealt with.

The complete risk allocation process seems to go hand-in-hand with experience and thus seems to be subjective. However, a nuance needs to be made: If each decision regarding the risk allocation were made individually, this would indeed indicate subjectivity. However, as it was seen in all projects, these decisions are not made individually. The 'stuurgroep' or the 'kernteam' are the groups of people that decide on the risk allocation. And yes, they all do this based on their own experience. But this experience is then shared with the other members of the team, and based on their joint experiences agreements are reached regarding the risk allocation.

7.6 Intersubjectivity

Even though the importance of experience and its influence on subjectivity has been explained in latter chapter, it is not that black and white. If every decision is made by one single individual, the subjectivity indeed is enhanced. However, many aspects have been witnessed that would suggest not such a subjective character at all.

As seen in all projects, there is not only one person deciding on the risk allocation. There is a complete team behind the decisions, whether it is called the 'stuurgroep' or the 'kernteam'. This is a team of managers deciding on the risk allocation. In (bi-) weekly meetings, experience from previous projects is shared, based on which the risk allocation for the current project is discussed. This discussion ultimately leads to an agreement on the probability, the impact, how to deal with the risk and who to allocate the risk to. Not the experience of one individual is leading in the decision-making, but the experience of multiple managers, all having conducted different types of projects, with different risk allocations, in different settings. This shows that the experience of multiple managers leads to decisions regarding the risk allocation. Just as respondent 8 (2017) mentioned decisions regarding the risk allocation are a process of negotiations where in the end consensus is achieved. Consensus in this matter means an agreement. According to the Oxford dictionaries (2017), the word consensus comes from the Latin verb 'consentire', which means agree. Therefore, consensus is nothing more than a general agreement (Oxford Dictionaries, 2017).

The fact that multiple interviewees mentioned openness for discussion as an important influencing factor shows that the process was designed to reach an agreement, rather than taking one point of view and holding on to that.

How agreements on the risk allocation between private parties are reached is very related to intersubjectivity, which is a concept being observed in psychological analysis. 'Intersubjectivity theory is a field theory or systems theory in that it seeks to comprehend psychological phenomena not as products of isolated intraphysic mechanisms, but as forming of the interface of reciprocally interacting worlds of experience (Stolorow & Atwood, 1996, p181-182). Especially the last part, reciprocally interacting worlds of experience is what exactly concurs with the way agreement was reached in the cases. Individual subjective interpretations based on experience are shared and form the basis for negotiations. Based on this interaction between the managers of the private parties, agreements are reached for the risk allocation. Just as experienced in the different cases, in the intersubjective perspective experience is continually and mutually shaped (Stolorow & Atwood, 1996). This concurs with risk allocation between private parties in social infrastructure projects as managers constantly share experience and jointly reach an agreement based on this experience.

Furthermore, the external sources that have been based on experience are also not as subjective as depicted in the previous chapters. Normally, external sources are not based on experience of one single person either. Surveys or condition reports are generally not conducted by one single person, but by a team of experts. These experts exchange viewpoints to come to the best conclusion regarding the potential risk and thus showing an intersubjective character as well.

A due diligence report is often conducted by a company that in the introduction sells itself by having a lot of experience of reviewing multiple projects (Confidential source 3, 2014). The fact that these experts have reviewed a vast amount of projects makes their assessment less subjective. In some cases, the current project and its risks are compared to other previous projects and risks are assessed with that aid. However, a limitation of this observation is the fact that all projects are unique. This means that risk allocation from previous projects is not necessarily the most adequate risk allocation for current projects.

In conclusion, this chapter shows that decision-makers aimed to objectively assess and allocate risk between the private parties. Statistical modelling methods, such as Monte Carlo analysis, were applied to minimise subjective interpretations for the probability and impact of risks and therewith making them more accurate. It was tried to enhance objectivity, however, two major limitations formed a major barrier to the objective allocation of risk.

Furthermore, due to the paramount role of experience throughout the complete process, at first sight, it seems rather subjective. However, this chapter has shown that a nuance has to be made. The ‘kernteam’ and ‘stuurgroep’ jointly reach consensus on the risk allocation based on shared experience, which makes the risk allocation process rather intersubjective instead of purely subjective. The intersubjective way of decision-making implies that managers share their experience and knowledge on a subject, they discuss this and eventually, based on the sharing of information they jointly reach an agreement regarding the risk allocation.

External sources and due diligence reports are often based on joint experience of multiple experts. Additionally, especially in the case of due diligence reports, experience is based on a vast amount of comparable previous projects. These two aspects combined show a high degree of intersubjectivity.

8. Enhancing objectivity and intersubjectivity

In practice, the managers in charge tried to objectify the risk allocation process by using statistical modelling techniques. They intended to eliminate subjectivity and to prevent risk estimations and the risk allocation process being based on normative interpretations. Sharing their extensive experience of previous projects enhanced intersubjectivity. This implies that managers preferred the objective and intersubjective way to the pure subjective way of allocating risks. Therefore, this chapter will elaborate on how to enhance objectivity and intersubjectivity in risk allocation.

Theoretically, the way to achieve objective risk allocation is known. Basing the risk allocation on facts instead of normative interpretation makes it objective. In terms of intersubjectivity, this is a bit more complicated. How do you reach consensus? What factors influence reaching a decision? More aspects come into play. Based on observations in the case studies, propositions how to enhance intersubjectivity are developed and tested.

8.1 Objectivity

Statistical modelling techniques, such as the Monte Carlo analysis, have been used in order to objectively allocate risks between the private parties. However, due to two major limitations rather the opposite was achieved. First of all, incorrect or missing data led to employees using subjective interpretations such as experience or external sources as input in the model. This can result in the ‘GIGO’ acronym, which stands for ‘garbage in, garbage out’. When unreliable data is used as input in the model, it is very likely that the output of the model is inaccurate or even worse, that it is incorrect. Secondly, it was acknowledged that employees often lack the understanding and the ability to accurately apply these kinds of techniques. They often do not possess the right skills to conduct the statistical analyses. This is also an important factor resulting in unreliable results.

A way to enhance objectivity in the risk allocation process is to find a solution to the two limitations of the statistical modelling techniques. In the following paragraphs, two solutions to counter these limitations will be addressed.

First of all, the inability of employees to conduct for instance a Monte Carlo analysis should be solved. A solution to this limitation is to provide training for the employees who are to conduct the analysis. When private parties train their employees, these people will acquire the appropriate knowledge and skills how to conduct e.g. a Monte Carlo analysis. This will increase the accuracy and reliability of the output of the data.

The second limitation is that all necessary information is not always available. This leads to the employees using subjective interpretations to compensate for missing data. Thus, in order to solve the problem of employees using subjective interpretations, the problem of missing data needs to be addressed. One way to solve this problem is by developing a database with historical data about the risk allocation of similar projects. This database most preferably contains information about all characteristics of an elaborate list of risks. These characteristics might include the probability of occurrence, the impact on (either one of) the project objectives, who deals with the risk and how, residual risk (risk that remains after dealing with a risk). Basically, all information inserted in a risk register is valuable for the database.

With this data, the missing data of the current project can be compensated with data from previous projects. Herewith, the reliability of the input in the statistical model can be safeguarded. Developing a database containing abundant relevant information about the risk allocation of various projects throughout the infrastructure sector, or more specific about the risk allocation of social infrastructure

projects would enhance transparency on the risk allocation between private parties. The need for subjective interpretations by employees would be minimalised or even eliminated with the development of such a database.

However, the recommendation to develop a database to compensate for missing data has two major limitations. These limitations are first, the unique nature of projects and secondly, the confidentiality of data.

First of all, 'every project is unique' (Nicholas & Steyn, 2012, p. 4). In some way, be it the environment, the stakeholders, the project constellation, all projects are different. Purely hypothetically, even if a carbon copy of a project can be found, the course of the project will still not be exactly the same. Due to this unique nature, every project is exposed to different risks, which implies that the identification of risks is different. Furthermore, assuming that the all risks are identical to a similar historical project, the risk specifications (e.g. impact and probability) will have different values. Just to give an example, in case 1 the probability of the ground risk was higher than the ground risk in case 2. This is due to completely different ground conditions in both cases. Subsequently, different risks are identified, and the risks have different specifications in every project, which means that the party taking the risk can also differ in each project. In addition to this aspect, in every project, there are different participating private parties. For instance, in case 1 a specialised inner square architect was appointed for the design of the plaza. However, when in a next project no inner square architect were to be appointed, this means that another party would have to take this risk. The unique nature of projects restricts managers to simply take over a risk allocation from a similar previous project.

This limitation on its turn can be countered by two measures. First of all, the revised risk allocation concept shows, regardless of the unique nature of projects, a standardised concept according to which risk is allocated between private parties in social infrastructure projects in European public-private partnerships. This is a general process that can be applied to social infrastructure projects and can help overcome the issue of unique nature of projects. Secondly, accumulating data of a very high number of projects will eventually result in a very accurate probability distribution of the impact and the probability of risks in social infrastructure projects. With this probability distribution, trends can be determined and an objective estimation of risk can be provided.

Secondly, as experienced in the cases in this research, a lot of information about the risk allocation in the cases is confidential. The confidentiality of the information about projects restricts the sharing of the information about the risk allocation. Parties are often not willing to share their data with regard to the risk allocation of a project. This means that it would be very hard to acquire and develop the database with reliable information. The confidentiality of data seems to have a major impact on the development of databases regarding risk allocation. The author is not aware of any existing database that deals with risk allocation in construction projects. Even big reinsurance companies such as Munich Re, dealing with risk and risk allocation on a daily basis, are not aware of the existence of any of those databases.

This issue is harder to tackle and is an issue that will most likely be dealt with over time since other consortia will not change their mind on sharing confidential data from today to tomorrow. So most preferably, over time you want to change the mind-set of consortia and enhance transparency throughout the (social) infrastructure sector. However, the majority of private parties have conducted various projects in the past. Beginning with putting information of these projects in a database will eventually show the advantageous character of such a database and its according transparency to other private parties. This should over a period of time change the mind-set and sharing character of other consortia.

8.2 Intersubjectivity

Not all decisions of risk allocation can be made objectively. However, for the resting decisions, an intersubjective character is preferred over subjective interpretations. Therefore, the intersubjective way of allocating risk and the way to enhance intersubjectivity will be discussed in this chapter.

The intersubjective way of reaching consensus on the risk allocation between the private parties is closely related to the commitment of the private parties towards the project and trust amongst the various private parties. This is demonstrated by two different examples.

First of all, in case 1, one major party at some point during the project was declared bankrupt. However, due to the fact that the other parties were severely committed to complete the project, all risks borne by that bankrupt party were divided and shared amongst the other private parties (Respondent 1, 2017). The managers decided this jointly, and this decision showed a high level of commitment from the other parties, to bear risk that they initially were not supposed to take, just to complete the project. Due to the fact that all parties were so committed, consensus could be reached on how to distribute the risks from the bankrupt party between the other parties. All parties could have stated that they are not willing to take additional risk, but that would have led to failure of the project. Reaching this consensus between the parties how to distribute the risks showed that parties trusted each other to share the responsibilities of a bankrupt party between each other.

Another example is that during the tender process of case 2, for a long time the contractor had not yet been determined. This issue was addressed in multiple manager meetings and decided that in order to be able to hand in a bid during the tender process, the other parties had to take a lot of additional risks on top of the risk that they were already taking until a contractor was found. This implies that there was a lot of trust between the parties and commitment towards the project. Just as in the previous example, sharing the responsibilities of another party between the private parties shows a high level of commitment to complete the project and trust between the parties to reach an agreement regarding additional risk. As respondent 7 (2017) said, if the parties had not been willing to take additional risks, this project would not have been realised.

Both situations show that commitment and trust are major factors influencing intersubjectivity. In both examples, unexpected events occurred that were addressed during manager meetings. These managers then jointly decided upon the measures to be taken, which in both cases led to sharing the risk. Allocating additional risk to the private parties demonstrated a high amount of commitment and trust amongst the private parties.

