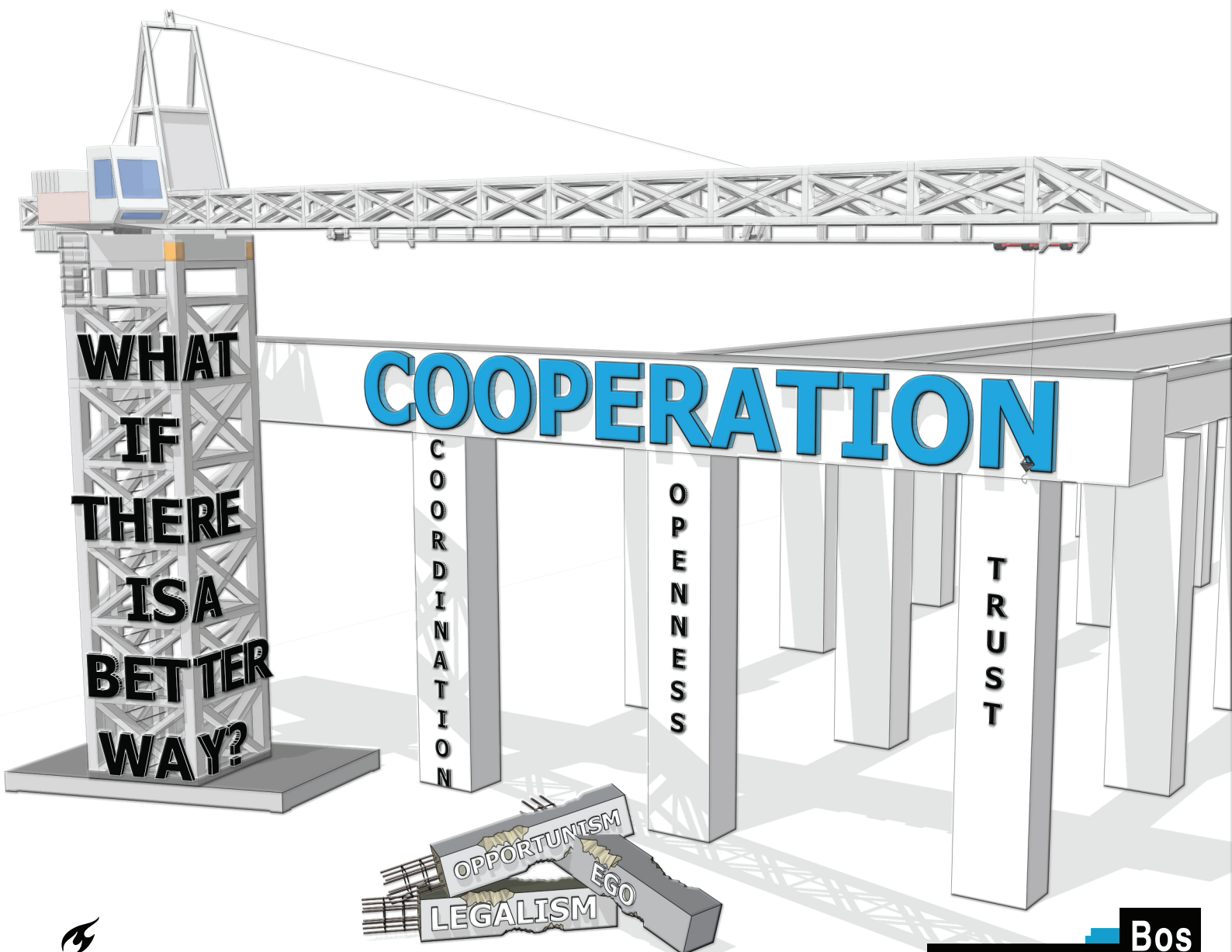


The design of risk sharing to promote cooperation

Antonio Perrone



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by

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Executive summary

Cooperation figured prominently in the Dutch construction industry's agenda over the past years. In 2016, major clients, sector organizations and the relevant market parties officially committed to promote a culture based on good cooperation and healthy relationships by signing the "Market Vision" (*De Marktvisie*, 2016). This document illustrates the objectives, principles and necessary changes to achieve this ambition in 2020. However, according to the report of Rijkswaterstaat (2019), there have not been structural changes in cooperation within the supply chain where fighting relationships, self-interest and opportunistic behaviours still prevail. The unattractive risk-return profile, i.e. the ratio between the expected return and the amount of risk undertaken by contractors, of large projects in the civil engineering sector is considered to be a barrier that prevent this change. The current approach to risk management is one factor that contribute to decrease the risk-return ratio. According to the report of Rijkswaterstaat (2019), market parties have the impression that risks are not always allocated to the "natural owner". The natural owner is the party that has the knowledge, ability and financial capacity to manage a certain risk. Market parties have more or less consciously accepted risks under competitive pressure although Rijkswaterstaat argue that during the tendering process of large complex projects some risks are taken back based on the contractors' argumentation. However, construction companies point out that the dialogue focus on limiting risks on the client's side and they are not yet sufficiently stimulated to discuss their own risks. This research proposes risk sharing to fills the gaps of the current approach with the purpose of stimulating the development of cooperation. The scope of the research is limited to Dutch infrastructure projects procured by public authorities through Public-Private Partnership. The research objective is to provide partner organizations with a framework to share risk at the project level in order to foster commitment and cooperation for the long duration of the partnership. Accordingly, the research question reads as:

"How can risk sharing be designed at the project level in order to improve cooperation between public and private partners in infrastructure projects?"

The first step to answer the research question is to investigate current risk sharing from a theoretical and practical perspective. This is achieved through literature review, exploratory interviews with employees of WitteveenBos and document review. The results of these activities are compared with the elements mentioned in the literature to stimulate cooperation. Afterward, a conceptual model is elaborated based on the results of literature review and exploratory interviews. The purpose of the proposed conceptual model is to illustrate contractual and relational elements that can be added to the current risk sharing in order to promote cooperation. Then, the proposed risk sharing mechanisms that constitute the conceptual model are discussed with practitioners. This activity aims to refine the proposed risk sharing mechanisms in order to obtain detailed measures that form the risk sharing framework. Mechanisms and measures do not differ in substance because both explain how elements occur in practice but with different level of detail (mechanisms are generic and abstract while measures are detailed and tangible). Finally, the proposed framework is validated with experts in order to assess whether it meets the economic and functional requirements of its intended users and fits within the restrictions imposed by the current practice. The risk sharing mechanisms applied in the construction sector mentioned in the literature refer to financial incentives such as government guarantees, target cost contracts, etc. However, the literature study suggests that the attitude and willingness of partners to engage in cooperative behaviours is stimulated more by trust and relational norms than formal enforceable rules. Therefore, it can be argued that risk sharing requires additional elements in order to promote cooperation. The following elements can be added to the current risk sharing:

1. Coordination function;
2. Adaptation function;
3. Trust;
4. Open communication;

-
5. Informal interactions;
 6. Joint management;
 7. Enhanced participation;

The elements (1), (2), (3), (5), (7) are considered in the conceptual model because they are mentioned in the literature to stimulate cooperation. Likewise, the elements (4) and (6) are considered because respondents of the exploratory interviews suggest that, in the current practice, cooperation can benefit from these changes. The proposed risk sharing framework requires certain personal attitudes of team members in order to be effective in promoting cooperation. According to practitioners, partners should:

- seek the participation of all team(s)members, internal and external;
- take the initiative to help rather than being passive;
- show behaviours oriented toward the achievement of common goals and mutual benefits;
- be open and receptive to new ideas, different perspectives, external influence;

Furthermore, an essential attitude is to accept and embrace the idea that risk ownership does not exclude the chance of managing a risk together. The legal boundary of having one risk owner should not prevent partners from being forthcoming and providing support to control risks. Based on the results of the discussion with practitioners, the proposed risk sharing framework is effective in stimulating cooperation only if partners coordinate with each other and commit to implement these measures together. According to validators, barriers for the framework implementation are time, competition, personal attitude and organizational culture. Furthermore, they claim that the main challenge is to convince the executives above the project level to make the necessary changes to remove or by pass these barriers.

In future research related to the subject of this research, it is interesting to:

- include the role and perspectives of subcontractors in the proposed framework;
- evaluate the implications of the ‘two-phase’¹ process on the proposed framework;
- collect empirical evidence to demonstrate that ‘best value’² approach is more cooperative oriented than competitive dialogue
- evaluate how the risk sharing framework changes if the relationship with cooperation is assumed to be characterised by ‘feedback effect’³;
- investigate whether the effects of risk sharing on competition and cooperation can coexist.

¹In the two-phase process, design and construction phase are divided. According to Rijkswaterstaat (2019) this reduces the risk profile of projects because the pricing for the construction phase only follows after the design or engineering phase. More information is then known, which leads to fewer uncertainties and risks.

²Best Value Procurement (BVP) was created by Dean Kashiwagi at Arizona State University and it focuses on selecting the contractor that is most suitable for the job and minimizing the client's decision making (Storteboom, Wondimu, Lohne and Lædre, 2017; Wondimu, Klakegg, Lædre and Ballard, 2018) .

³The feedback effect which occurs when variable X has an effect on variable Y and, in turn, variable Y has an effect on X (Verschuren and Doorewaard, 2010).

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1

Introduction

1.1. The partnering approach

Major infrastructures such as highways, railroads and airports are essential to the need of modern society of being “*independent from space*” [Flyvbjerg et al., 2003]. Infrastructure investments are crucial to economic growth [Panayiotou and Medda, 2014], particularly, in emerging economies [Chakrabarti and Pratap, 2018]. In the traditional procurement model the relationship between the public entity and the private party is a pure agency-contractor transaction [Cruz and Marques, 2013]. Traditional public work contracts contain exact specifications regarding the work to be performed and allocate all the risk to the public authority except for the risk inherent to the construction work [Sarmiento and Renneboog, 2016]. Under traditional procurement, delays and cost overruns occur frequently, particularly in complex projects [Flyvbjerg et al., 2003]. The inefficiencies of traditional procurement processes added up as overhead outlays to the projects final cost [Gadde and Dubois, 2010]. A profound change in the relationship between the organizations involved in the construction industry was required in response to increased complexity and unsatisfactory projects performance. Establishing a shared culture that crosses organizational boundaries was the foundation of the new relationships identified as “*partnering*”. The partnering approach seeks to eliminate adversarial conditions and, consequently, promote better integration and cooperation between contractual partners [Gadde and Dubois, 2010]. Nevertheless, the development of cooperation can be seriously threatened by opportunistic behaviours and lack of coordination [Malhotra and Lumineau, 2011] between partners. Furthermore, Gadde and Dubois [2010] identify characteristics of the construction industry that prevent the partnering approach from delivering expected benefits. In particular, they emphasize the negative impact of the features (table 1.1) of existing relationships between organizations.

Discontinuous business exchange which results in low expectations about future involvement;
Unwillingness to develop dependency from other parties which explains why exchanges are characterized by arm's length distance and, therefore, low involvement;
Low transmission of knowledge between projects;
Lack of mutuality;
Unwillingness to share knowledge;
Market oriented with a strong focus on competition and costs reduction;

Table 1.1: Features of the relationships in the construction industry

These features suggest a strong individualistic and adversary attitude, whereas partnering implies moving beyond the boundaries of the individual organization toward cooperating partners that jointly develop products and services and share risks, costs and resources [Ham and Koppenjan, 2001]. The partnering approach can be recognized in the innovative business relationships that governments established with the private sector in the attempt to ensure that certain infrastructures and/or services are available to citizens while, at the same time, reducing the economic burden on public accounts [Cruz and Marques, 2013]. Most of these new relationships fall under the broad definition of Public-Private Partnership (PPP), i.e. agreements between public authority and one or more private partners for the provision of assets and/or services [Sarmiento and

Renneboog, 2016]. PPP models focus more on the outputs of the process and seek to shift more risks to the market which, supposedly, should spur the private sector to innovate and strive for efficiency [Cruz and Marques, 2013, Medda, 2007]. The advantages of risk transfer result from the fact that market parties may have more information or may have better capabilities to control or diversify risks [Miller and Lessard, 2001]. However, considerable evidence indicates that financiers' requirements, company culture and bargaining power, rather than information availability or capabilities, are the criteria that guide risk transfer in PPP projects [Ng and Loosemore, 2007]. Failing to select suitable candidates or negligent risk transfer may result in inability of contractors and subcontractors to meet their obligations and, consequently, the project may end up with additional risks [Burke and Demirag, 2018, Cooper et al., 2005].

1.2. The Dutch context

Rijkswaterstaat is responsible for approximately 65% of all publicly awarded projects larger than ten million euros each year which makes this organisation the main client in the civil engineering sector (GWW) of the Netherlands [Rijkswaterstaat, 2019]. Since the construction fraud in 2002, Rijkswaterstaat was forced to take more distance from the market and started to work in a more 'business like' way. Consequently, the role of Rijkswaterstaat as a client and the interaction with market parties in the civil engineering sector has changed considerably. This organisation has evolved from traditional designer to managing principal. This development is partly driven by the results and recommendations from the Parliamentary Construction Survey, the further implementation of the EU tendering rules and the demand of market parties to be involved more and earlier in the process [Rijkswaterstaat, 2019]. The intended transition from the previous client-contractor relationship to the new PPP agreements have encountered several issues. According to the report of Rijkswaterstaat [2019], market parties have the impression that risks are not always allocated to the "natural owner". The natural owner is the party that has the knowledge, ability and financial capacity to manage a certain risk. Market parties have more or less consciously accepted risks under competitive pressure although Rijkswaterstaat argue that during the tender of large complex projects, some risks are taken back based on the contractors' argumentation. However, construction companies point out that the dialogue focuses on limiting risks on the client's side and they are not yet sufficiently stimulated to discuss their own risks [Rijkswaterstaat, 2019]. This attitude combined with the increasing complexity of the building assignments, the high costs to make a bid and the limited importance given to quality during bid evaluation resulted in a less attractive risk-return ratio¹ of large projects in the civil engineering sector. In addition, the civil engineering sector has the characteristics of an imperfect market, especially for large projects. Rijkswaterstaat is the only structural client for large projects and there is a limited number of contractors. The top 108 contractors in the Netherlands took 50% of the total sector turnover between 2014 and 2017 [Rijkswaterstaat, 2019]. These companies are increasingly permanent contractors of Rijkswaterstaat and, therefore, represent the core of the client's supply chain. Moreover, market parties often participate in consortia in large-scale projects which further decrease the number of tenderers. As a result, the average number of tenderers for projects larger than € 250 million decreased from three to two point five in the last five years (figure 1.1). According to interviews with parties from the civil engineering sector, it seems that this trend may even accelerate [Rijkswaterstaat, 2019].

1.3. Problem statement

The significant decrease in the number of bids led to a discussion between the main parties in the construction sector. Rijkswaterstaat, together with other clients, sector organizations and the relevant market parties, created the "Market Vision" (*Marktvisie*) which includes principles of cooperation that focus primarily on attitude, behaviour and culture. However, according to the report of Rijkswaterstaat [2019], this has insufficiently led to a reduction in undesirable behaviours, such as low number of bids and conflicts about the interpretation of contract provisions. In general, there have not been structural changes in cooperation within the supply chain and the sector as a whole. The lack of cooperation can lead to the absence of bids for large complex works and, consequently, undermine the realization of the social task. Hence, it is important for Rijkswaterstaat to stimulate cooperation. This requires a change in the way Rijkswaterstaat interacts with the market, distributes risks and stimulates innovations. On the other hand, market parties must become more adaptive in offering new functionalities and, at the same time, provide more and better support to the client in the area of risk management. According to the report of Rijkswaterstaat [2019], it can be argued that, in the Dutch context, the attitude of clients and market parties with regards to risk prevents the development

¹the ratio between the expected return and the amount of risk undertaken by contractors

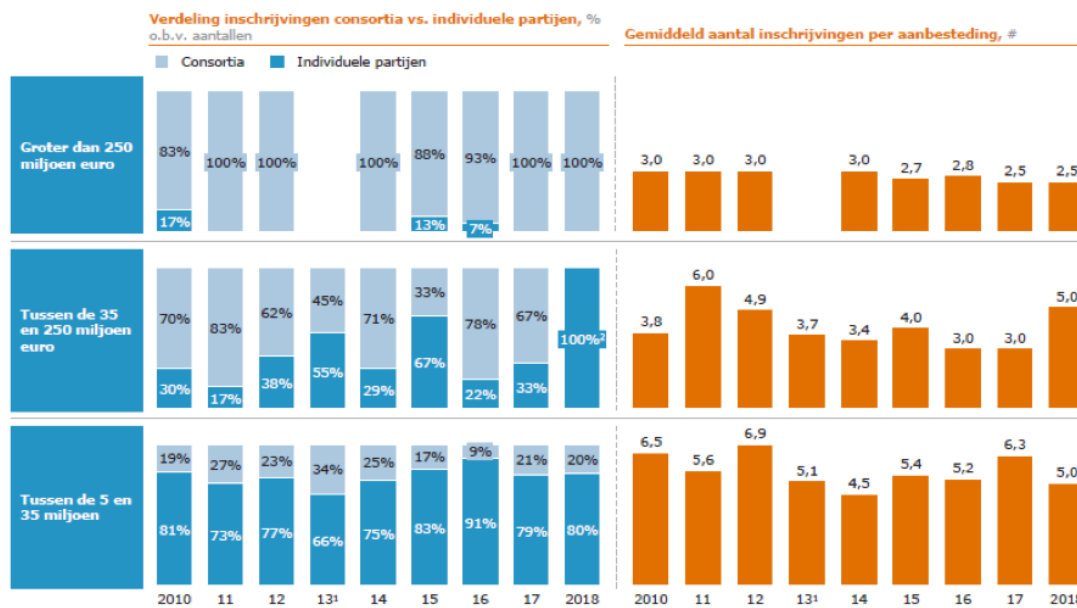


Figure 1.1: Number of bids per tender distinguished in consortia and individual parties [Rijkswaterstaat, 2019]

of structural changes in cooperation in the construction sector as envisaged by the Market Vision. Hence, a different approach to risk may facilitate the development of cooperation. The current approach is advantageous when market parties have more information or better capabilities to control or diversify risks [Miller and Lessard, 2001]. However, this raises the question of whether this approach is appropriate when the contractor is not able to manage a certain risk at the lowest cost or does not have the technical and managerial capabilities to do so. It may also be the case that the information available during the dialogue is not sufficient to accurately define the “natural owner” of risk. In these circumstances, it can be reasonably expected that the party designated as natural owner of risk is unable to meet their obligations, which may lead to negative consequences for the project such as legal disputes between partners, mutual blame, economic and reputational loss, etc. Hence, it can be argued that, under these circumstances, sharing the risk between partners may be a better alternative than appointing a party that does not fit the description of natural owner. This alternative strategy can be designed to stimulate cooperative behaviours. Furthermore, it may compensate some of the flaws of the current approach and, consequently, contribute to increase the risk-return ratio of large projects. Hence, it is assumed that risk sharing can directly stimulate partners’ cooperative behaviours and foster the development of structural changes in cooperation in the construction industry.

1.4. Research objective and research question

This research investigates how risk sharing can be designed with the purpose of stimulating the development of cooperation. The research objective is to provide partner organizations with a framework to share risk at the project level in order to foster commitment and cooperation for the long duration of the partnership. The framework aims at the project level because the commitment of public and private organizations to embrace the new cooperation forms at the strategic level has not been optimally translated at lower operational levels [Koops, 2017]. The scope of the research is limited to Dutch infrastructure projects procured by public authorities through Public-Private Partnership. The stakeholders involved in the analysis are the contracting authority and the private parties from the winning consortium, including contractors, advisors and financiers. Given the research objective, the main research question reads as:

“How can risk sharing be designed at the project level in order to improve cooperation between public and private partners in infrastructure projects?”

In order to answer the main question, the following sub-questions are formulated:

1. What is the current understanding of risk sharing from a theoretical and practical perspective?

2. What are the contractual and relational elements that impact cooperation between public and private partners?
3. Which contractual and relational elements can be added to the current risk sharing to promote cooperation?
4. Which measures can be developed, based on the current practice, to enhance the effect of risk sharing on cooperation?
5. To what extent are the proposed measures applicable in practice?

1.5. Research design

The strategy represents the character of the research and concerns decisions about the approach to be followed, whether it is qualitative or quantitative, theoretical or empirical. The methods used to collect and process the necessary material to answer the research question are decided according to the research strategy.

1.5.1. Research strategy

The character of this research is exploratory because it aims to explore rather than evaluate the risk sharing strategy. The qualitative approach fits the small scale, descriptive character of exploratory research. Moreover, qualitative analysis is appropriate considering the broad and multidimensional nature of the core concepts, whereas quantitative analysis requires robust initial assumptions. However, qualitative research can reveal motivations and modalities of certain phenomena but cannot provide indications about their extent or frequency. The first part of the investigation uses theoretical approach to learn about the academic discussion regarding the concepts of risk sharing and cooperation. Then, the research proceeds through empirical approach to gather information about the current practice. The results of the research are expected to provide insights into the phenomenon of interest but are unlikely to constitute a solid basis for decision making by themselves.

1.5.2. Research methods

The investigation is divided into three phases in order to gradually collect the necessary information to answer the sub-questions and, finally, the main research question.