When there is a high amount of trust and commitment between the different private parties, this will ease the process of reaching an agreement on the risk allocation. When private parties are more committed, they are more willing to 'take one for the team' and for example take additional risk. This shows that committed parties are more open to working on a solution, and therefore, an agreement between private parties is reached easier than between uncommitted parties. The same accounts for parties that trust each other. Private parties that trust each other, will not just transfer the risk back to one another when agreed otherwise. Trustful parties keep their word, and reaching an agreement with that kind of parties is easier.

The ways to enhance trust and commitment will be discussed further. Furthermore, two propositions about the effect of trust and commitment on reaching consensus are formulated:

Proposition 1: Trust between all private parties has a positive effect on reaching consensus on the risk allocation;

Proposition 2: Commitment of all involved parties has a positive effect on reaching consensus on the risk allocation.

8.2.1 Trust

This chapter will develop several propositions on how to enhance trust, in order to positively influence reaching consensus. These will be mainly based on findings from the research and then fed back to literature.

First of all, clear communication and information distribution is a factor that is expected to have an effect on trust. All respondents in the cases agreed that it was an important factor for the risk allocation, and played an important role for understanding of the risk. Additionally, Pinto, Slevin & English (2009, p. 638-639) acknowledge that communication develops trust. Therefore, it is believed that clear communication and information distribution has a positive influence on trust and the following proposition is formulated:

Proposition 3: Clear communication and good information distribution have a positive influence on trust

Throughout the different cases, different methods have been observed that were used to enhance communication and distribution of information. Both case 1 and case 2 used a centralised and digital database, accessible to all parties in the consortium who required that information. This digital database eased the process of sharing information; the more while people could access the database from everywhere. Another factor taking away the barrier of distance is working from one location, as observed in case 2. Being close to each other enhanced not only formal but also informal communication. Thirdly, in addition to working from one location, integrated project teams enhance communication. Integrated project teams work together to achieve common project objectives (Meng, Sun, & Jones, 2011). Since they share a common goal, the assumption is made that this enhances communication between the parties. Especially confidential data, which individual parties rather keep to themselves, should be shared more easily. Based on these three factors, three propositions are formulated:

Proposition 3a: Using one centralised and digital database has a positive influence on clear communication and good information distribution;

Proposition 3b: Working from one location has a positive influence on clear communication and good information distribution;

Proposition 3c: Forming an integrated project team has a positive influence on clear communication and good information distribution

The next factor investigated is openness for discussion. During the interviews, this factor was identified as an influencing factor of risk allocation. It was acknowledged in the cases that being open for discussion created more trust between the parties. A combination of latter factor of clear communication together with openness for discussion is congruent with open and transparent dialogue, a factor identified by Osipova & Eriksson, 2011). When open and transparent dialogue occurs, it means that all stakes are shared. Additionally, when parties are also open for discussion, these stakes can be exchanged in conversations and this leads to trust. For that reason, proposition 4 is formulated:

Proposition 4: Being open for discussion has a positive influence on trust

The next identified factor is a factor that has been identified during the case interviews; a clear structure and process. Together with openness for discussion, this factor contributes to trust. A clear structure and

process, especially in case 2 meant that people knew how to go about to realise the project. All parties should be aware of the constellation of the project, the sequence of the activities and most important of all, the individual responsibilities. Once there is a clear structure and process, this enhances trust. Consequently, the following proposition is drawn up:

Proposition 5: A clear structure and process has a positive influence on trust

Another factor identified in case 2 is working with parties that the consortium has worked with before. Several parties in case 2 were the same as in case 1. For example, the debt investor, the sponsor and the SPV managers were the same companies. This aided in creating a trustful relationship. Bennet & Jayes (1995, p. 12) emphasize the importance of working together with parties that you have worked with before. Meng et al. (2011, p. 101) state that the highest degree of trust exists between strategic partners, which are partners that worked on several projects together. Therefore, the proposition is developed:

Proposition 6: Working with private parties that you have worked with before has a positive influence on trust

As de Ridder (2009, p. 12) states: 'In business terms, trust is composed of making clear agreements and applying proper business practice, thus making sure the collaboration develops with real commitment in place'. This once more shows the relation between trust and commitment. Therefore, the next chapter will elaborate on how to enhance commitment.

8.2.2 Commitment

Several propositions are formulated to investigate how commitment can be enhanced. Once more, observations from the cases will be leading in the development of these propositions.

In the case studies, it was established that parties have diverging objectives in the projects. However, common sense would rather suggest that having common goals enhances commitment. When parties share the same goals, they are more open to bear risks, or to use the formulation of the cases: 'take one for the team'. This shows that shared goals have an influence on sharing liabilities or risks. Lastly, sharing benefits enhances commitment, because when all private parties share benefits, together they will try to achieve the best possible outcome. This leads to the following proposition:

Proposition 7: Sharing goals, benefits and liabilities has a positive influence on commitment

The next factor evolves from the process observed in case 2 and is closely linked to a clear structure and process. In case 2, many respondents described the process to be different. They first wanted to know exactly what all parties expected of the project before starting to discuss the risks. When all parties know their responsibilities, but also what to expect from the other parties they will be more committed.

Proposition 8: Setting clear expectations has a positive influence on commitment

Lastly, the proposition is made that integrated project teams have a positive influence on commitment. As depicted earlier, integrated teams have shared goals. Therefore, when shared goals have a positive effect on commitment of the parties, consequently integrated project teams should also have a positive effect on commitment.

Proposition 9: Forming an integrated project team has a positive influence on commitment

9. Expert validation

In order to validate the propositions formulated in the previous chapter, a questionnaire was sent out to all interviewees of the case studies. The questionnaire consisted of three parts:

1. The influence of trust and commitment on reaching consensus on the risk allocation between the private parties;
2. Factors influencing trust between the private parties in PPP's;
3. Factors influencing commitment of private parties in PPP's.

For each proposition, the respondent could choose between five different answers. This was to determine the degree to which the interviewees agreed to each individual proposition. The possible answers were:

1. Completely disagree
2. Disagree
3. Neutral
4. Agree
5. Completely agree

Figure 32 has been inserted to provide a graphical example. Appendix E shows the complete questionnaire. In total, four respondents completed the questionnaire.

Trust between all private parties has a positive effect on reaching consensus on the risk allocation*

*Consensus on the risk allocation is a mutual agreement between all parties on to which party risk should be distributed

	1	2	3	4	5	
Completely disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Completely agree

Figure 32: Example of a question in the questionnaire

To determine the central tendency of Likert scale data, Boone Jr. & Boone (2012) have identified mean, median and mode as methods. Mean is generally the average of the responses (Purplemath, 2017). The median is the middle number of an array of numbers. In the case of an even amount of numbers, the average of the two middle numbers is used (Purplemath, 2017). The mode consists of the number that occurs most frequently in the array (Purplemath, 2017). However, according to Allen & Seaman (2007), the mean and standard deviation are invalid parameters for descriptive statistics. Therefore, the data will be analysed using the median and the mode.

9.1 Results

First of all, the influence of trust and commitment on reaching consensus is analysed. For this, the first and second propositions are analysed.

9.1.1.1 Proposition 1: Trust between all private parties has a positive effect on reaching consensus on the risk allocation

For this proposition, two respondents ‘completely agree’, one respondent ‘agrees’ and there is one respondent that ‘disagrees’ with the statement. The results of the first proposition are presented in figure 34.

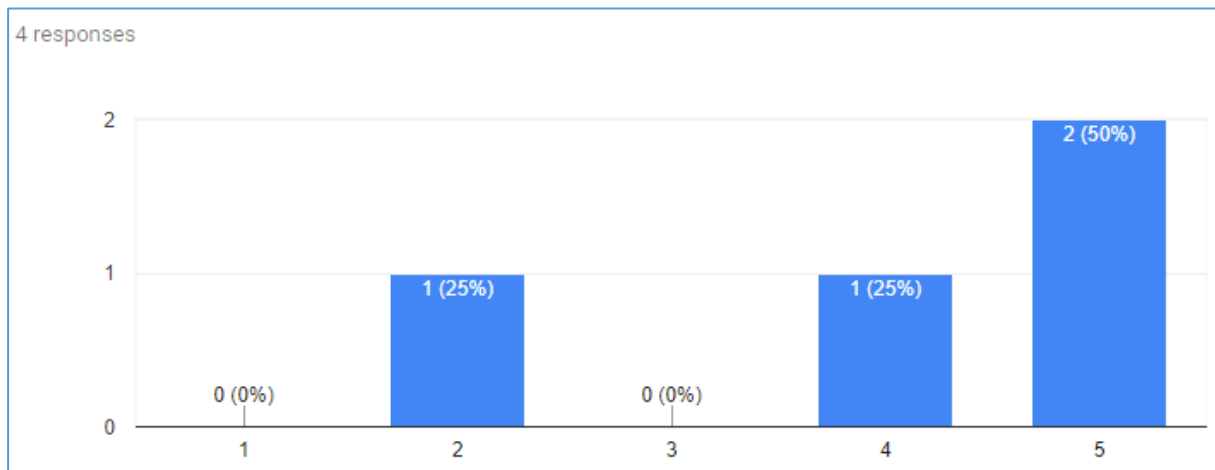


Figure 33: Results of proposition 1

Using these numbers, the median and mode have been calculated and these are shown in table 13. Even though one respondent disagrees with the statement, both the median and the mode show a strong tendency towards an agreement of the statement. Therefore, this proposition one is accepted and the positive effect of trust between the private parties on reaching consensus on the risk allocation is confirmed

Parameter	Result
Median	4,5
Mode	5

Table 13: Median and mode for proposition 1

9.1.1.2 Proposition 2: Commitment of all involved parties has a positive effect on reaching consensus on the risk allocation.

The results of the second proposition are shown in figure 34. This figure shows that three respondents ‘agree’ with the statement and one respondent ‘completely agrees’ with the proposition.

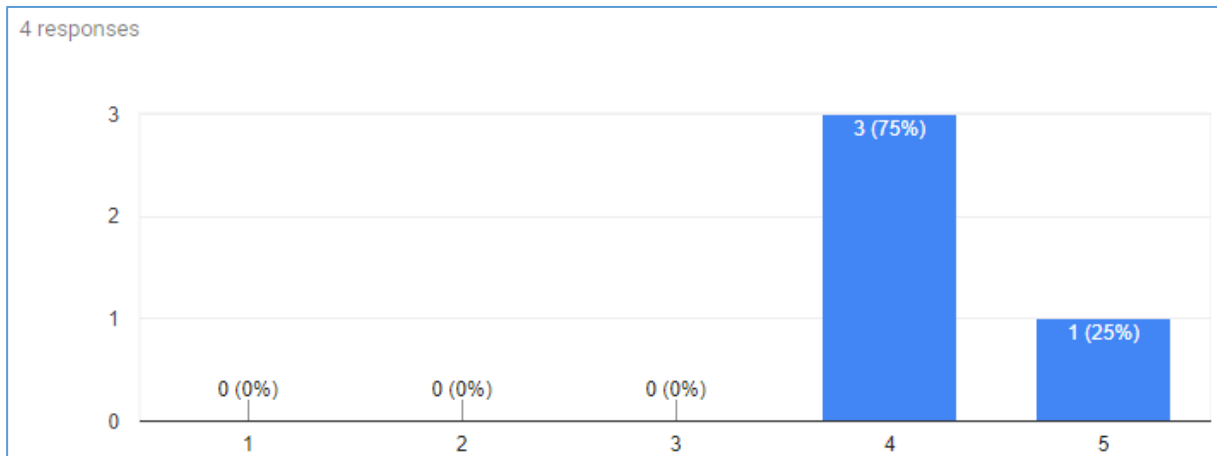


Figure 34: Results of proposition 2

Using the results of the questionnaire, the median and mode are calculated and depicted in table 14. With a final score of 4 as the median and mode, this proposition is also confirmed. Therefore, the positive effect of commitment of all involved parties on reaching consensus on the risk allocation is confirmed.

Parameter	Result
Median	4
Mode	4

Table 14: Median and mode for proposition 2

9.1.2 Trust

This chapter analyses the influence of certain factors on trust between the private parties. Propositions 3-7 will be either rejected or confirmed.