The first part of the research is structured by combining theoretical and empirical approach. The desk or theoretical approach consists in reviewing the existing studies on risk sharing and inter-organizational cooperation. The empirical approach involves exploratory interviews and document review. The interviews are conducted with employees from WitteveenBos after the start of the literature review and are progressively designed according to the findings. Afterwards, guidelines and standards related to risk sharing and/or cooperation available in the WitteveenBos' library and the NEN database are reviewed. The findings of the literature review give an overview of the status of the research in the area of interest and help to identify possible gap(s) in the body of knowledge. More specifically, the theoretical perspective on risk sharing and cooperation is expected to highlight variables that can be used to develop the conceptual model. On the other hand, the results of exploratory interviews provide a first illustration of the practical perspective on the two core concepts. The documentation review is expected to provide a better picture of what is currently prescribed in relation to risk sharing and/or cooperation. At the end of this phase, it is possible to identify contractual and relational elements that can be added to the current risk sharing in order to stimulate cooperation. These information are used to develop the conceptual model. The results of this phase answer the second and third sub question and provide partial responses to the first one.

The second phase of the research follows an empirical approach by conducting semi-structured interviews. The open setting is an opportunity and, at the same time, a necessity considering the limited knowledge about risk sharing. This interview structure may allow to collect information on aspects that have been overlooked and reduce the risk of biased answers. Furthermore, the benefit of this method, particularly in this context, is that people in the field are more likely to embrace changes or suggestions based on their perspective. On the other hand, results may hardly be extended to different circumstances. The strategic sample of respondents is drawn from Dutch infrastructure PPP projects. The proposed risk sharing mechanisms, based on the information collected during the previous stage, is submitted to the respondents and their responses are recorded. The results of the interviews are qualitative statements that address practitioners' understanding

of the concept of risk sharing and are expected to provide a clear picture of the actual and desirable practice. The statements given are expected to indicate barriers and opportunities related to actors and processes that must be considered in order to organize and embed the proposed risk sharing mechanisms into the current practice with the purpose of stimulating cooperation. At the end of this phase, it is possible to complete the answer to the first sub question and provide the answer to the fourth one. The results of this phase provide the necessary information to refine the conceptual model and obtain the risk sharing framework. The third phase involves a discussion with experts that are familiar with the research. The qualitative validation aims to assess whether the proposed framework meets the economic and functional requirements of its intended users and fits within the restrictions imposed by the current practice. The results of the validation answer the fifth sub question.

1.6. Scientific and practical relevance of the research

The objective is defined based on the potential contribution to the body of knowledge in the area of interest and the potential benefits for the civil engineering sector. In terms of scientific relevance, this research aims to trigger an academic discussion on risk sharing in order to reduce the gap identified in the literature. The considerations made to elaborate the proposed risk sharing framework can be used as inputs for the discussion. Furthermore, this research contributes to the debate on "how" contractual and relational elements interact in the context of cooperation between partner organizations.

The Dutch construction industry has manifested its willingness to improve cooperation. The proposed risk sharing framework consists of detailed measures that enable organizations to demonstrate cooperative behaviours and, consequently, contributes to this purpose.

Finally, the decision on the research objective is not limited to its scientific and practical relevancy but it also considered the issue from a public perspective. This research can contribute to improve the cooperation between partners which, in turns, may improve project performance. In this research context, improved project performance also means a better use of tax money because the projects under considerations are eventually paid by present and future citizens.

1.7. Research structure

Chapter one introduces the research topic and explains the context and boundary of the research. Then, it defines the research objective and, consequently, set the research question and sub-questions. It concludes with a description of the research design and, finally, presents the expected outcome and the scientific and practical relevancy of this research. Chapter two describes in detail the research methodology, including the strategy and methods applied. Chapter three discusses the findings of the literature review and it describes the relevant contents related to the concepts of risk sharing and cooperation. Chapter four discusses the exploratory phase. It describes how interviews are conducted and which results are obtained. Moreover, it reports and discuss the most relevant contents of the reviewed document. At the end of this chapter, the conceptual model is elaborated. Chapter five explains the setting of discussion with practitioners. It describes the samples of respondents and the structure of the interviews. It reports the analysis of the findings and present a comparison between the findings of the previous phases and the results of the interviews. Chapter six illustrates the proposed risk sharing framework and describes the organization and results of the validations process. Chapter seven contains the conclusions, where the answers to research questions and sub questions can be found. It also includes the practical implications of the framework, general recommendations, limitations and indications for future researches. Afterwards, personal reflections are given.

2

Methodology

This chapter illustrates the methodology used in this research to gain the necessary information to achieve the research objective. There are three distinctive phases, activities performed in each phase are described by stating their purpose and organization. Phase one includes a theoretical and practical approach. Phase two is empirical but it is integrated with insights from the theory. Phase three only involves empirical research. Phase one aims to investigate the core concepts of risk sharing and cooperation. The results of this phase are the inputs to develop the conceptual model. Afterwards, the model is refined during phase two to obtain the risk sharing framework. Then, the framework is validated during phase three.

2.1. Phase one: X & Y

Phase one includes both theoretical and empirical approach. The objective of this phase is to develop a conceptual model that supports the investigation of how risk sharing (X) can be designed to impact cooperation (Y). A model is a logical representation of a system, process, phenomenon, in short, “*models are approximations of the real world*” [Sokolowski and Banks, 2010]. In particular, a conceptual model “*consists of a set of assumed causal relationships between the core concepts of a research project*” [Verschuren et al., 2010].

The first step is to conduct a desk research to outline the latest theories regarding risk sharing and cooperation in infrastructure projects. However, one limitation of the literature study is that the researcher is likely to have a biased perspective on the research material [Verschuren et al., 2010]. Furthermore, the literature on both topics is likely to be extensive and diverse. The empirical approach can mitigate the researcher’s biased interpretation of literature and provide more focus on the context of PPP infrastructure projects in the Netherlands. The interaction between the results of the literature review and the findings of exploratory interviews and document review are illustrated in figure 2.1. The contractual and relational elements identified in the literature are not included in the model if they are already part of the current practice and are considered by respondents to be effective in promoting cooperation. On the contrary, elements are included in the conceptual model if they are absent in current and prescribed practice or are considered by respondents to be insufficiently implemented. Further investigation is conducted when elements are prescribed but not applied in practice. At the end of this phase, the information collected contribute to answer the sub questions:

1. *What is the current understanding of risk sharing from a theoretical and practical perspective?*
2. *What are the contractual and relational elements that impact cooperation between public and private partners?*
3. *Which contractual and relational elements can be added to the current risk sharing to promote cooperation?*

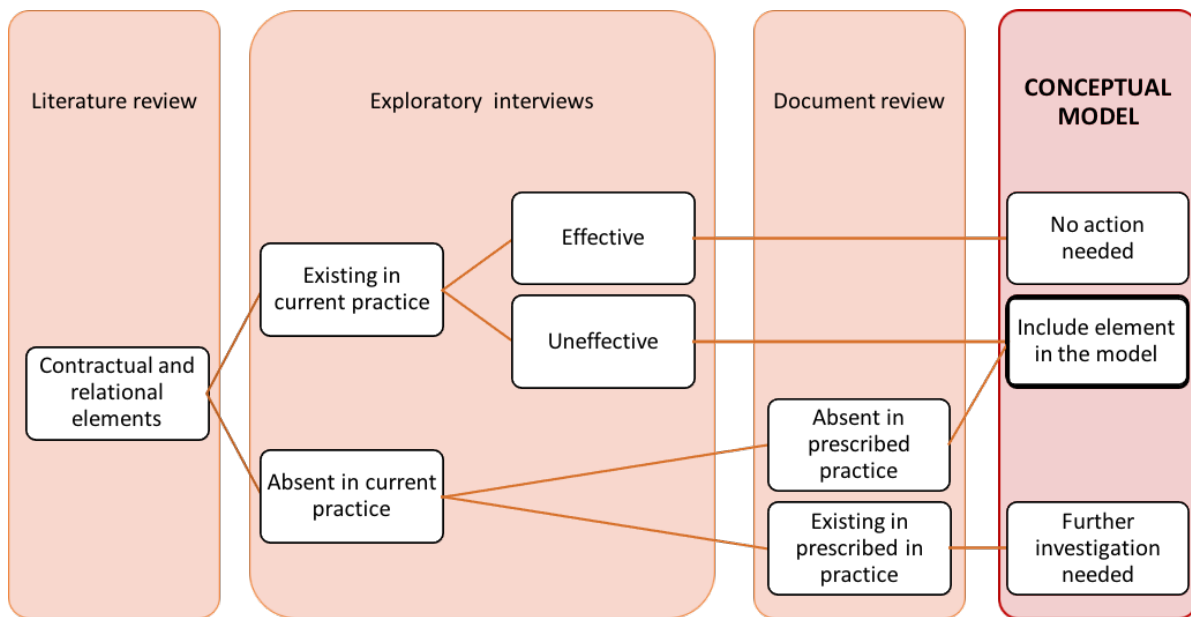


Figure 2.1: Process to select contractual and relational elements to be included in the conceptual model

2.1.1. Literature review

The concepts of risk sharing and cooperation are broad and can be investigated from different perspectives. The purpose of the literature review is to break down these two large concepts into their smaller, more 'tangible' aspects that can be included in the conceptual model. The literature review is based on the documents collected from Scopus and ResearchGate which include a large amount of peer-reviewed literature. The research is also extended to the university repository. The first step is to collect relevant literature through the use of key words related to the research question, objective and scope, initially used on their own and, then, combined. The key words utilized are:

- Public-Private Partnership
- Risk Management
- Risk sharing
- Risk allocation
- Collaboration
- Cooperation
- Project success
- Contracting
- Governance mechanisms

Table 2.1 illustrates the combinations of key words that are used.