9.1.2.1 Proposition 3: Clear communication and good information distribution have a positive influence on trust

Figure 35 shows that for the third proposition, one respondent 'agree' with the statement, and three respondents 'completely agree' with the statement.

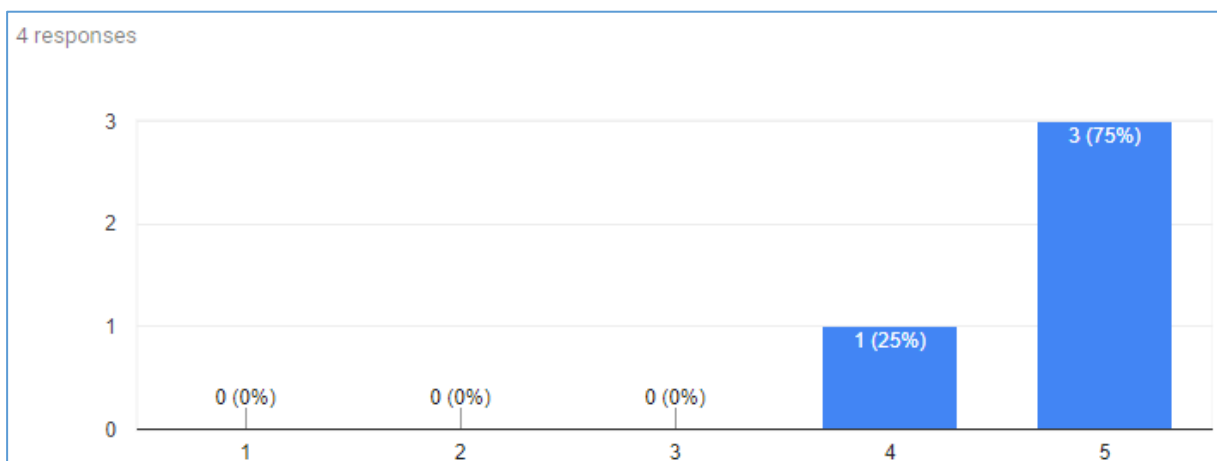


Figure 35: Results of proposition 3

As table 15 shows, the median and mode for this proposition are both 5, meaning that respondents ‘completely agree’. Therefore, the positive influence of clear communication and good information distribution on trust between private parties has been confirmed.

Parameter	Result
Median	5
Mode	5

Table 15: Median and mode for proposition 3

In order to enhance clear communication and good information distribution, three propositions are formulated. These are analysed in following paragraphs, to begin with proposition 3a.

9.1.2.2 Proposition 3a: Using one centralised and digital database has a positive influence on clear communication and good information distribution

In figure 36, the results of the questionnaire for this proposition are presented. It shows that one respondent neither ‘agrees’ nor ‘disagrees’ with the statement. Two respondents ‘agree’ with the statement while one of the respondents ‘completely agrees’ with the proposition.

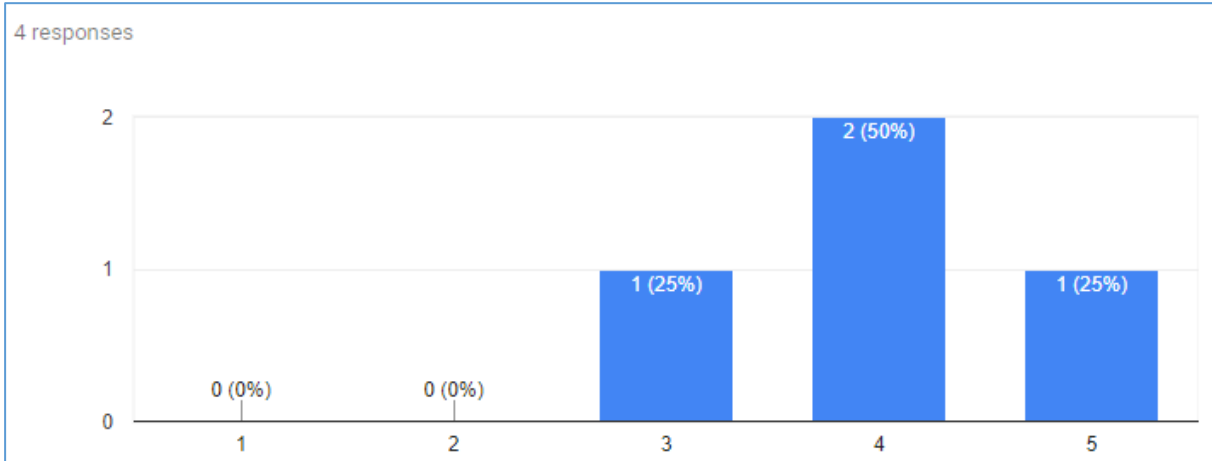


Figure 36: Results of proposition 3a

Using the respondents’ replies, the median and mode are calculated and these are presented in table 16. Both the median and the mode are ranked with a 4, meaning that using a centralised and digital database has a positive influence on clear communication and good information distribution.

Parameter	Result
Median	4
Mode	4

Table 16: Median and mode for proposition 3a

9.1.2.3 Proposition 3b: Working from one location has a positive influence on clear communication and good information distribution

Two respondents ‘agree’ to this statement and two respondents ‘completely agree’, as depicted in the underlying figure.

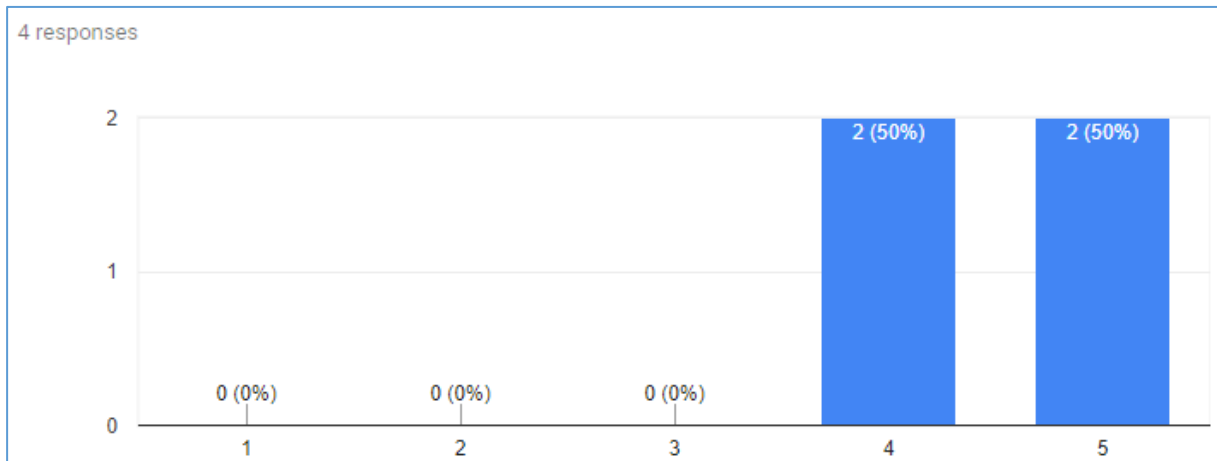


Figure 37: Results of proposition 3b

The median and mode are based on the respondents' replies and are presented in the underlying table. 4 and 5 occur equally frequent and therefore they are both considered as the mode. Due to the fact that the median is 4,5 and the mode is 4 and 5, the proposition that working from one location has a positive influence on clear communication and good information distribution is confirmed.

Parameter	Result
Median	4, 5
Mode	4 & 5

Table 17: Median and mode for proposition 3b

9.1.2.4 Proposition 3c: Forming an integrated project team has a positive influence on clear communication and good information distribution

To proposition 3c two respondents 'agree' and two respondents 'completely agree'. This is demonstrated in the underlying figure.

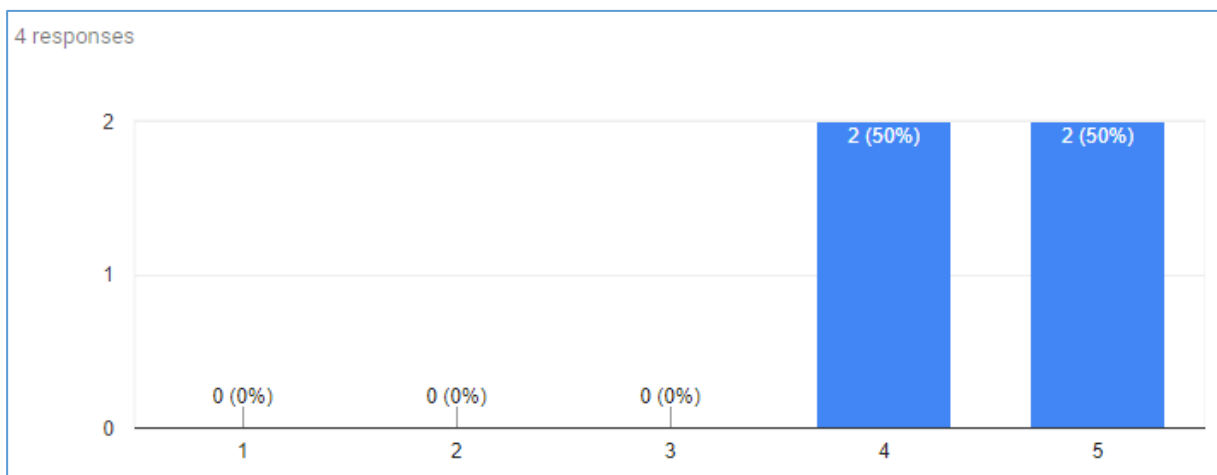


Figure 38: Results of proposition 3c

The underlying table shows that for this proposition the median is 4,5 and the mode is 4 and 5. This means that the positive influence of forming an integrated project team on the clear communication and good information distribution is herewith confirmed.

Parameter	Result
Median	4,5
Mode	4 & 5

Table 18: Median and mode for proposition 3c

9.1.2.5 Proposition 4: Being open for discussion has a positive influence on trust

This proposition is 'agreed' with by three respondents and 'completely agreed' with by one respondent, as depicted in the underlying figure.

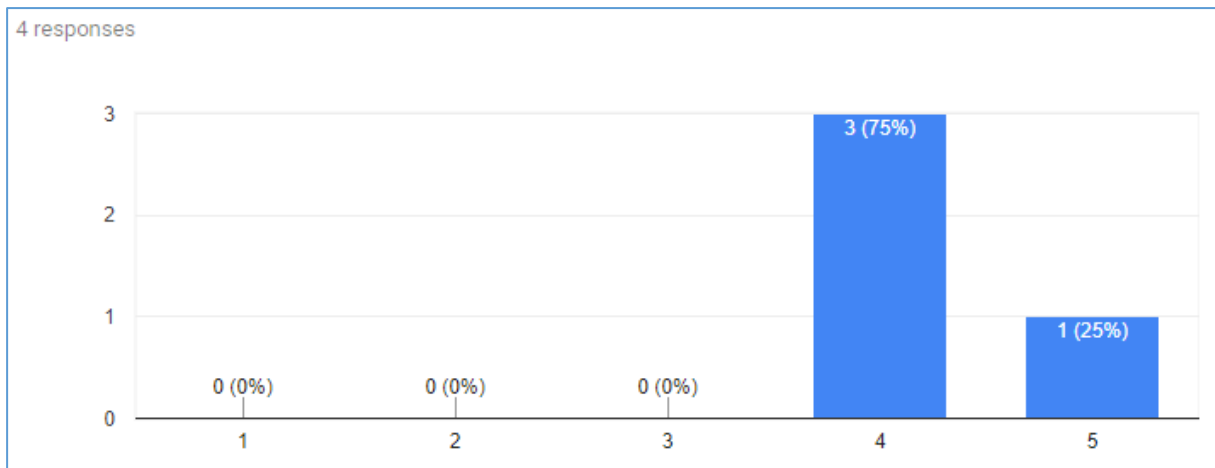


Figure 39: Results of proposition 4

Having both a median and a mode of 4 results in the confirmation of the proposition, stating that being open for discussion has a positive influence on trust.

Parameter	Result
Median	4
Mode	4

Table 19: Median and mode for proposition 4

9.1.2.6 Proposition 5: A clear structure and process has a positive influence on trust

Similar to the fourth proposition, three respondents 'agree' and one respondent 'completely agrees' with the fifth proposition, resulting in a similar figure.

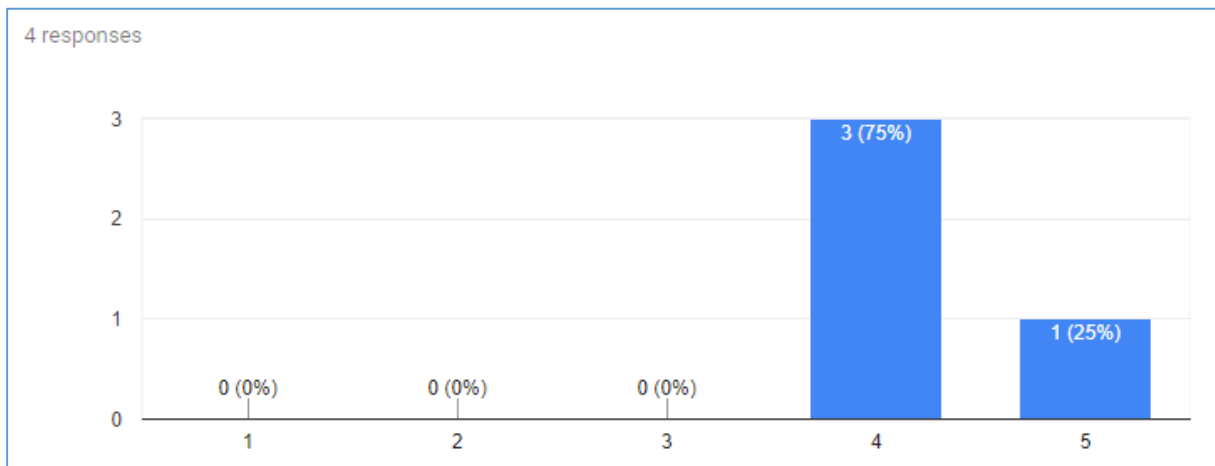


Figure 40: Results of proposition 5

Since the replies were the same, this means that the mode and median are also identical to those of the fourth proposition. The underlying table shows the identical results. Due to the fact that identical results have been obtained for this proposition, the proposition that a clear structure and process has a positive influence on trust is confirmed.

Parameter	Result
Median	4
Mode	4

Table 20: Median and mode for proposition 5

9.1.2.7 Proposition 6: Working with private parties that you have worked with before has a positive influence on trust

The last proposition regarding factors influencing trust is regarding working with parties that you have worked with before. One respondent does ‘not agree’, nor does he ‘disagree’ with the statement. Another respondent ‘agrees’ with the statement while two respondents ‘completely agree’ with the statement. This is shown in the underlying figure.

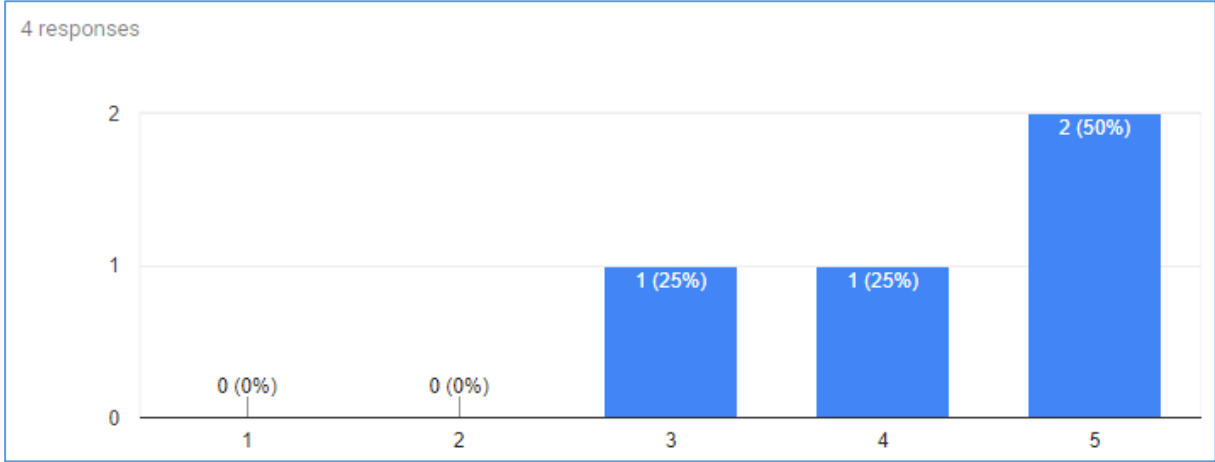


Figure 41: Results of proposition 6

Table 21 shows that the median of the results is 4,5, and the mode is 5. Based on these results, the proposition that working with private parties that you have worked with before has a positive influence on trust is confirmed.

Parameter	Result
Median	4,5
Mode	5

Table 21: Median and mode for proposition 6

9.1.3 Commitment

This chapter validates the propositions on what factors have an influence on commitment of private parties.

9.1.3.1 Proposition 7: Sharing goals, benefits and liabilities has a positive influence on commitment

Three respondents 'agree' with the proposition, the other respondent 'completely agrees' with this statement. Figure 42 shows these results.

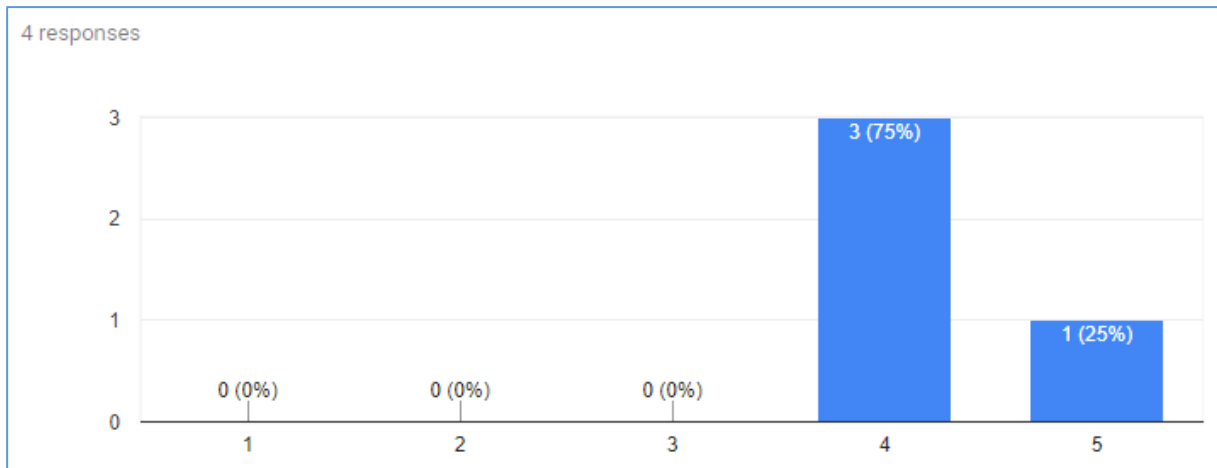


Figure 42: Results of proposition 7

The given responses result in the fact the median and mode both are 4, as shown in the underlying table. Therefore, sharing goals, benefits and liabilities has a positive influence on commitment according to the respondents.

Parameter	Result
Median	4
Mode	4

Table 22: Median and mode for proposition 7

Sharing goals, benefits and liabilities, therefore, enhances commitment of the parties. A way to achieve this is by integrating this concept of sharing especially the benefits and liabilities into the contract between the different private parties. De Ridder (2009, p. 45) has presented three ways of sharing risks between the authority and the contractor:

- Sharing the risks on a 50/50 % basis
- Sharing of residual risks on the basis of a 50/50 % arrangement
- Sharing risks on the basis of performance'

In the first method, a contingency fund is created, with financial contributions from both the authority and the contractor. This contingency fund at the end of the project is returned to both parties based on a 50/50 % basis, enhancing the interest of the party to not use this fund during the project.

The second method, first of all, allocates the risk of obtaining a permit to the authority, and the process risks (procurement, use of equipment and personnel) to the contractor. For the remaining risks, the concept is the same as the first method. A contingency fund is created to compensate for risks that fired. The remains of the fund are equally distributed to the parties.

The third method shares risks based on performance. For each risk that fires, the impact is measured and the goals of the project are adjusted accordingly. Consequently, based on the fired risks and adjusted goal, a new performance target is set.

These three options are also presented as solutions to share goals, liabilities and benefits between the private parties. However, in order to determine which method of sharing liabilities, further research is needed.

9.1.3.2 Proposition 8: Setting clear expectations has a positive influence on commitment

Three respondents ‘agree’ with this proposition and one respondent ‘completely agrees’ with it. The underlying figure shows the responses to this statement.

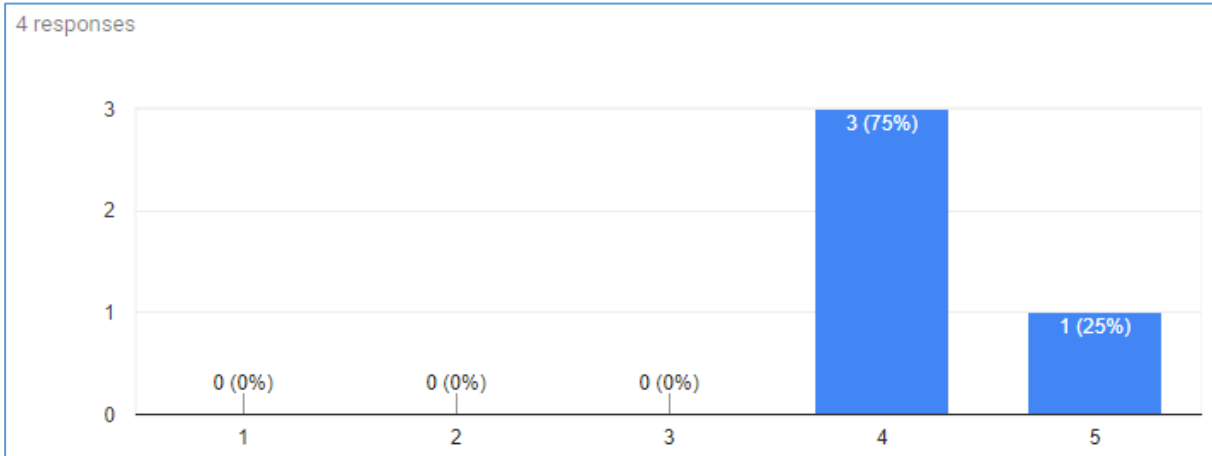


Figure 43: Results of proposition 8

Based on these responses, both the median and the mode are assigned a 4, as depicted in table 23. Herewith, the proposition that setting clear expectations has a positive influence on commitment is confirmed.

Parameter	Result
Median	4
Mode	4

Table 23: Median and mode for proposition 8

9.1.3.3 Proposition 9: Forming an integrated project team has a positive influence on commitment

This proposition is ‘agreed’ with by three respondents and ‘completely agreed’ with by one respondent. This is shown in the underlying figure.