'Collaboration' OR 'Cooperation' AND 'Risk management'
'Collaboration' OR 'Cooperation' AND 'Risk allocation'
'Collaboration' OR 'Cooperation' AND 'Risk sharing'
'Collaboration' OR 'Cooperation' AND 'Project success'
'Collaboration' OR 'Cooperation' AND 'Governance mechanisms'
'Collaboration' OR 'Cooperation' AND 'Contracting'
'Public Private Partnership' AND 'Risk management'
'Public Private Partnership' AND 'Risk allocation'
'Public Private Partnership' AND 'Risk sharing'
'Public Private Partnership' AND 'Cooperation'
'Public Private Partnership' AND 'Risk sharing' AND 'Cooperation'
'Public Private Partnership' AND 'Project success'
'Risk sharing'
'Risk' AND 'Sharing'
'Risk sharing' AND 'Project success'
'Risk sharing' AND 'Governance mechanisms'
'Risk sharing' AND 'Contracting'

Table 2.1: Combination of key word(s) used to search literature

The initial search produces thousands of results, including articles, conference paper, reports, books, working paper, master thesis and doctoral dissertations. Then, a selection is made based on the content of the abstract, number of citations, year of publication and field of application. Journal articles are preferred because of peer review. Nevertheless, the review also includes working papers, reports, surveys, conference proceedings, master and PhD thesis. The majority of the reviewed working and papers and reports in the context of PPP is published by OECD (Organisation for Economic Co-operation and Development), EIB (European Investment Bank), EPEC (European PPP Expertise Centre part of EIB) and IMF (International Monetary Fund). The review focuses mostly on papers discussing European PPP infrastructure projects although papers that refer to a different context (ex. cooperation in R&D development, supply chain risk sharing, etc.) are also considered. The preliminary review includes 137 documents excluding the material obtained from the university repository. The majority of the articles are published in the "International Journal of Project Management" while most of the reports and working papers are published by the European Investment Bank. The articles are mostly related to the following subject areas: "Engineering", "Economics, Econometrics and Finance", "Social Sciences", "Business, Management and Accounting" and "Environmental Science". Many of these articles are related to the topics of this research and offer remarkable insights but, given the research objective, their applicability is limited. Hence, the final review includes approximately 50 documents from different types of literature. However, only 29 of these provide insights that contribute to the purpose of the literature review and, especially, to the development of the conceptual model. The remaining literature does not discuss specific aspects of the two core concepts but it is used to support the overall research argumentation.

2.1.2. Exploratory interviews

The purpose of the exploratory interviews is to clarify the concept and practice of risk sharing because the literature does not provide sufficient insights to clearly address this topic. Furthermore, the aim of this activity is to verify whether the influence on cooperation of the elements identified in the literature holds in practice and to identify aspects that may have been overlooked in the theory. Interviews with colleagues are expected to provide a description of how risk are shared in practice and in which circumstances. Considering the available time for the interviews and the technical profile of the respondents, the theoretical aspects need to be clustered and elaborated into objects that are part of the common practice. Respondents are encouraged to provide additional information when they consider it to be necessary regardless of the object of the question. Each interview lasts around 60 minutes, is recorded and, then, transcribed. Interviews are conducted in different WitteveenBos offices according to the location of the respondent. The interviews are semi-structured and based on open questions. Some questions are added to the initial set according to the results of the previous interviews. The interview protocol is divided in four sections and is reported in Appendix A . The

purpose of the first section is to obtain general information about the context and generic indications about the degree of uncertainty and complexity of the projects. This information does not have intrinsic value but are useful to analyse the rest of the data. The second section is designed to identify what type of risks are considered to be relevant and recognize patterns that may suggest which criteria are used. The third section provides indications about the current organizational (client and contractors) attitudes with regards to risk sharing and cooperation. In general, these five questions are meant to assess the implicit balance between contractual and relational elements without going into the specific aspects of each category. This suggests whether the current practice is more oriented towards a formal or informal approach. Furthermore, these questions may highlight risk sharing mechanisms that are applied in practice but are not mentioned in the literature. Finally, the fourth section describes the personal attitude of the respondents and may suggest space for improvement. Unforeseen events and conflicts are mentioned on purpose because, according to the theory, decisions and behaviours showed in these critical circumstances are particularly significant for the concepts under investigation. The questions are designed in order to get the most out of the respondents in the time available and given their profile but, most importantly, to reduce the influence of the wording on the answers.

2.1.3. Documentation review

The purpose of the documentation review is to verify whether the recommended practice describes different measures or procedures compared to the theory and the common practice. A second review takes place after phase two in order to check potential correspondence between practitioners' suggestions and prescribed practice. The documentation review is based on the documents available in the WitteveenBos' library and the NEN portal (collection of national and international standards) to which WitteveenBos provides access. 'Risk management', 'risk sharing' and 'cooperation' are the keywords used to run the search for relevant documents. In the second round, the research criteria are extended to more keywords resulted from the analysis of the practitioners' interviews. The additional keywords are 'communication', 'interactions', 'team functioning', 'contract management', 'coordination', 'leadership'. Most of the documents are provided in Dutch and, consequently, need to be translated. Afterwards, these are read integrally and the contents that directly or indirectly refer to the keywords are highlighted and transcribed. The results are then compared with theoretical contents and common practice in order to highlight correspondences or differences. The first step is to conduct a search using key words in order to identify relevant documentation. They key words are related to the aspects identified in the literature study. However, as in the case of the interviews, the theoretical aspects are translated into items that are part of the terminology commonly used in practice. The following key words are used:

- Risk management
- Risk sharing
- Risk allocation
- Risk assessment
- Collaboration
- Cooperation
- Contract management
- Relationship management
- Communication
- Personal attitude
- Organizational culture
- Informal meetings

The initial search produces twenty-five results, the full list is reported in Appendix B. These documents are scanned to identify contents that may be related to the topic of this research. If there is, at least, one subject that is significant to the discussion on either risk sharing or cooperation, the document is included in the final review. Following the preliminary evaluation, the following documents are analysed and discussed:

- **WitteveenBos' Quality Manual** (Appendix C) updated in the late 2018. It describes how project-related and other activities should be carried out at the company.
- **WitteveenBos' Project Management Handbook** (Handboek Projectmanagement) (Appendix D) updated in the early 2017. The project management manual is complementary to WitteveenBos' quality manual. The aim of the Project Management Handbook is to provide a framework for project management in all projects.
- **WitteveenBos' guidelines for communication** (Leidraad communicatie) (Appendix E) updated in the mid-2014. It emphasizes the role of communication with the environment in the context of relationship management.
- **WitteveenBos' step-by-step plan for customer specification** (Stappenplan klanteisenspecificatie) (Appendix F) updated in the early 2017. This plan describes the work processes that are followed to collect, honour and validate customer wishes. The purpose of the KES is two-fold, on the one hand it forms the input for the further specification / design process and, on the other, it forms the basis for accountability to the stakeholders.
- **WitteveenBos' note about teamwork** (Appendix G) released in the mid-2016. The note shows the importance of teamwork, key aspects of team functioning, how team functioning can improve, which tools are available and who provides advice and support.
- **WitteveenBos' note about collaboration in the Afsluitdijk project** (Appendix H) taken from the WitteveenBos's chapter "Teamwork and collaboration" from the project management plan developed for the Afsluitdijk project. The chapter illustrates the company's vision of effective cooperation and the ambition for the client and contractor collaboration.
- **Rijkswaterstaat's Construction and Maintenance Work Guide** (WWAO) (Appendix I) was released in 2013 but, the version examined was update at the end of 2016. It describes the project implementation process in Construction and Maintenance contracts. It is an instrument that is intended for everyone who works at Rijkswaterstaat on and for Construction and Maintenance projects. The standards from the WWAO (process steps and frameworks) are mandatory. But, where the project situation is so specific that it does not comply, deviations are allowed after the client's permission.
- **Rijkswaterstaat's Interface Management guideline** (Appendix J) first version was released in 2011. This document provides a guide for making interfaces more manageable and is part of the method description for Systems Engineering. This guide is primarily intended for technical managers, environmental managers in the management of complex interfaces between systems both externally and internally in the system under consideration.
- **ISO Risk Management Guidelines** (ISO 31000) (Appendix K). The version reviewed was the second one and was released in 2018. This document outlines principles, framework and process that are the foundations of efficient, effective and consistent risk management. The application of these guidelines is not industry or sector specific and, therefore, can be adapted to any organization and its context.

The prescribed practice described in these document is not case specific but provides general indications. The only document that provides case-specific indications is the WitteveenBos' note about collaboration in the Afsluitdijk project.

WitteveenBos' documents describe the organization of the processes required to supply the consultancy services. In short, these documents refer to internal practices and procedures that WitteveenBos' employees should follow when performing their tasks. Nevertheless, it can be reasonably expected that WitteveenBos promotes its own way of working and, consequently, the advices provided to clients reflect the same guidelines and procedures implemented within the organization. The cooperation with the market is not the main theme described in the guidelines of Rijkswaterstaat. The purchase of services and work from engineering firms, contractors and other parties is only described as one of the subprocesses within Rijkswaterstaat. However, it can be expected that practices and procedures included in these guidelines provide significant information on the way of working of Rijkswaterstaat. The ISO guideline is the most objective because it does not consider specific parties or relationships. On the other hand, it is also the most generic and, consequently, detailed descriptions or suggestions are not found. The full description of the contents of these documents can be found in the Appendix.

2.2. Phase two: Trial run

Phase two involves gathering and analysing empirical data. The results are expected to indicate restrictions to the application of the proposed risk sharing mechanisms in practice and key aspects that must be promoted. Furthermore, the discussion is expected to provide further information about the ideal risk sharing practice. The aim of the discussion with practitioners is to refine the proposed risk sharing mechanisms included in the conceptual model and obtain detailed measures that form the framework. Frameworks provide general guideline that organizations can adopt to achieve a certain objective. The absence of specific steps in a precise order results in some degree of ambiguity in frameworks. On the other hand, this creates rooms for flexibility and creativity. These characteristics make a framework the most suitable outcome given the exploratory character of this research. The proposed framework guides the parties in the design of risk sharing but, at the same time, allow them to deviate from it and adapt to the specific circumstances. In this phase, the empirical data are collected through semi-structured interviews. Semi-structured interviews are based on a set of predetermined questions to be used. However, this does not prevent the opportunity to ask further questions based on the direction of the conversation. This type of interviews allows some comparison between respondents, without neglecting their personal insights. The subjective nature of the interview and the analytical character of the information collected through open-ended questions require qualitative analysis of the results. Quantitative analysis can be applied as well but an in-depth description that emphasizes the full meaning of the observations is a better option considering the kind of answers that are sought [Borrego et al., 2009]. Therefore, when interviews are concluded, contents are analysed through coding of transcripts in order to identify relevant concepts or ideas [Flynn et al., 1990]. The results of this phase should contribute to answer the sub questions:

- 4 *Which measures can be developed, based on the current practice, to enhance the effect of risk sharing on cooperation?*

2.2.1. Discussion with practitioners

The choice regarding the structure of the discussion and the form of the questions results from the degree of uncertainty of the information used as inputs. At this point, the information collected is still too generic or uncertain to conduct more structured interviews. Furthermore, the 'open' setting may allow to obtain information that would not have been collected with more detailed or closed-ended questions. The discussions last around 75 minutes and are conducted between June 2019 and July 2019 in the locations designated by respondents. The discussions are recorded with the permission of the interviewees and, then, transcribed. First, respondents are asked to introduce themselves. Then, three points are discussed in the following order:

1. the concept of risk sharing;
2. the proposed risk sharing mechanisms;
3. the impact of risk sharing on cooperation.