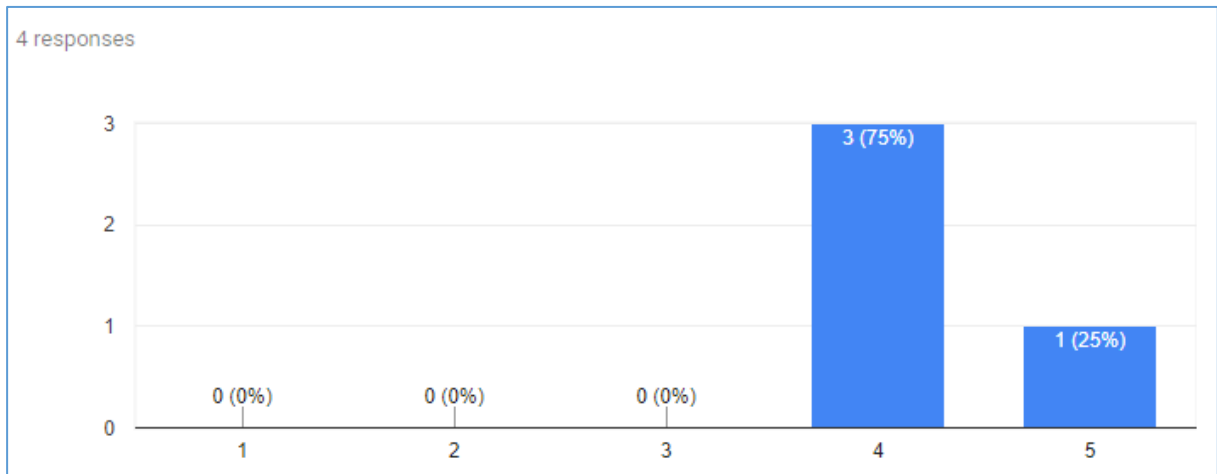


Figure 44: Results of proposition 9

The median and mode are both 4. Therefore, it can be concluded that integrated project teams do not only have a positive influence on trust as confirmed in proposition 3c. Forming integrated project teams also positively influences commitment of the private parties.

Parameter	Result
Median	4
Mode	4

Table 24: Median and mode for proposition 9

10. Objectivity and intersubjectivity in the revised risk allocation concept

Throughout this research, various results have been obtained. First of all, the cross-case analysis resulted in a revised risk allocation concept. Secondly, different aspects to enhance objectivity and intersubjectivity were highlighted. This chapter aims to further integrate the results by showing which aspects have an influence on what steps of the revised risk allocation concept.

The revised risk allocation concept developed in this research is portrayed in the figure below, where on the left side the original concept by Abednego & Ogunlana (2006) is shown and on the right side the revised allocation concept.

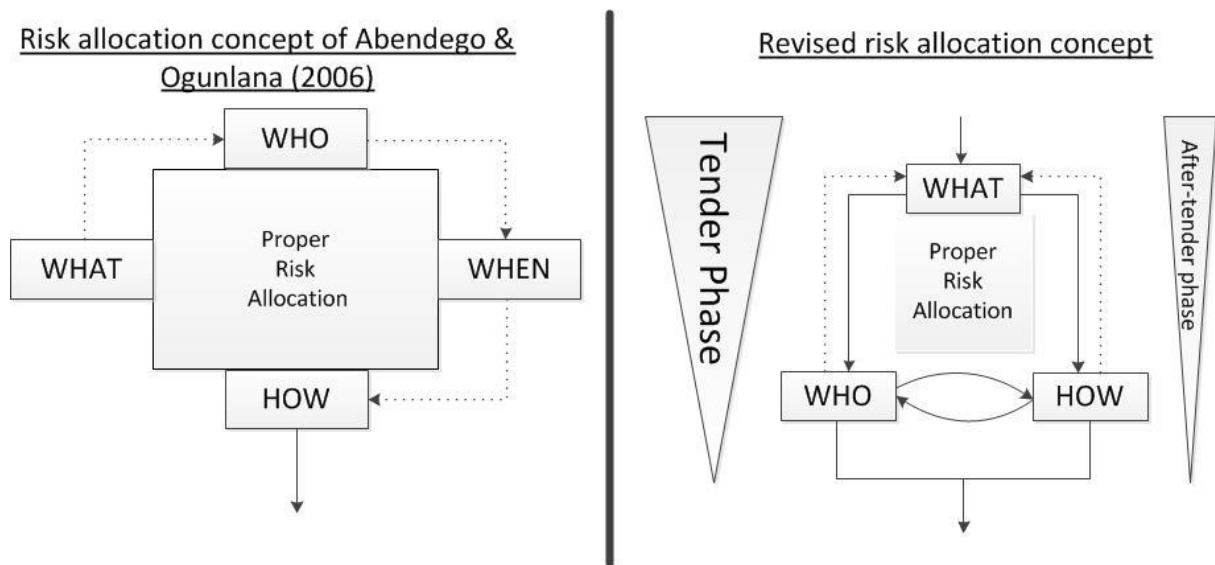


Figure 45: Original and revised risk allocation concept

First of all, to enhance objectivity, improvement of statistical models has been posed as a potential solution. This is achieved by eliminating the limitations of these models, which include the inability of employees to conduct these analyses and lacking data. Secondly, several aspects were mentioned in the propositions that enhance intersubjectivity. Trust and commitment of the private parties appeared to be factors that have an influence on reaching consensus, and thus affect intersubjectivity.

This research has shown that there are various ways to enhance trust amongst the private parties. Factors include clear communication and information distribution, being open for discussion, a clear structure and process, and working with private parties that you have worked with before. These factors positively influence trust as confirmed in the expert validation. Furthermore, clear communication and information distribution are influenced by using one centralised and digital database, working from one location and forming an integrated project team.

As depicted in this research, three aspects can enhance commitment of the private parties. These aspects are sharing goals, benefits and liabilities, setting clear expectations, and forming an integrated project team.

10.1 Objectivity in the revised risk allocation concept

Improving and applying statistical models enhances objectivity in the 'what' step of this model. The 'what' step of the risk allocation concept consists of identifying, analysing and prioritising risks. Using statistical models enhances objectivity, especially in the analysis and the prioritisation. A Monte Carlo analysis in case 2 demonstrated that there was a 20% chance of a delay of two days. Therefore, with statistical analyses, both the impact and probability of a risk can be determined objectively and therefore very accurately. As a result, the prioritisation of the risks is also objective, since the prioritisation is based on the risk score, which is the probability*impact. If both values are determined objectively, the risk score and the prioritisation will be objective as well.

In conclusion, eliminating the limitations and improving the statistical models, such as Monte Carlo analysis, enhance objectivity. The 'what' step of the revised risk allocation concept benefits from this improvement since the analysis and prioritisation of risks are more objective and therefore more accurate.

10.2 Intersubjectivity in the revised risk allocation concept

First of all, trust and commitment mainly have an impact on the 'how' and 'who' step of the risk allocation concept. The case studies provided two examples that show that trusting and committed parties are more willing to 'take one for the team' by taking additional risks. This severely impacts the decision on who takes risk and how risk is dealt with since 'taking one for the team' implies that private parties accept more risk than they initially were willing to take. Since 'who' and 'how' are highly interrelated, when in one step (e.g. who) intersubjectivity is enhanced by trust and commitment of the private parties, intersubjectivity in the other step (how) is enhanced as well.

Trust also impacts the 'what' step. When the various private parties trust each other, they will more likely rely on experiences from other parties. They will more likely agree to identified risks or values assigned to the impact and probability of the risk, thus easing the process of reaching consensus. The same is true for commitment. When a private party is committed and eager to realise the project, they are more willing to accept a risk score, which was assigned based on the experience of another party without further questioning.

Clear communication and information distribution affect all three steps of risk allocation. In case the private parties clearly communicate and distribute information, together they will be able to develop and agree to a more complete risk list than each party individually. When private parties share information that is important to assign risk scores, the other parties are more likely to accept these risk scores when these are based on reliable information. For instance, in case 1 ground research has been conducted. This research was shared amongst private parties and led to a more accurate risk score, which all private parties agreed to.

When clear communication and good information distribution takes place, this also affects the 'how' step and the 'who' step of the revised risk concept. When abundant information is available and shared about a certain risk, uncertainty decreases and parties are better able to agree on how to deal with the risk. Furthermore, since uncertainty decreases, parties might be more willing to bear the risk, thus paving the way for an agreement on who takes the risk is easier.

Experts validated that using one centralised, digital database, working from one location and forming an integrated project team has a positive influence on clear communication. Both, case 1 and 2 showed that by using a digital database enhanced communication between private parties. Furthermore, in case 2, the added value of working from one location was depicted. Therefore, when implemented, these factors will enhance intersubjectivity in all three steps of the revised risk allocation concept.

Openness for discussion of private parties is not only a major driver for trust but for reaching an agreement in general. When parties are open for discussion, they will be more likely to reach an agreement on any issue, whether this is on risk identification, assigning values to the probability of risk, who takes the risk or how to deal with risk. Therefore, when private parties are open for discussion, this enhances intersubjectivity in all three steps (what, who, how) of the revised risk allocation concept.

A clear structure and process also enhance intersubjectivity within the ‘what’, the ‘who’ and the ‘how’. Clarity about the process gives all private parties a better overview of what risks might occur, but also an overview over the parties involved, thus knowledge on which parties are involved in the discussion about the risk allocation. If parties don’t know the risks, they obviously cannot deal with them. Therefore, knowing what risks might occur enables the discussion and eases reaching an agreement.

Working with private parties that one has worked with before also contributes to intersubjective decision-making in the ‘who’ and ‘how’ steps of the revised risk allocation concept. When private parties have already worked together on a previous project, they already know what other parties prefer in terms of willingness to take certain risks and dealing with risks. This was observed in case 2, in which many parties had already worked together in case 1. This measure simplifies the process of reaching an agreement.

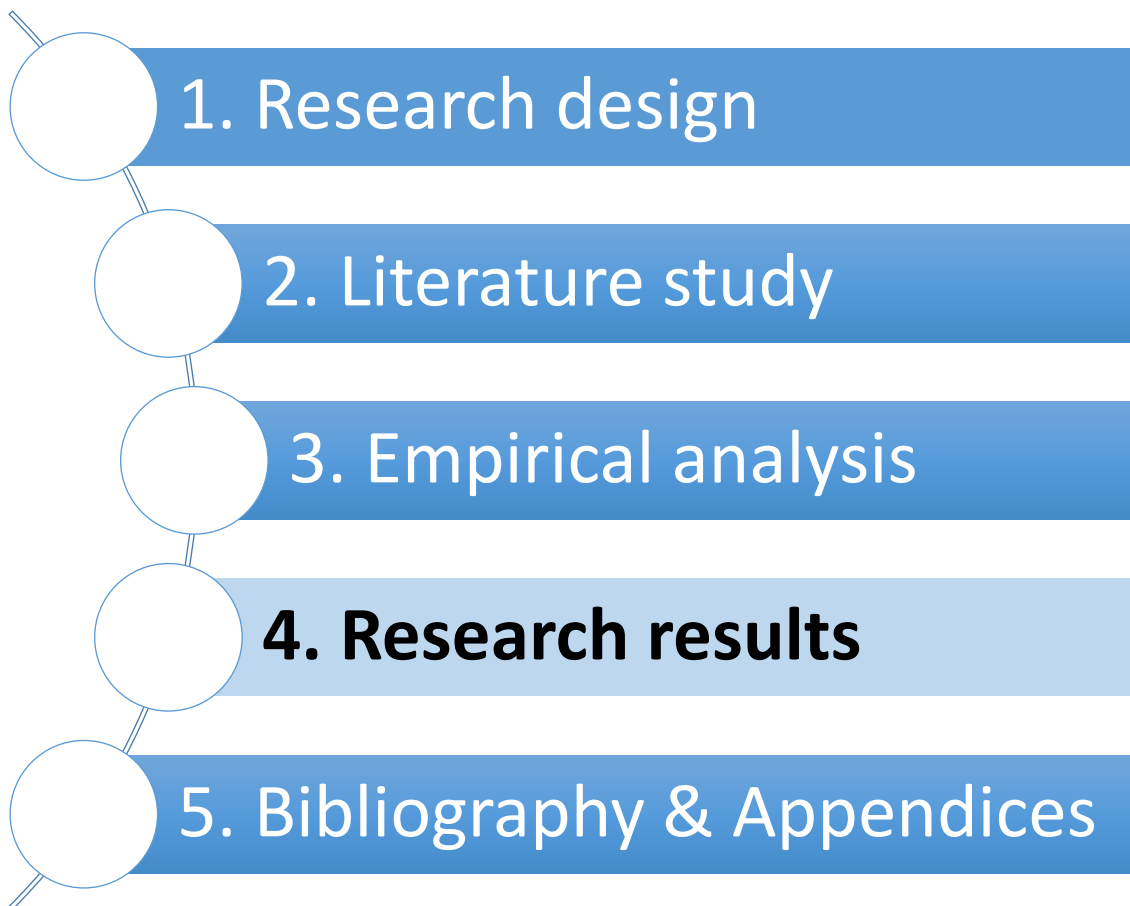
Intersubjectivity is enhanced in the ‘how’ and ‘who’ step of the revised risk allocation concept when goals, benefits and liabilities are shared. Parties sharing the same goals are in alignment when it comes to what must be achieved in a project. It helps cooperation between parties since cooperation is ‘the action or process of working together on the same end’ (Oxford Dictionaries, 2017). Especially, when risks are shared, all parties benefit from dealing with those risks in the best possible way. Therefore, all parties are eager to contribute experience and knowledge in order to reach the best possible risk allocation.

Setting clear expectations relates to the aspect of a clear structure and process. Clear expectations are required in order to be able to develop a clear structure and process. Since the aspects of a clear structure and process enhance intersubjectivity in the ‘what’, the ‘who’ and the ‘how’ step, setting clear expectations has the same effect on these steps. Therefore, these steps are intersubjective when clear expectations are set between the private parties.

The table below shows which steps of the revised risk allocation concept are affected by the measures that have been validated by the experts.

Objectivity/intersubjectivity	Measures	What	Who	How
Objectivity	Improving statistical models	X		
	Trust	X	X	X
Intersubjectivity	Commitment	X	X	X
	Clear communication and information distribution	X	X	X
	One centralised and digital database	X	X	X
	Working from one location	X	X	X
	Forming an integrated project team	X	X	X
	Openness for discussion	X	X	X
	A clear structure and process	X	X	X
	Working with parties that they have worked with before		X	X
	Sharing of goals, benefits and liabilities		X	X
	Setting clear expectations	X	X	X

Table 25: Measures influencing steps of revised risk allocation concept



11. Conclusions & Recommendations

11.1 Conclusions

This research has focussed on investigating the dichotomy between two different risk approaches and relates this dichotomy to risk allocation in practice. Different aspects have been discussed such as project objectives, influencing factors, risk allocation criteria and finally the risk allocation process. The following research question has been leading throughout the research:

How to allocate risks between the private parties in European Public-Private Partnerships for social infrastructure projects?

11.1.1 Conclusions concerning the risk allocation process

The first conclusion is that in practice the process of risk allocation differed a lot from the theoretical concept. The steps of risk allocation between the private parties in social infrastructure projects in practice are: 1. Identify the risks, 2. Analyse and prioritise the risks, and 3. Allocate risk and determine risk response strategy. Step 1 and 2 in practice equal the ‘what’ step of the theoretical concept. Step 3 combines the ‘who’ and ‘how’ step of the theoretical concept. This resulted in a revised risk allocation concept of the theoretical risk allocation concept, to be seen in the underlying figure. The left side depicts the theoretical concept; the right side illustrates the revised risk allocation concept developed in this research.

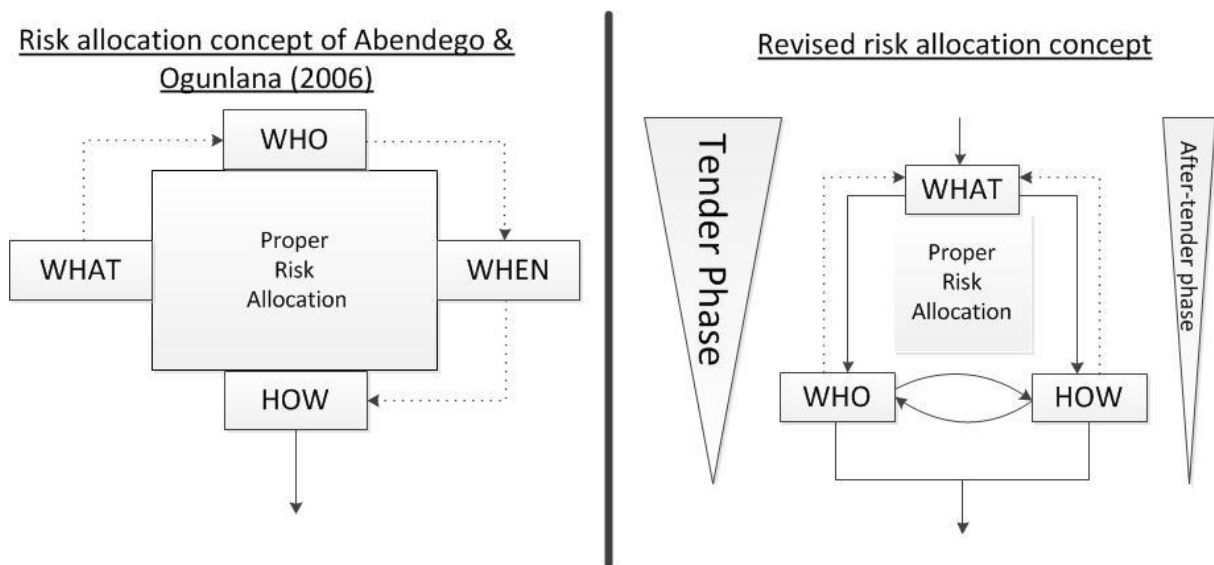


Figure 46: Original and revised risk allocation concept

First of all, the risks are identified, analysed and prioritised in the ‘what’ step. The identified risks are listed in the risk register of the project. The risk analysis is conducted by determining the probability and the impact of the risk on project objectives. By multiplying these values, an overall risk score can be established. Based on these risk scores, risks can be prioritised in this step.

From the first step, there are two paths to the next step. The interviews showed that the ‘how’ and ‘who’ step are interrelated. If one party decides to accept the risk (how), it automatically implies that this party bears the risk (who). This goes vice versa as well, when a party decides they are bearing the risk (who), this implies that they have accepted the risk (how). However, this is not always automatically settled within one iteration between ‘how’ and ‘who’. If a party decides it bears the risk, it can also decide to transfer the risk to another party. This shows that initially the ‘who’ - decision was settled, but by looking at how to deal with it, it is decided to transfer the risk, meaning that the owner of the risk will change too.

The fact that (bi-) weekly meetings were held to discuss the risk allocation between private parties of the project shows the repetitive character of risk allocation. Furthermore, after deciding on how to deal with risk and who deals with it, residual risk often remains. Due to these two reasons, two arrows in the concept have been added, leading back from the 'who' and the 'how' to the 'what' step. These arrows show the repetitive character of risk allocation.

The 'when' step is not a conscious decision. The majority of the risk allocation appears to occur during the tender phase as acknowledged by almost all respondents. The amount of risks identified, analysed and allocated steadily declines throughout the tender procedure. A triangular shaped object that narrows towards the bottom has been added on the left side of the revised concept in figure 46. This object illustrates the decrease of risk allocated throughout the tender procedure. Also, during other phases of the project life cycle, (unforeseen) risks can occur. These need to be dealt with as well, hence the similarly shaped triangle on the right-hand side of the concept. But coming closer to the termination of the project, fewer risks occur. Therefore, the breadth of this object decreases towards the bottom. Finally, since the majority of the risks are allocated in the tender phase, this triangle is portrayed much bigger than the other one.

11.1.2 Conclusions on objectivity and intersubjectivity

In the case studies, it was shown that the private parties intended to enhance objectivity in the risk allocation by using statistical models, such as Monte Carlo analysis. However, missing data and inability to perform such analyses prevented complete objectivity. Furthermore, the guiding role of experience throughout the influencing factors, the allocation criteria and the process suggests a high amount of subjectivity. Yet, a nuance has to be made. In regular manager meetings, they share their experience and discuss that. Based on that, they take decisions jointly to reach consensus, which implies an intersubjective way of decision-making for the risk allocation.

In theory, objective estimations of the impact and probability of risk are more accurate than subjective interpretations. In practice, managers tried to enhance objectivity by statistical modelling and intended to eliminate subjectivity by taking joint decisions. Reaching consensus on the risk allocation shows the intersubjective character the risk allocation. These arguments imply that subjective decisions should be minimalised while intersubjective and objective decisions should be enhanced.

11.1.2.1 Conclusions to enhance objectivity

Objective decisions can be improved by counteracting the limitations of statistical models. Two solutions have provided in order to do so. First of all, training employees of the private parties who perform statistical analyses improves their ability and skillset. This can eliminate the first limitation. Secondly, constructing a database with information about the risk allocation of similar projects in the past eliminates the limitation of missing or insufficient data. The data preferably contains all information that is generally inserted in a risk register of a project (probability, impact on project objectives, who bears risk, how to deal with the risk, residual risk).

The measure of counteracting the limitations of statistical analyses enhances objective decision-making in the 'what' step of the revised risk allocation concept. The analysis and prioritisation of risks that is conducted with statistical models is objective and more accurate. No interpretation of managers is needed when statistical models are used for the determination of e.g. the impact or probability of a risk.

11.1.2.2 Conclusions to enhance intersubjectivity

Furthermore, the strong influence of commitment and trust on reaching consensus, and thus intersubjectivity has been demonstrated. In case 1, the example of a bankrupt private party and in case 2, the late entrance of an important private party showed a lot of trust and commitment between the private parties.

Proposition	✓/✗
1. Trust between all private parties has a positive effect on reaching consensus on the risk allocation	✓
2. Commitment of all involved parties has a positive effect on reaching consensus on the risk allocation.	✓

Table 26: Confirmation or rejection of proposition 1-2

Both proposition 1 and 2 have been confirmed in the expert validation, supporting the previous statement that trust and commitment positively influence reaching consensus. Besides the influence on reaching an agreement on the risk allocation, trust and commitment both have a positive effect on all three steps (what, who, how) of the revised risk allocation concept.

Several propositions providing measures that enhance trust have been developed. The underlying table shows whether these propositions were confirmed or rejected in the expert validation.

Proposition	✓/✗
3. Clear communication and good information distribution have a positive influence on trust	✓
3a. Using one centralised and digital database has a positive influence on clear communication and good information distribution	✓
3b. Working from one location has a positive influence on clear communication and good information distribution	✓
3c. Forming an integrated project team has a positive influence on clear communication and good information distribution	✓
4. Being open for discussion has a positive influence on trust	✓
5. A clear structure and process has a positive influence on trust	✓
6. Working with private parties that you have worked with before has a positive influence on trust	✓

Table 27: Confirmation or rejection of proposition 3-6

As table 27 shows, in the expert validation propositions 3-6 have been confirmed. This means that all measures mentioned in proposition 3-6 have a positive influence on trust. Furthermore, the measures in propositions 3a-3c have also been confirmed. This demonstrates that using one centralised and digital database, working from one location and forming an integrated project team have a positive influence on clear communication and information distribution.

Subsequently, chapter 10 has shown that when the measures named in proposition 3-5, including those in proposition 3a-3c are implemented, it enhances intersubjectivity in the ‘what’ step, the ‘who’ step and the ‘how’ step of the revised risk allocation concept. If private parties work together with other private parties that they have worked with before, this only influences the ‘who’ and ‘how’ step of the revised risk allocation concept.

Additionally, some propositions have been developed regarding factors that influence commitment. The table below shows whether these are confirmed or rejected.

Proposition	☑/☒
7. Sharing goals, benefits and liabilities has a positive influence on commitment	☑
8. Setting clear expectations has a positive influence on commitment	☑
9. Forming an integrated project team has a positive influence on commitment	☑

Table 28: Confirmation or rejection of proposition 7-9

Experts confirmed all three propositions (1. sharing goals, benefits and liabilities, 2. setting clear expectations, and 3. forming an integrated project team) to have a positive influence on commitment.

The first measure stated in proposition 7, when applied influence the ‘who’ and ‘how’ step of the revised risk allocation concept. Setting clear expectations and forming an integrated project team, however, enhance intersubjectivity in all three steps of the revised risk allocation concept.

11.2 Recommendations

Based on the conclusions, several recommendations can be given. First of all, this research has presented a revised risk allocation concept. Furthermore, this research has shown that the risk allocation process, the criteria and the influencing factors are mainly subjective interpretations. However, objective and intersubjective decisions are preferred. Therefore, it is recommended to enhance objectivity and intersubjectivity throughout the complete risk allocation process, the risk allocation criteria and the influencing factors. More specific recommendations on how to achieve objectivity and intersubjectivity are provided in the next paragraphs.