One open-ended question is formulated for each point. Prior to the second question, respondents are given a description of the proposed risk sharing mechanisms and, then, are left free to discuss what they consider to be more relevant. The first question is about the respondent's perspective on risk sharing. The purpose of this question is to further elaborate the practical perspective on risk sharing including the point of view of organizations that are directly implicated in it. The second question is about the proposed risk sharing mechanisms. A concise explanation is provided to respondents that are, then, left free to discuss what they consider more significant and relate to their experience. The aim of the second question is to assess the applicability of the proposed risk sharing mechanisms and identify similarities and differences with the current practice. The third question is about the effect of the proposed risk sharing mechanisms on cooperation. The reason for this question is to verify whether the proposed mechanisms can actually stimulate the development of cooperation.

2.2.2. Analysis of the results

The information sought may be concealed by the characteristics of the sources and the setting of the interviews. The different profile of the organizations, the personal attitude and experience of respondents and the formulation of the questions do not ensure uniformity in the answers. This is why the transcriptions are analysed through the qualitative method of coding. The coding method allows to identify similarities and

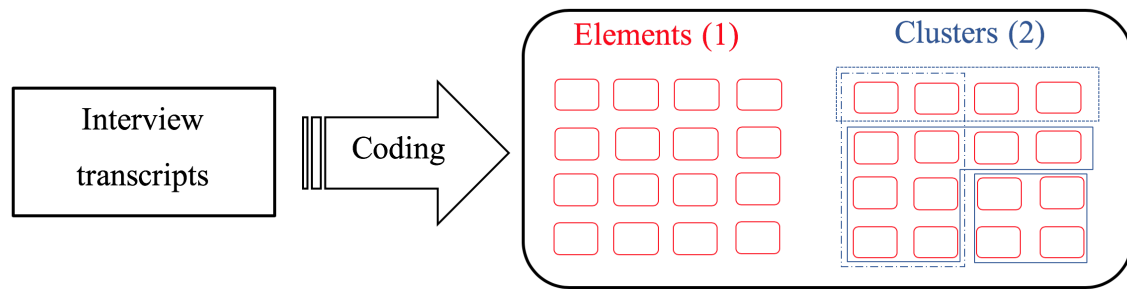


Figure 2.2: Schematization of coding process

contrasts among the different sources regardless of their wording. Most importantly, this method gives the opportunity to identify and critically discuss the true meaning of the answers given by respondents. It is not a simple data reduction process but it is a method to stimulate and facilitate qualitative analysis, it is a way to access a deeper level of information that is not be accessible with a simple review.

Each code is described by a label which synthetizes the content of one or more passage of data and reflect the meaning given by the researcher [Bazeley, 2014]. Coding usually goes through two main stages (figure 2.2), the first, called 'open coding', involves elements identification and labelling and the second, called 'focused coding', refers to interpretation and clusters development [Miles and Huberman, 1994]. The first stage ends when new elements cannot be easily identified. The second stage involves processing and interpreting elements in order to identify patterns and relationships between them. The outcome of the second stage are broader categories, called clusters, that unlike elements are more analytical than descriptive [Bazeley, 2014]. Theoretically, coding is exhaustive when all events can be easily categorized, each code is fully developed and all possible variations are identified [Bazeley, 2014, Miles and Huberman, 1994]. This, however, may become a never-ending process. Hence, the degree of coding is based on subjective considerations and, according to the literature [Bazeley, 2014, Miles and Huberman, 1994, Saldana, 2016], depends on the purpose of the analysis and the available resources.

The approach in this case is to develop first a code base based on literature and key words identified in the exploratory phase. The code base is extended with codes created while working. The labels generation is not completely indiscriminate but it is primarily performed in relation to the aspects that are significant to the context of this research. In particular, the coding applied in this research is developed based on the awareness of the crucial role of people in the investigated relationship. Consequently, the analysis of the interviews focuses, especially, on statements and opinions that are associated to personal attitudes. The theory on coding describes two main stages. These two stages comprise different activities that can be performed in different ways based on the style and resources of the coder. In this case, the coding is divided in four activities and executed manually with the support of Word and Excel.

- *Create a code base*

In this activity, a preliminary list of codes is created based on key words that are collected from the research question and objective, the findings of the literature study and the results of the exploratory phase. This helps to identify parts of the transcripts related to important aspects of the research and facilitate the comparison with previous findings to highlight differences or similarities. This activity is performed on paper by recording next to the passage which aspect (s) can be related to it.

- *Open coding*

The previous activity also serves as first screening. In addition to making notes about preliminary aspects, observations about new ideas and concepts are also recorded. The second screening is more focused and less bounded to previous ideas. It consists in reading the transcripts line by line and formulating one or more labels for each element identified in each row. This activity is also done on paper and, consequently, it is time consuming. On the other hand, it allows to 'reduce' the transcripts to basic thoughts and opinions.

- *Codes revision and codebook creation*

At this point, connections with previous findings and new observations result in a extensive list of el-

ements. Further reading of transcripts and remarks is required to reduce the number of elements and formulate labels (the existing labels can also be used) that capture the meaning of similar aspects. Furthermore, the value of each element is determined based on the contribution to the research question. Elements that are not significant to answer the research question are deleted. The results of this selection are reported into a codebook where each entry is designated by specifying an exact definition, boundaries for its use and an example of a passage that is associated to it. When the codebook is completed, this can be used to check whether the identified elements can comprehensively summarize all the messages contained in the transcripts. If the revision highlights blank spots, additional element can be added to the codebook. The elements are transcribed in a Word file, where all the passages that refer to that label are reported. This facilitates later analysis.

- *Clustering*

The elements included in the codebook are reported and sorted in Excel. Each element is associated to the source, the location within the transcript, in which question it is mentioned and a short note to clarify the content of the coded passage. This is needed to quickly retrieve labels and related information. Analysing the statements associated to each element it can be noticed that specific phenomena recur. These phenomena refer to patterns that are similar across the different sources. The identification of these patterns results in the definition of clusters that include elements that can be associated to them. These clusters are labelled following a similar process to the one performed to label elements. Hence, initial labels are formulated and revised until the identified clusters can contain all identified elements. It is important to specify that elements can be found in more than one cluster because it is often the case that one element can refer to different patterns. The following example explains the rationale used in the coding process. This passage is taken from an answer to the third question:

“What the industry and the government often forget is that cooperating in a PPP is a bit like being friend with somebody because you are in it together for quite a long time and you are very much dependent on each other. The government cannot have success with a private party somewhat satisfied and vice versa.”

The quote *“The government cannot have success with a private party somewhat satisfied and vice versa”* signals that satisfaction of both parties is needed. Therefore, this is labelled ‘Balance’. On the other hand, the same quote implies dependency between success and parties’ satisfaction. Consequently, the same quote is also labelled ‘Interdependency’. The line *“What the industry and the government often forget is that cooperating in a PPP is a bit like being friend with somebody”* can imply two things. First, it may be argued that parties do not cooperate sufficiently because they ignore the fundamental nature of cooperation. This is labelled ‘Limited perspective’. On the other hand, this passage suggests that cooperation, as well as friendship, is a two-way commitment. Thus, the label ‘Reciprocity’ is also attached to this reference. The labels described so far refer to the elements associated to this part. However, the same logic is followed to formulate labels that refer to clusters. For instance, the element ‘Limited perspective’ is included in the cluster ‘Negative attitude’. The label ‘Negative attitude’ refers to elements that, according to the interviewees, can raise the ineffectiveness of the process, hamper decision making and damage cooperation between actors. In the case of ‘Limited perspective’, the parties’ mindset can be considered as one of the factors that prevent cooperation from developing.

2.3. Phase three: Hurdles

Phase three involves the validation of the proposed framework resulted from phase two. Validation refers to a process to assess whether the proposed framework satisfies the requirements of its intended users and complies with applicable regulations. Therefore, the validated framework includes measures developed according to the users’ need and are not in conflict with the boundary conditions of the process. The validation is organized through a meeting with experts from the WitteveenBos. Independent analysis of consensual experts that are familiar with the topic under study can improve the validity and reliability of findings [Brink, 1993]. In this research, the viewpoint of WitteveenBos is relevant because they are aware of the different standpoints and working methods of both client and contractors. The discussion and comments that result from this phase are expected to provide sufficient insights to answer the sub questions:

5 *To what extent are the proposed measures applicable in practice?*

2.3.1. Validation

The purpose of validation is to assess the applicability of the proposed framework and to identify obstacles to its implementation. The meeting is designed to observe individual remarks as well as interactions between experts. First, the research is introduced and, then, each recommendation is presented and discussed. Experts are expected to discuss the applicability of the proposed measures and indicate whether these are already in place. Finally, the framework is adapted to the comments received during the validation.

The framework is qualitatively validated through a discussion with two employees of WitteveenBos that are familiar with research. The meeting took place in the Amsterdam office of WitteveenBos. The first validator is part of the 'risk management and contract advice' group within the Construction Management PMC and he has been working at WitteveenBos for almost five years. The second validator is the manager of the WitteveenBos Amsterdam office. He has been working at WitteveenBos for over twenty years and is an expert in procurement, integrated contracts and strategic advice on building processes and building organizations. The validators are provided with the framework prior to the validation in order to familiarize with the contents. A presentation is given to provide an overview of the research and, then, to explain the measures one by one. After each measure, participants are left free to discuss the content and rationale. Finally, the following questions are asked to them:

- 1 *In your opinion, would WitteveenBos and/or its clients be willing to invest in the implementation of any of these measures?*
- 2 *Has any of these measures already been implemented (even partially)?*
- 3 *What would you add to the framework?*

2.4. Intermediate conclusions - Methodology

The research design is articulated in three phases (figure 2.3). The first phase (**X & Y**) aims to gather the necessary information to elaborate the conceptual model. This information is collected through literature review, exploratory interviews and documentation review. The conceptual model is the output of phase one and the input of phase two. In the second part (**Trial run**), the proposed mechanisms are discussed with practitioners. The answers provided during the discussion are recorded and qualitatively analysed through coding technique. The results of phase two are integrated with insights from additional literature and document review and are used to refine the proposed mechanisms into detailed measures that form the risk sharing framework. The output of phase two is the input of phase three (**Hurdles**), during which the proposed framework is validated with experts. The remarks obtained during this stage allow to further refine the measures according to the boundaries of the current practice and organizations' culture.