11.2.1 Recommendation concerning the risk allocation process.

It is recommended that private parties adopt the revised risk allocation concept depicted in figure 46. In this concept, the first step is to identify, analyse and prioritise risks and is depicted as ‘what’ in the concept. The first step is followed by two options, determining who deals with the risk or how to deal with the risk. This research has illustrated the close relation between these steps, hence the connecting arrows between the steps. This concept presents the iterative and continuous process of risk allocation, which is depicted by the arrows returning to the first ‘what’ step.

11.2.2 Recommendations to enhance objectivity

Eliminating the limitations of statistical modelling can increase objectivity. Two limitations have been observed during the case studies: lacking skills of employees and missing data. Private parties in consortia are recommended to provide training on how to conduct these analyses to counteract the first limitation. Secondly, private parties are recommended to jointly develop a database with extensive information about the risk allocation in the previous project to tackle the limitation of missing data. Implementing these recommendations leads to enhanced objectivity in the ‘what’ step of the revised risk allocation model.

11.2.3 Recommendations to enhance intersubjectivity

Furthermore, not all decisions can be made objectively. In that case, this research has shown that intersubjective decisions are preferred over subjective ones. Therefore, it is recommended that when decisions cannot be made objectively, they must be made intersubjective by reaching consensus between the different private parties. In order to do so, trust between, and commitment of the private parties is key. The confirmation of the first two propositions has demonstrated the positive influence of trust and commitment on reaching consensus. Therefore, this research recommends that the private parties of a consortium build a trustful relationship and are committed to the project. Implementing these measures

results in enhanced intersubjectivity in the three steps (what, who, how) of the revised risk allocation concept. The following paragraphs elaborate on how to enhance trust and commitment of private parties.

11.2.3.1 Recommendations related to trust between private parties

Trust can be enhanced in many ways, as was confirmed during the expert validation. First of all, clear communication and good information distribution have a positive influence on trust. Factors that improve communication and information dissemination are the use of one centralised and digital database, working from one location and forming an integrated project team. The author recommends that private parties in a consortium implement these measures in their risk allocation process to enhance trust. All these factors enhance intersubjectivity in the 'what', the 'who' and the 'how' of the revised risk allocation concept.

Another measure enhancing trust is being open or discussion according to the experts. Therefore, the author recommends that all parties are open for discussion. With an open attitude, employees are more approachable and easier trusted. Openness for discussion is also a factor that enhances intersubjective decision-making between private parties regarding the all three steps (what, who, how) in the revised risk allocation concept.

The expert validation has shown that a clear structure and process is an additional factor that has a positive influence on trust. Thus, it is recommended that a clear structure and process be applied in the risk allocation between private parties. This means that all parties must be aware of their own responsibilities, the constellation of the consortium and the sequence of activities. Having a clear structure and process affects the 'what' step, the 'who' step and the 'how' step of the revised risk allocation concept.

The last factor that has a positive influence on trust according to this research is to work with private parties that you have worked with before. When parties have worked together on previous projects, they are more willing to take on additional risk from these parties to complete a project. The author recommends consortia to, where possible, work with parties that they have worked with before, to enhance trust. With this measure, intersubjectivity is enhanced in the 'who' step and the 'how' step of the risk allocation concept.

11.2.3.2 Recommendations related to commitment of private parties

Furthermore, recommendations regarding commitment are provided. First of all, sharing goals, benefits and liabilities positively influences commitment of private parties. This research has provided three different ways to share liabilities of a project. The author recommends the private parties to enter into a contract or agreement where one of these three sharing liabilities methods is used. Goals and benefits must also be shared between the private parties. By doing so, the 'who' and 'how' step of the revised risk allocation concept are improved and decisions are made more intersubjective.

Secondly, the author recommends all private parties to set clear expectations for the project. This research has shown that setting clear expectations enhances commitment. Therefore, this measure increases intersubjectivity in all three steps of the revised risk allocation model.

Lastly, forming an integrated team does not only have a positive influence on clear communication but also on commitment according to the experts. Once more, the author recommends that all private parties jointly form integrated project teams to enhance commitment. This measure enhances intersubjectivity in the 'what', the 'who' and the 'how' decisions of the revised risk allocation concept.

12. Discussion

12.1 Limitations

12.1.1 Limitations of the methodology

The first limitation is regarding the preliminary research and the theoretical framework. The author has been limited due to the limited amount of literature existent on risk allocation between private parties. Extensive research has been conducted on the risk allocation between the authority (public) and the consortium (private). However, research on the risk allocation between the private parties is very limited.

Secondly, the fact that qualitative research has been conducted, limited the research. Qualitative research is subject to interpretations made by the researcher, which in turn are very much influenced by the researchers' bias. In contrast to quantitative research, no numerical data is used, but merely subjective project documentation and interviews. This limitation has been tackled by using triangulation of data. Replies from the interviewees have been validated with project documentation and vice versa.

Thirdly, the conducted case studies posed several limitations as well. Even though for literal replication a few cases suffice, a small number of cases make it hard to generalise the results. Furthermore, the cases have a wide geographical spread. Even though they are all European social infrastructure projects, culture between the different countries can still vary. Especially the attitude towards PPP projects and the degree of acceptance of this type of project constellations can differ between the different countries. The difference of how the government deals with PPP projects was observed between case 1 and 2, and case 3. Another limitation of these case studies is the irretrievability of confidential data. Information has been withheld from the researcher, increasing bias by the researcher, as more interpretations have to be made. Again, triangulation of data has formed the major technique to tackle this bias.

Fourthly, the interviews have been subject to some limitations. Once more, the small number of interviewees decreases the validity of this research. Especially in the third case, only one respondent was found available for an interview. The statements of this single respondent accounted for the complete case, which limits the reliability. The author has contacted various different private parties in all three cases repeatedly, however, no additional respondents were willing to be interviewed. Also, due to the fact that all interviewees are very busy, the amount of time for each interview was constrained, which limited the depth of the interview. All interviews have been approximately an hour, yet sometimes, additional time would have been beneficial. This, however, was beyond the researcher's control. Again, bias of the researcher plays a role in this way of conducting research. To be of value to the research, the author needs to interpret the replies from the interviewees. The majority of the answers have been validated with the aid of project documentation to enhance the validity of the research. Also, to eliminate bias, all topics of risk allocation during the interview were initially addressed with open questions to make sure that the respondents were not steered to a certain direction. The open questions did lead to a certain amount of incomprehension of the respondents. Especially when asking about the risk allocation criteria, even after repeated explanation of the topic, the respondents did not mention any criteria. Throughout the further interview, the author identified and suggested several criteria, which were not pursued by the interviewees. This indicates that the respondents did not completely understand that topic, which posed another limitation. After the open questions, more specific questions were asked for the sake of comparison. The closed questions ensured that the same topics were covered in each interview.

Fifthly, the expert validation phase showed limitations. One major limitation is that only four out of the nine interviewees actually completed the questionnaire. The low number of respondents decreases the validity of this research. A higher sample size would have resulted in higher statistical validity of the formulated propositions.

12.1.2 Limitations of the conclusions and recommendations

Furthermore, some limitations of the conclusions and recommendations are provided. First of all, the revised risk allocation concept has not been validated in this research. The new concept has not been applied to any case, thus, to test its validity, application of the model to real cases should be undertaken.

Secondly, the recommendations are only provided for the construction, organisation and operational risk. Therefore, the results are limited to only these types of risks. The inclusion of other risks could result in different conclusions and recommendations regarding the risk allocation.

Thirdly, the recommendation to construct a database shows two major limitations. First of all, the confidentiality of data poses a problem. Since other private parties of other projects might not be willing to share sensitive information, this could lead to an incomplete database. Secondly, the unique nature of projects poses limits to build a database of this kind. Due to the fact that every project is unique, one common way to allocate risks will not be applicable.

Lastly, the recommendation that aims for a clear structure and process in the risk allocation is limited. The limitation of this recommendation is that it does not go into much detail on how to achieve that. Therefore, a way to enhance clearness of structure and process needs to be researched.

12.2 Recommendations for further research

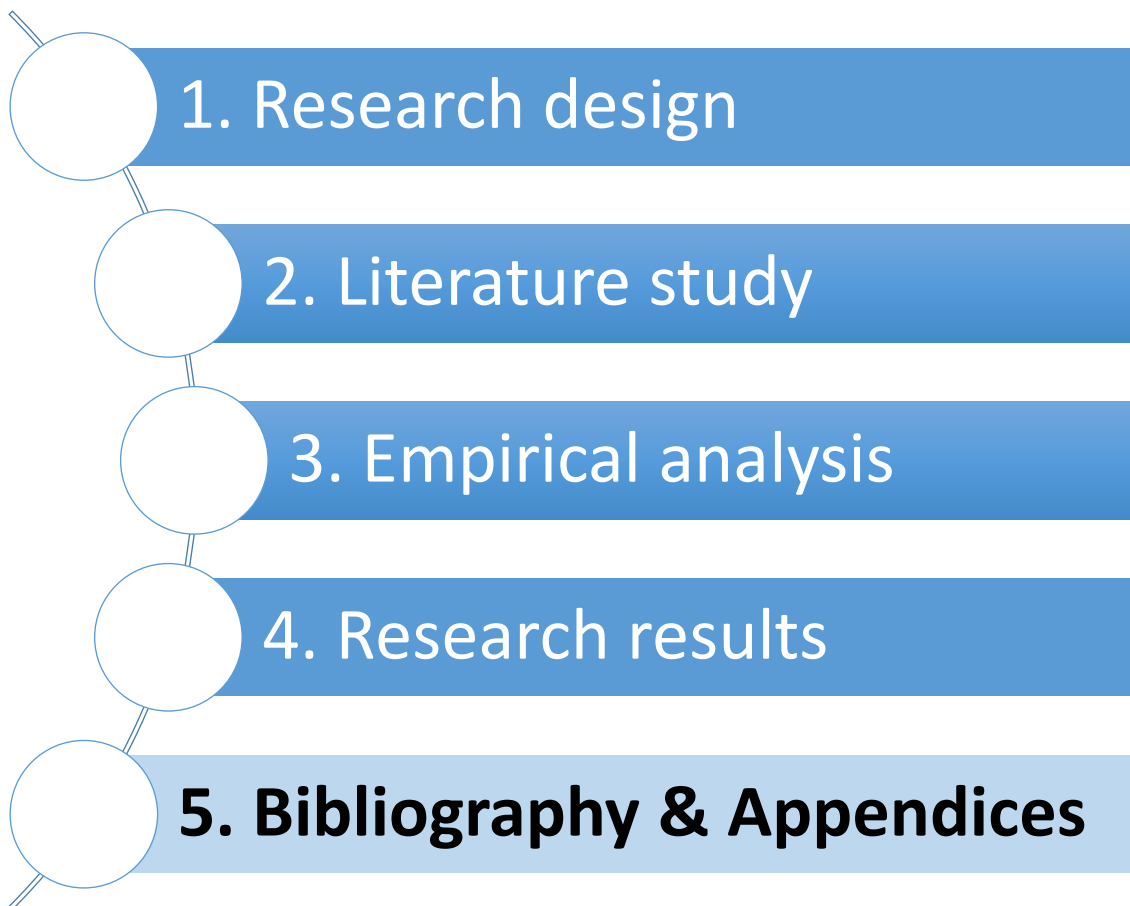
First of all, further research is to be done on the revised concept. An alteration on the existing concept of Abednego & Ogunlana (2006) has been concluded from this research. This revised concept should be validated and tested. Applying the new concept to cases will enhance the validity of it. Not only should this be tested on the risk allocation between the private parties, but this can be extended to the overall risk allocation in PPP projects (between the authority and the private parties). Additional research should be done on the applicability of the concept in economic infrastructure, instead of solely social infrastructure.

Secondly, a limitation is that this research has only focused on construction, operational and organisation risk. However, the universe of risks that may influence any construction project is much larger. This exploratory research has been the basis, but further research should be conducted about additional risks.

Thirdly, differences have been observed between the projects in different geographical locations. The Benelux projects showed very different characteristics than the British Isles projects. This means that other geographical locations might have shown different results when included in the research. Therefore, further research should be conducted on different geographical locations to validate results.

Fourthly, one of the recommendations stated that goals, benefits and liabilities which are shared, enhance commitment, and therewith the intersubjective way of allocating risks. However, this research has also presented three different ways to share liabilities. Further research is necessary to determine which way of sharing risks fits which kind of projects best. The methodology of sharing risks goes hand in hand with e.g. the contract or the choice for reimbursement. Further research should investigate the relation between the different aspects influencing the way liabilities are shared in consortia.

Lastly, many of the recommendations include factors that enhance trust and commitment to achieve intersubjective decisions. When looking into scientific literature, it shows that many of these factors also influence (strategic) partnering of multiple parties. Therefore, further research should be conducted on the relation between partnering and (intersubjectivity of) the risk allocation.



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14. Appendices

14.1 Appendix A: Comparative analysis of risk allocation in literature

Risk factor	Lam et al. (2007)	Ng and Loosemore (2007)	Li et al. (2005)	Arndt (1998)	Wang and Tiong (2000)	NTSA (2004)	VDTF (2001)	Same	
Political	Termination of concession by Government		Public			Public	Public	✓	
	Expropriation and nationalization		Private	Public		Public	Public	×	
	Political opposition			Public			Public	✓	
	Change in law	Share	Private	Share	Share	Share	Public	×	
	Unstable government	Public		Public				✓	
	Project approval and permit	Private	Share		Share		Private	×	
	Influential economic events			Private			Private	✓	
	Changes in industrial code of practices			Private	Share		Share	Private	×
Construction	Availability of finance			Private	Private		Private	✓	
	Improper design	Private	Private	Private	Private	Private	Private	✓	
	Insolvency of subcontractors	Private		Private	Private	Private	Private	✓	
	Quality risk	Private	Private	Private	Private	Private	Private	✓	
	Site safety	Private			Private			✓	
	Availability of labor/materials	Private		Private		Public		×	
	Ground conditions	Public	Private	Private			Private	×	
	Site availability	Public	Private	Public	Share			Private	×
	Construction/design changes	Private	Public				Public	Public	×
	Labor disputes and strikes	Private				Private		Private	✓
	Land use		Public	Public			Public		✓
	Waste of materials		Private	Private	Private				✓
	Construction cost overrun		Private	Private	Private	Private	Private	Private	✓
	Construction completion		Private	Private	Private	Private	Private	Private	✓
	Supporting utilities risk		Public		Share	Share			×
	High financial cost			Private	Private	Private			✓
	Unproven engineering techniques			Private	Private	Private	Private	Private	✓
	Protection of geological and historical objects					Private	Private	Private	✓
Operation	Operation cost overrun		Private	Private	Private		Private	✓	
	Operator default		Private		Private	Private	Private	Private	✓
	Quality of operation		Private		Private	Private	Private	Private	✓
	High maintenance cost			Private	Private		Private	Private	✓
	Frequency of maintenance			Private	Private		Private	Private	✓
	Low operating productivity			Private	Private	Private	Private	Private	✓
	Residual assets risk				Private		Private	Public	×
	Condition of facility					Private		Private	✓
Legal	Contractual risk	Public				Share		×	
	Third party tort liability	Public		Private				×	
	Ownership assets		Private			Share	Private	Share	×
	Insolvency of Concession company					Private	Private		✓
Market	insufficient income			Private	Private	Private		✓	
	Fluctuation of material cost (by government)		Public			Public	Public	Public	✓
	Fluctuation of material cost (by private sector)		Private			Private	Private	Private	✓
	Tariff change		Private	Private		Private	Private	Private	✓
	Market demand change		Private	Private	Share	Private	Share		×
	Exclusivity					Share		Private	×
Economic	Inflation risk	Share	Share	Private		Share	Share	Share	×
	Interest rate		Share	Private		Share	Private		×
	Foreign currency exchange					Public	Private		×
Other	Force majeure		Share	Share	Share		Share	Share	✓
	Residual risk		Public	Private					×
	Weather	Share		Private	Public		Public		×

source: Ke et al. (2010)

14.2 Appendix B: RBS for construction, operational, and organisational risks

Level 1 risks	Level 2 risks
Construction risk	Construction cost overrun
	Design deficiency/improper design
	Late design changes
	Availability of finance/financial attraction of project to investors
	Insolvency of subcontractors
	Quality risk
	Site safety
	Waste of materials
	Construction completion
	High financial cost
	Unproven engineering techniques
	Protection of geological and historical objects
	Fluctuation of material cost (by private sector)
Operational risk	Operation cost overrun
	Operator default
	Quality of operation
	High maintenance cost
	Frequency of maintenance
	Low operating productivity/Insufficient income
	Condition of facility
Organisation risk	Lack of private sector experience in PPP's
	Inadequate experience in PPP
	Organisation and coordination risk
	Insolvency of concession party
	Internal inconsistency of project objectives

Source: Ke et al. (2010)

14.3 Appendix C: Risk management model comparison

ATOM	ISO 31000	PRAM	PMI	Summary
1. Initiation	1. Establishing the context	1. Initiate	1. Risk management planning	1. Initiation
2. Identification	2. Risk identification	2. Identify	2. Risk identification	2. Risk identification
3. Assessment	3. Risk analysis 4. Risk evaluation	3. Assess	3. Qualitative risk analysis 4. Quantitative risk analysis	3. Risk analysis
4. Risk response planning	5. Risk treatment	4. Plan responses 5. Implement responses	5. Risk response planning	4. Risk response planning
5. Monitoring & review	6. Monitoring & review		6. Risk monitoring & control	5. Monitoring & review

sources: Hillson & Simon, 2007; ISO 31000, 2009; Chapman, 1997; PMI, 2000

14.4 Appendix D: Interview protocol

Introduction:

- My name is Bastiaan van den Broek. I am studying Construction Management & Engineering at the Faculty of Civil Engineering and Geosciences and currently I am writing my master thesis.
- For my thesis I am doing a research regarding the risk allocation criteria, the factors influencing risk allocation and the process of risk allocation, between private parties in infrastructure PPP projects.
- The goal of this research is to give recommendations on the risk allocation process, factors influencing the risk allocation and the consequences of risk allocation on the project objectives.

Conditions

- This interview will approximately take 1 hour.
- The interview consists of open and closed questions
- Your answers will be treated confidentially and will be used anonymously in the final report of the thesis.
- To be able to accurately reuse the interview, I would like to record this interview. This recording will be treated confidentially as well. Only I will have access to this recording

INTRO:

1. What is your role within this project?
2. How long have you been involved in this project?
3. What is your role within the organisation?
4. What is your interest in this project?

PROJECT OBJECTIVES:

1. What are the main objectives of this projects from your perspective?
2. What happens if these objectives are not achieved?
3. What is the main contributor to project success?
4. Does risk allocation affect achieving project objectives? How?
5. How important is adequate risk allocation to achieve project objectives? (1-5) Why?

INFLUENCING FACTORS:

1. What are the most essential factors that have influenced the risk allocation process?
 - a. Do you think communication/information distribution influences risk allocation? How?
 - i. Has there been clear communication during the risk allocation process?
 - b. Do you think understanding of the risks influences risk allocation? How?
 - i. Has there been a clear understanding of the risks?
 - c. Do you think the risk allocation criteria influence overall risk allocation?
 - i. Based on what criterion/criteria were the risks allocated between the private parties in this project?
 - d. Do you think the support of the top management influences overall risk allocation? How?
 - i. Did top management support the risk allocation?

RISK ALLOCATION PROCESS:

1. General
 - a. What is risk allocation in your eyes?
 - b. How has the risk allocation between private parties been established?

- c. Do you have a standard risk allocation procedure within your company?
 - i. If yes, how does it look?
 - ii. Is this process used in every risk allocation for every project?
 - iii. Was this applied in this particular project as well?
 - d. How did the process of risk allocation between private parties look in this project?
 - e. Is this process objective or subjective? How?
2. Process – What
- i. How are risks identified in the project?
 - ii. In which ways are these risks prioritised?
 - iii. (What are the most important risks) → outcome
3. Process – Who
- a. In which way have the risks been allocated?
 - i. Based on what criterion/criteria were the risks allocated between the private parties in this project?
 - ii. Are these criteria the same for every project?
 - b. Who identifies the (most important) risks?
 - c. Who decided who the risks were allocated to?
 - d. Was there disagreement with any risks regarding the allocation? Why?
 - i. What were those risks?
 - e. Were there any risks that you did not want to take but you took/had to take anyway?
4. Process – When
- a. What is the right time to identify the most important risks?
 - i. When have the most important risks been identified?
 - b. What is the right time to allocate the risks? (procurement, design etc)
 - i. When have the most important risks been allocated?
5. Process – How
- a. What is the best strategy to prevent or minimise the probability or the impact?
 - i. Accept?
 - ii. Reduce?
 - iii. Transfer?
 - iv. Avoid?
 - b. What has been done with the top risks?
 - c. What measures have been taken to mitigate the risks?

FURTHER

1. Have there been any questions that you expected that I didn't ask?
2. Are there any questions from your side?
3. Are there any other people that I could interview for this case study?

WRAP UP

Thank you very much for the interview. As mentioned before the interview, your results will be treated confidentially and used anonymously in the report. Are there any final questions from you side?

14.5 Appendix E: Questionnaire for the expert validation

Questionnaire on the influence of trust and commitment on reaching consensus on the risk allocation between private parties in public-private partnerships

Dear reader,

Thank you very much for filling out this questionnaire. By filling out this 5-10 minute questionnaire, you will help me validate the results of my master thesis.

This questionnaire consists of three sections:

1. The influence of trust and commitment on reaching consensus on the risk allocation between the private parties;
2. Factors influencing trust between the private parties in PPP's;
3. Factors influencing commitment of private parties in PPP's.

Every question consists of a statement, to which a range of answers is possible:

1 = completely disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = completely agree

When answering each question, please relate to the project that we discussed during our interview.

As promised, I will share the final report of my thesis with you upon completion.

Kind regards,

Bastiaan van den Broek

b.f.j.vandenbroek@gmail.com

* Required

Email address *

Your email

Section 1: The influence of trust and commitment on reaching consensus on the risk allocation between the private parties

Trust between all private parties has a positive effect on reaching consensus on the risk allocation* *

*Consensus on the risk allocation is a mutual agreement between all parties on to which party risk should be distributed



Commitment of all involved parties has a positive effect on reaching consensus on the risk allocation* *

*Consensus on the risk allocation is a mutual agreement between all parties on to which party risk should be distributed



Section 2: Factors influencing trust between the private parties in PPP's

Clear communication and good information distribution have a positive influence on trust *

	1	2	3	4	5	
Completely disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Completely agree

Using one centralised and digital database has a positive influence on clear communication and good information distribution *

	1	2	3	4	5	
Completely disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Completely agree

Working from one location has a positive influence on clear communication and good information distribution *

	1	2	3	4	5	
Completely disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Completely agree

Forming an integrated project team* has a positive influence on clear communication and good information distribution *

*An integrated project team is a team that is built up by members of all different private parties

	1	2	3	4	5	
Completely disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Completely agree

Being open for discussion has a positive influence on trust *

	1	2	3	4	5	
Completely disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Completely agree

A clear structure and process* has a positive influence on trust *

*A clear structure and process is when all parties are aware of the constellation of the project, the sequence of activities, and their own responsibilities

	1	2	3	4	5	
Completely disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Completely agree

Working with private parties that you have worked with before has a positive influence on trust *

	1	2	3	4	5	
Completely disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Completely agree

Section 3: Factors influencing commitment of the private parties in PPP's

Sharing goals, benefits and liabilities has a positive influence on commitment *

	1	2	3	4	5	
Completely disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Completely agree

Setting clear expectations has a positive influence on commitment *

	1	2	3	4	5	
Completely disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Completely agree

Forming an integrated project team* has a positive influence on commitment *

*An integrated project team is a team that is built up by members of all different private parties

	1	2	3	4	5	
Completely disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Completely agree

Thank you for completing the questionnaire

If you have any questions, feel free to contact me at b.f.j.vandenbroek@gmail.com