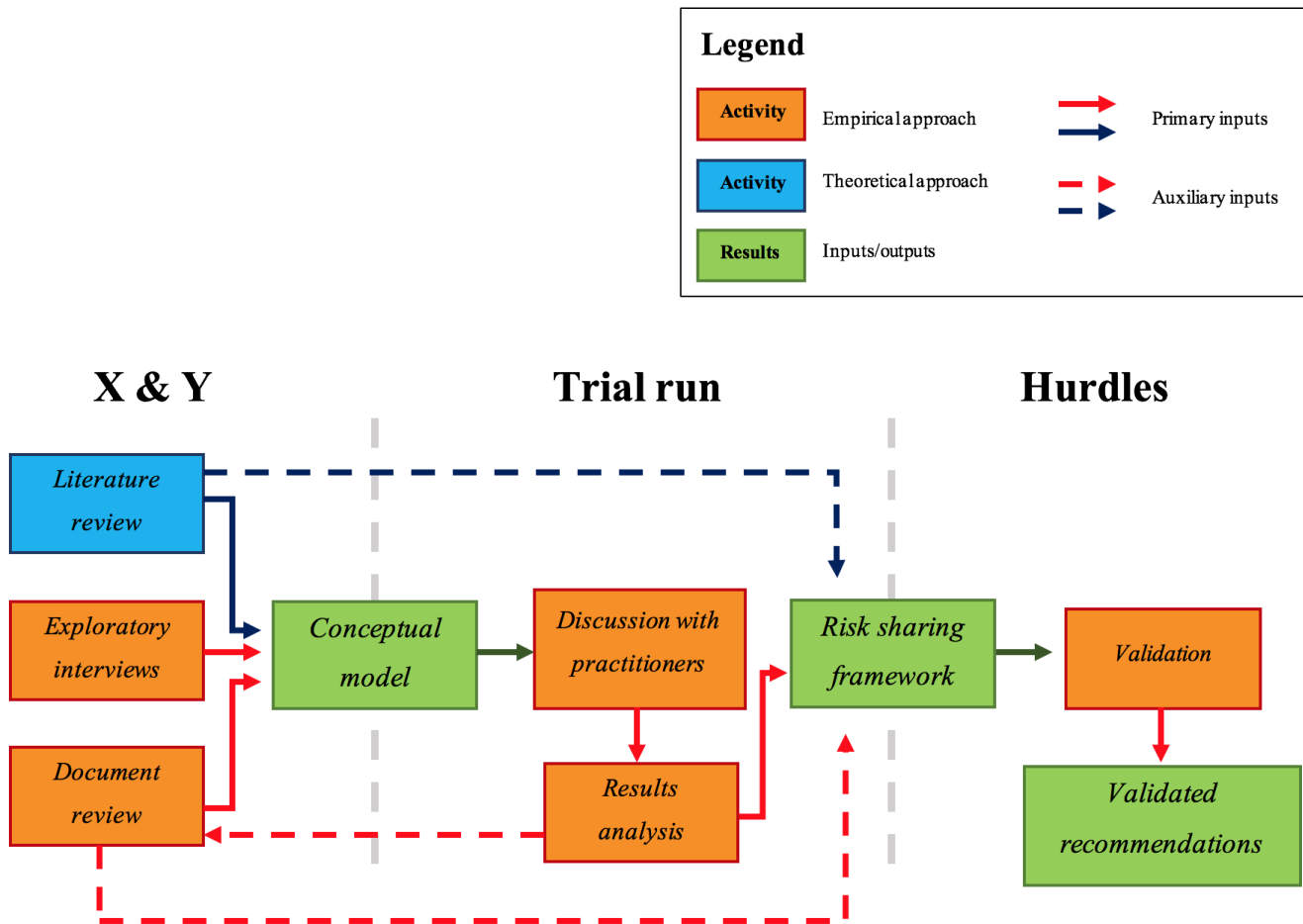


Figure 2.3: Overview research methodology

3

Literature Review

In this chapter, the theoretical perspective on risk sharing and cooperation is analysed and discussed. First, the scientific papers utilized to develop the conceptual model are classified according to research type, applied methods and subjects discussed. Then, the significant contents found in the reviewed papers are analysed and critically discussed to highlight aspects that are used to develop the conceptual model.

3.1. Papers classification

Several topics are discussed in the literature: contracting, cooperation, knowledge sharing, success factors, success criteria, risk sharing, target cost contract, organizational culture, trust, etc. The first grouping is made according to closeness of the main content(s) of the papers to either risk sharing, cooperation or both. Fur-

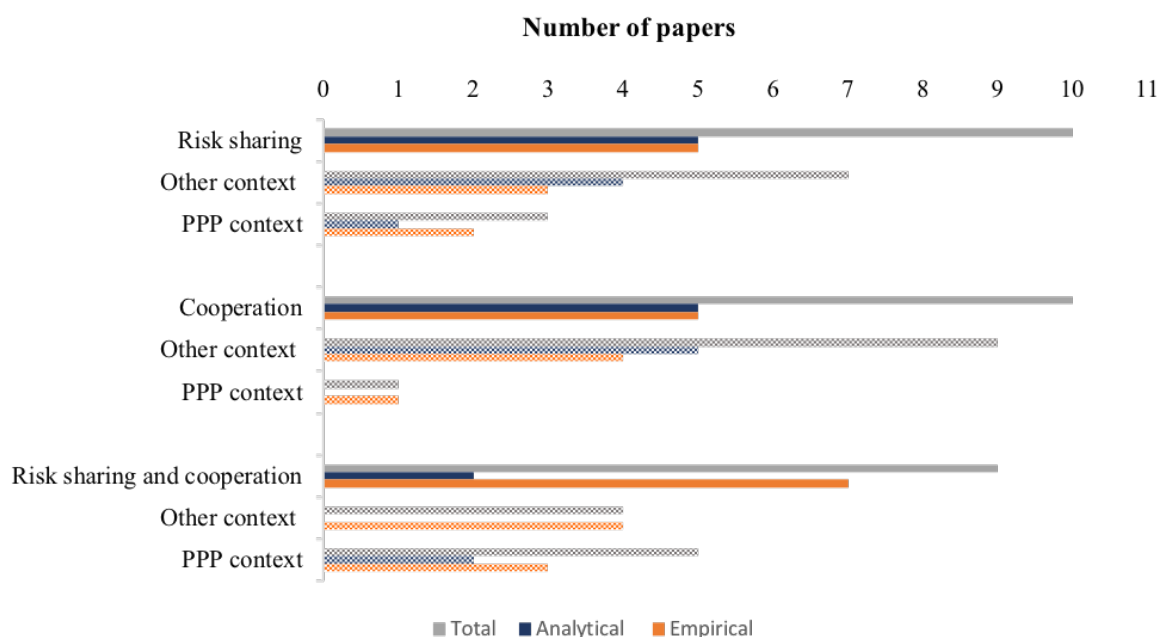


Figure 3.1: Papers classification according to content(s), context and research strategy

thermore, each category is distinguished based on the context: PPP or different kind of arrangements that do not involve partnering. The reviewed papers often include a combination of analytical and empirical methods. It is decided to classify a document as empirical if the author(s) make use of, at least, one method that involves direct collection of empirical data (survey, interviews, etc.). Studies that make use of documentation review and mathematical or statistical modelling but do not involve collection of primary empirical data are considered analytical. Analytical methods applied in the examined literature are documents and litera-

ture review, mathematical modelling, theory development, statistical analysis. These methods are grouped in two macro categories, conceptual and mathematical. These categories are not mutually exclusive and it is common to find mixed methods. The purpose of this categorization is to indicate whether the paper makes a larger use of knowledge from scientific literature, project documents, etc. or mathematical and statistical models. Collection of empirical data in the examined literature is performed through case study, survey, interviews. It is not unusual to observe a combination of these methods. However, papers are classified according to the method used to gather raw data rather than the ones used to confirm or further clarify findings. As a result, methods used in the empirical papers are categorized in case study, survey and interviews. One

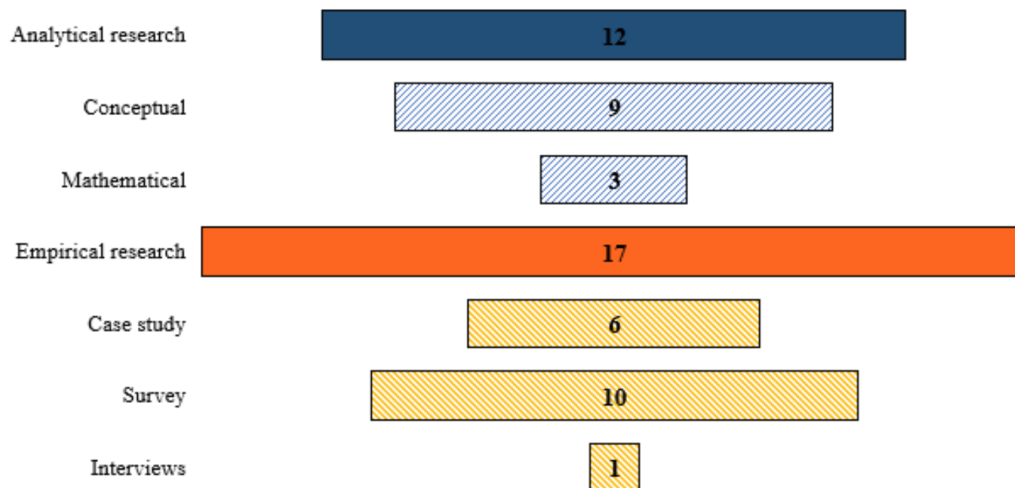


Figure 3.2: Papers classification according to content(s), context and research strategy

significant feature is the utilization of specific theories in these papers. The following theories are the most mentioned: agency theory, transaction cost theory (TCT, also referred to as transaction cost economics), behavioural motivation theory, social exchange theory (SET), relational exchange theory (RET), structural role theory, socio-legal theory.

3.2. Steering cooperation

This research considers cooperation in the context of Public-Private Partnership (PPP) where different organizations pursue their own objectives within the common scope of the project. As a result, achieving effective cooperation among heterogeneous participants whose objectives may be different and, sometimes, even conflicting is challenging [Fu et al., 2015]. In a cooperative network such as PPP, cooperative behaviours usually refer to synergies that contribute to advance shared objectives [Koops, 2017]. Fu et al. [2015] investigate the interaction of contractual incentive and trust in promoting inter-organizational cooperation which they propose as a multidimensional concept and distinguish between task and relational behaviours. The authors use a three-staged Stackelberg model, a strategic game in which one firm moves first and then the follower firms move sequentially, to simulate the dynamic interaction between the client and contractor as illustrated in 3.3. Then, they solve it by backward induction to get the optimal behavioural decision-making equilibrium. According to the authors, task behaviours refer to fulfilment of obligations, as stipulated in the contract in order to generate economic benefits. Relational behaviours refer to voluntary and mutual assisting behaviours that are not part of the role requirement and aim to develop a long-term trustworthy relationship.

Das and Teng [2001] claim that inter-organizational cooperation is influenced by parties' perception of relational and performance risk. They describe the former as the perception that partners may pursue their own interest at the expense of the others. The latter refers to the perception that partnership targets may not be achieved due to partners' poor business performance.

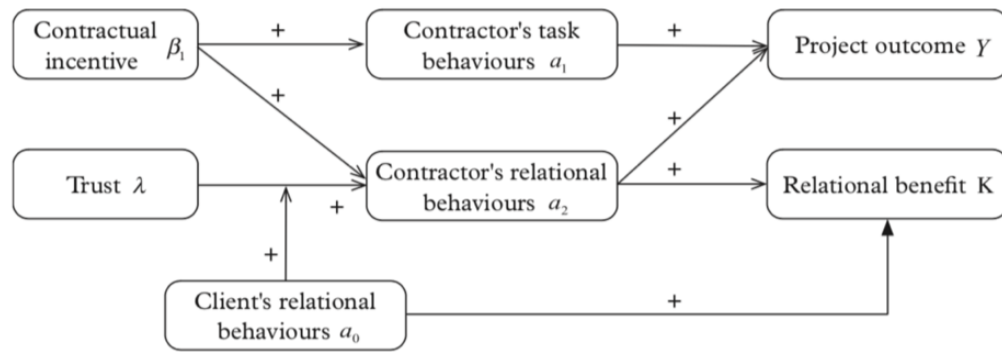


Figure 3.3: Interaction of contractual incentive and trust in promoting inter-organizational cooperation, retrieved from [Fu et al., 2015]

3.2.1. Communication and informal interactions

O'Brien [1968] argues that communication supports the development of new informal relationships and cooperation must be supported by these. Fu et al. [2015] claim that the client willingness to promote informal moments is a demonstration of cooperative behaviours. The contractor reacts to the client's initiative by increasing relational behaviours. Hence, informal moments can directly stimulate cooperation and, moreover, give the opportunity to communicate and develop new interpersonal relationships.

3.2.2. Personal attitude and organizational culture

Gadde and Dubois [2010] recommend that evaluation of project success should be less centered around project performance and prioritize criteria that promote interaction and relationship-building over time. However, the results of Koops [2017] show that Dutch public managers, including those who value cooperation, do not endorse this vision. Therefore, Dutch public clients are not expected to actively invest in cooperation. According to Koops et al. [2016], the perspective on project success and, consequently, managers' efforts and attentions is the result of personal attitude and organizational culture.

3.2.3. Contractual and relational elements

"Legal safeguards" [Lui and Ngo, 2004] refer to effect of contractual elements on inter-organizational cooperation. The presence of formal rules that clearly stipulate the responsibilities and obligations of both parties, including outputs, monitoring procedures, etc., is considered to be a safeguard mechanism against opportunism and conflict [Cao and Lumineau, 2015, Lui and Ngo, 2004]. The control function refers to the power of imposing penalties [Lui and Ngo, 2004] on partners in the case that these are unwilling or incapable of fulfilling what agreed [Malhotra and Lumineau, 2011]. One tangible example is financial incentives, contractual clauses that establish how parties share pains and gains [Malhotra and Lumineau, 2011]. The coordination function refers to those terms designed to mitigate the risk that misinterpretations give rise to conflicts which may deteriorate collaboration between well-intentioned parties [Malhotra and Lumineau, 2011]. Coordination provisions are needed to align parties' different expectations and efforts [Fu et al., 2015]. As a result, this function is effective in mitigating the risk of opportunistic behaviors and coordination failure [Malhotra and Lumineau, 2011]. Onishi et al. [2002] argue that contracts can only give rules to address unforeseen event but cannot provide specific responses. These rules are part of the adaptation function of contracts (can be referred to as contingency adaptability) [Fu et al., 2015]. When this function is properly designed, it contributes to mitigate the risk that arises from strategic behaviour of parties [Onishi et al., 2002], commonly referred to as opportunism.

"Social control" [Cao and Lumineau, 2015] refer to the effect of relational elements on inter-organizational cooperation. The most cited relational elements are trust and relational norms. Relational norms, or "informal rules of social exchange" [Benítez-Ávila et al., 2018], refer to shared expectations about parties' values and behaviors. Examples of these norms are flexibility, information exchange, solidarity harmonization of conflict and restraint in the use of power. These norms create an informal framework that suggest how parties should behave [Cao and Lumineau, 2015] and, consequently, can reduce the risk of opportunism through peer pressure and social sanctions [Fu et al., 2015]. The operation of relational norms aims at reducing differences among partners and promoting appropriate behaviors while, at the same time, fosters a trust breeding

organizational environment [Das and Teng, 2001].

The control function of contracts and goodwill trust both reduce opportunism. However, excessive emphasis on control hinders the development of goodwill trust [Malhotra and Lumineau, 2011] and may conflict with the preference of more 'cooperative' parties that use contracts in a more 'flexible' way [Cao and Lumineau, 2015]. Frequent interactions can help to reduce the perception that contract is used as control mechanisms and, therefore, as a signal of distrust [Cao and Lumineau, 2015]. Furthermore, control as well as trust development implies costs. Greater control function is needed in the case of a relationship with a new partner where trust will be likely based on competence [Lui and Ngo, 2004]. When goodwill trust exists, the coordination function of contract can prevail. This function is compatible with trust development, contribute to reduce opportunism and, furthermore, decrease the risk of coordination failure [Fu et al., 2015]. This function can be particularly useful when dealing with unforeseen circumstances, when the occurrence of opportunism and conflicts is more likely.

In conclusion, contractual and relational elements have different effects on cooperative behaviours but, overall, are considered to promote inter-organizational cooperation [Benítez-Ávila et al., 2018, Fu et al., 2015]. However, construction contracts are unavoidably incomplete and are not sufficient to address unexpected circumstances [Cao and Lumineau, 2015]. When unforeseen circumstances arise, this is likely to give rise to episodes of opportunism which damage cooperation. On the other hand, relational elements are based on a '*over-socialized view of human action*' [Fu et al., 2015], are time and resources consuming and increase parties' vulnerability. According to Fu et al. [2015], trust, in particular, is fragile and can lead to 'lock-in' situations. Project managers are the interfaces between organizations, they interact daily and are aware of the cooperation process [Lui and Ngo, 2004]. Success of inter-organizational cooperation depends on the managers' approach, whether it is contractual or relational oriented [Cao and Lumineau, 2015] and their ability to evaluate and balance pros and cons of both elements.

3.2.4. Enhanced participation

According to Albalade et al. [2015], when insufficient guarantees and incentives are provided, the likelihood of renegotiations increase and, although, these are inevitable it is appropriate to keep their occurrence to the least. Therefore, the authors claim that risk sharing should aim at avoiding opaque renegotiations. Sarmiento and Renneboog [2016] suggest to address issues that may trigger renegotiations ex ante (i.e. before execution) and deal with them in a balanced way. Ham and Koppenjan [2001] argue that market forces should already be involved during project definition in order to benefit from their expertise, resources etc. More discussion between project participants [Sarmiento and Renneboog, 2016], participatory decision making [Das and Teng, 2001] and early involvement of market parties [Ham and Koppenjan, 2001] can be clustered and classified as enhanced participation. On one hand, this can improve the contracting process and, therefore, reduce information asymmetry [Cao and Lumineau, 2015], support the adaptation [Onishi et al., 2002] and coordination function of contract and stimulate trust development [Cao and Lumineau, 2015]. On the other hand, this facilitate the development of relational elements [Benítez-Ávila et al., 2018, Cao and Lumineau, 2015, Das and Teng, 2001]. Although the participatory nature is an essential characteristic of partnership, alliances, etc. [Das and Teng, 2001] and clients advocate for more cooperation at the expense of competition [Gadde and Dubois, 2010], cultural and institutional differences between public and private parties, market conditions and the EU tendering regulations inhibit the development of these attitudes and behaviours [Ham and Koppenjan, 2001].

3.3. The risk sharing gap

The risk sharing mechanisms applied in the construction sector are mentioned in the literature as government guarantees [Wang et al., 2019], target cost contracts [Badenfelt, 2008, Broome and Perry, 2002, Chan et al., 2010, 2011, Laryea, 2016], contractual or financial incentives [Olsen and Osmundsen, 2005, Sánchez Soliño, 2014, Wamuziri and Seywright, 2005]. Risk sharing stimulates cooperation via contractual incentives because of economic rationality of actors [Fu et al., 2015]. However, Wamuziri and Seywright [2005] warn that incentives may increase the likelihood of renegotiations asked by contractor to renegotiate target cost. Furthermore, setting wrong incentive coefficient can have adverse effects on cooperation [Fu et al., 2015]. In particular, the presence of government guarantees may incentivize private partners to behave opportunistically in order to maximize profit [Wang et al., 2019]. The strength of incentives needs to be tailored to contractor's financial capacity, otherwise the client may have to compensate when contractors cannot cope with their liabilities [Olsen and Osmundsen, 2005]. According to Wamuziri and Seywright [2005], the benefit of contrac-

tual incentives can be enhanced more by accuracy in forecast of base estimate rather than elaborate sharing mechanisms.

The basic notion of risk sharing underlying this research comes from the economic literature [Ahrend et al., 2011, Cimadomo et al., 2018] and is that distinct entities share risk to protect themselves against adverse events. In the economic field, households, firms and the public sector spread risk through different mechanisms like cross-border borrowing, international diversified investment portfolios and fiscal transfers. These mechanisms involve sharing risk among different entities in order to reduce the occurrence or negative consequences of the risk event. However, in the reviewed literature [Charoenngam and Yeh, 1999, Lee et al., 2009, Onishi et al., 2002] the wording 'risk sharing' is used as a synonym for risk allocation or distribution.

3.4. Intermediate conclusions - Literature review

The findings of the literature review indicate that cooperation can be broken down into task and relational behaviours. Task behaviours refer to fulfilment of obligations, as stipulated in the contract in order to generate economic benefits. Relational behaviours refer to voluntary and mutual assisting behaviours that are not part of the role requirement and aim to develop a long-term trustworthy relationship. Personal attitude and organizational culture are considered to influence cooperative behaviours through the perspective on project success. Contractual and relational elements have different effects on cooperation. According to the theory, contracts serve as framework to indicate acceptable or desirable behaviours that are the basis for managers to develop relational rules for interacting and handling issues on a daily basis in the project. The literature distinguishes between the control, coordination and adaptation functions of contract. The most cited relational elements are trust and relational norms. The presence of informal moments can directly stimulate cooperation and, moreover, gives the opportunity to communicate and develop new interpersonal relationships. The influence of contractual and relational elements on cooperation can be increased by the development of enhanced participation. This is an abstract cluster formulated to combine and represent the suggestions of different authors with regards to improved discussion between project participants, participatory decision making and early involvement of market parties.

The results of the literature study highlight a gap with regards to the theoretical perspective on risk sharing. The use of the wording 'risk sharing' is ambiguous because it is used as a synonym for risk allocation or distribution. The other limitation found in the literature, perhaps related to the first issue, is the lack of criteria to assess whether a risk is eligible for sharing. There are articles that indicate which risks are or should be shared in construction projects, but, these refer to a specific case study or a broad source of risk without mentioning the conditions that underlie this choice. Considering the subject of this research, it is relevant to specify which risks are included in the analysis. Usually, this implies referring to well-known macro categories (e.g. construction risks) mentioned in the project management literature as in the case of some articles reviewed. However, the fact that the discussion on risk and related matters, in the context of construction projects, is limited to tangible and quantifiable risks can be considered another factor that contribute to the risk sharing gap. Hence, in this research, risks are considered to belong to the category of performance or relationship risks. This choice is motivated by the relevance of these two categories in relation to cooperation emphasized in the literature. Moreover, the nonspecific character of this classification gives the opportunity to elaborate a risk sharing framework without referring to specific circumstances. However, the most relevant issue is that risk sharing mechanisms in the construction sector only consists of contractual elements such as government guarantees, target cost contracts, etc. This kind of mechanism cannot be developed for any possible circumstance and, consequently, opportunistic behaviours that damage cooperation may occur when actual conditions differ from expectations. This raises the question of how much risk sharing can contribute to foster cooperation as long as it is limited to this mechanism.

In summary, cooperation is defined by task and relational behaviors that represent the dependent variable in the conceptual model. The current risk sharing design cannot be expected to stimulate cooperation. Therefore, the contractual and relational elements together with the other factors that influence cooperation identified in the literature are used to elaborate an alternative risk sharing design that constitutes the independent variable in the conceptual model. In the next part, interviews with colleagues and document review are expected to reveal if and to what extent these elements are significant in practice and provide additional information that can be used to elaborate the conceptual model in more detail.

4

Exploring the practice

In this chapter, the practical perspective on risk sharing and cooperation is assessed through exploratory interviews and documentations review. The results of these two activities are then analysed and discussed. First, the respondents of the exploratory interviews are introduced and the results are reported and discussed. The same is done for the documentations review. Then, this information is summarized and compared with the results of the literature review to develop the conceptual model which is explained in detail in the last part of the chapter.

4.1. Introduction

Contractual incentives are the only mechanism discussed in the literature associated to risk sharing. However, the literature argues that contractual elements are not sufficient to foster cooperation, particularly when dealing with unforeseen circumstances. This is particularly relevant in the context of PPP, where certain contractual incentives cannot be applied because the payment scheme is linked to availability of the asset and, therefore, finding other mechanisms becomes a necessary step in the pursue of cooperation. Hence, this part is designed to collect information that contribute to elaborate other risk sharing mechanisms. The design of this phase includes exploratory interviews and documentation review.

4.2. Exploratory interviews

The first activity involves unstructured interviews with employees of WitteveenBos. The aim of the interviews is to obtain a comprehensive description of the current approach to risks in PPP projects and compare it to the theoretical perspective. The results of the interviews represent to some extent the practical perspective on risk sharing. Moreover, these constitute a first indication of which theoretical aspects are present in the current practice and whether the implementation is satisfactory. These insights are needed to determine which aspects will be part of the conceptual model.

4.2.1. Respondents

Respondents are selected among the personnel working in the Netherlands based on their role within the company and experience in PPP projects. The role criteria include project and risk managers. Project managers are expected to provide a broad overview of the interactions between relevant aspects. Risk managers are expected to provide insights about the current process and procedures to manage risks and uncertainties. The PPP project criteria is related to the specific context of this research. The search is conducted on the internal company database, where the profile of each employee can be consulted and includes information about position, specific knowledge, years of experience, previous and current projects, etc. Potential candidates are approached via email in which the research project is briefly explained and the subjects and purpose of the interviews are stated. In total, six colleagues matched the criteria and gave their availability to be interviewed. Their details are reported in table 4.1. Four respondents are risks managers, one is a project manager and the sixth respondent is the head of the Amsterdam office who is involved due to his extensive knowledge of attitude and culture of both client and contractor organizations. Five of the respondents are currently involved in as many PPP projects, four of them advice the public client while one is an advisor for the main contractor.

Role of the respondent within WitteveenBos	Role of WitteveenBos within the project	Project name
Project manager	Advisor for the main contractors	Afsluitdijk
Risk manager	Advisor for the public client	Ring of Utrecht
Risk manager	Advisor for the public client	(Water production site)
Risk manager	Advisor for the public client	Haak om Leeuwarden (A31)
Risk manager	Advisor for the public client	A9 BAHO
Head Office Amsterdam		

Table 4.1: Details about respondents of exploratory interviews and projects in which they are currently involved

4.2.2. Exploratory interviews results

Respondents agree that, in general, the government expects the private sectors to take as many risks as possible and rejects bids that do not strictly comply with the requirements related to risk allocation. However, this attitude lead contractors to withdraw from different tenders and demand a more balanced risk allocation. The public client has not been indifferent to the industry's requests and is currently looking at a more cooperative procurement model like the *'tweefasenproces'* (two phase process). In the two-phase process, design and construction phase are divided. According to Rijkswaterstaat [2019] this reduces the risk profile of projects because the pricing for the construction phase only follows after the design or engineering phase. More information is then known, which leads to fewer uncertainties and risks. Respondents agree on the role of contract as guidance but emphasizes that it should not be the first reference to deal with setbacks. Instead, open communication between partners should be the first step to address conflicts and setbacks. This attitude, however, is strongly dependent on the personal attitude of people. In projects, it is equally likely to find people that are willing to cooperate and people that only focus on their own benefits and interests. A factor that can foster cooperative behaviours is reputation. People are more willing to cooperate when they are aware of the good reputation of the other party. According to the respondents, the most effective way to deal with unforeseen events requires the joint management of client and contractors. However, the average attitude does not reflect these thoughts. As explained during the interviews, both contractors and clients often demonstrate to be excessively concerned with contractual liability and let formal rules be the main driver of the cooperation. It is stated that whether a risk should be shared is determined by the circumstances, the decision is made on a case by case evaluation. However, respondents mention three criteria that can support parties during evaluation. The first criterion is the control that client and contractors can reasonably be expected to exert on a specific risk. For instance, construction risks should always remain with the contractor and, eventually, subcontractors because the client does not have enough control over these risks. The second criterion concerns the availability of information. When none of the parties possess enough information, then, the risk should be shared between them. The third criterion mentioned is the capabilities of parties, distinguished between financial and technical. Decisions that do not consider the actual capabilities of parties are likely to be perceived as unfair and, therefore, result in uncooperative attitudes of the contractors. The opinions expressed by respondents during the exploratory interviews are summarized in table 4.2.

4.2.3. Discussion of results of exploratory interviews

The result of the interviews does not provide an explicit definition of risk sharing. Respondents do not distinguish between the concept of risk sharing and the process of risk allocation. On the other hand, they suggest that some risks should be shared between client and contractor. This is the closest reference to the notion of risk sharing provided in section 3.3 although there is not an explicit connection nor it is indicated how these parties are supposed to share risks. The absence of risk sharing mechanisms most likely arises from the confusion between allocation and sharing. Nevertheless, the discussion about risk sharing criteria and the reference to joint management of unforeseen events suggest that the risk sharing idea is not completely unknown to people in the field. There is not explicit reference to informal interactions but it is assumed to be included in open communication. Enhanced participation and trust are not mentioned by respondents. In order to understand the opinions expressed during the interviews it is important to clarify the position of the respondents in the web of actors active in this context. WitteveenBos is a consultancy company and, consequently, all respondents work as advisor for either the client or the contractor. Their primary knowledge concerns the relationship between WitteveenBos and the receiver of the consultancy services (the client).

Aspect discussed	Current state (as mentioned by respondents)	Ideal state (if mentioned by respondents)
Client organization attitude	Transfer most of the risks to contractors; Considering more collaborative type of contracts;	
Contractor organization attitude	Demanding more balanced risk allocation	
Contractual mechanisms	Main driver of cooperation; Liability is a major concern;	Role of guidance
Open communication	Rare	Needed to address setbacks
Personal attitude	Equally likely to find people willing to cooperate and people that focus only on their own benefit	Positive towards cooperation
Joint management		Needed to deal with unforeseen events
Reputation	Stimulate willingness to cooperate	
Risk sharing definition	Ambiguous, confused with risk allocation	
Risk sharing decisions	Based on case by case evaluation	Based on control, capabilities and information availability

Table 4.2: Summary of results of exploratory interviews

Therefore, their perspective on risks as well as the role of contracts and relationships is usually limited to what concerns this relationship. On the other hand, previous experiences and information collected on the project and through their network increase the significance of their contribution. The project manager is much more informed about the working relationship between client and contractors whereas risk managers are less knowledgeable in this matter. He puts emphasis on the flaws of the current attitude and strongly supports a more relational approach. Likewise, the risk manager working at Rijkswaterstaat points out that the public client approach to risk put excessive pressure on contractors. He argues that this approach is sometimes unreasonable and the client should understand when a more cooperative approach is required in order to deal with specific circumstances. The head of the office is particularly experienced in (European) procurement and integrated contracts. He is also a member of different committees in the construction industry and, consequently, knows the stance of the main players. His contribution provides a comprehensive explanation of the average attitude of the industry and explain why formal rules occupy a central position in the relationships between actors.

Overall, the respondents demonstrate a positive attitude toward cooperation that value relationships more than contracts. This orientation may be justified by the fact consultants, unlike public client and contractors, are less subject to political pressure and market conditions. Their perspective on risk sharing may also be influenced by the different risk exposure because, despite the awareness of the existing risks in projects, consultancy companies are not directly affected by it.

4.3. Document review

The second activity involves the review of internal guidelines from WitteveenBos and Rijkswaterstaat and international standards used by the industry. The aim of the review is to obtain an illustration of the prescribed practice with regards to the aspects identified in the literature study. The results of the review provide a good description of the general attitude at the organization level and may be used to identify the cultural orientation of the main actors. Moreover, the comparison between the prescribed practice and the actual one may suggest the impact of personal attitude on cooperation at the project level. These insights coupled with the result of the exploratory interviews are needed to determine the elements to include in the conceptual model.

4.3.1. Document review results

In this paragraph each document is analysed to identify processes, procedures, recommendations that are significant for the research objective. The identification of relevant contents is performed using key words associated to the aspects resulted from the results of literature review and exploratory interviews.

WitteveenBos' Quality Manual

The project leader has the authority and power required to promote cooperative attitudes. The person in this role controls the flow of information within the project team and towards external stakeholders and, furthermore, can trigger discussion with the client particularly when deviations occur. This emphasizes the dependency of cooperative behaviours on the personal attitude of managers. Collaboration with other parties is only addressed in terms of legal responsibility. There is no reference to obligations and/or expectations in terms of processes, attitudes/behaviours and results. This implies that the control function of contracts is the only mechanism in place to stimulate cooperation.

WitteveenBos' Project Management Handbook

The use of the methods, tools and information presented in the handbook are not mandatory but they are strongly recommended for application in daily project practice. In general, it is stated that common sense prevails over the methodology. This emphasizes the influence of personal attitude on cooperation. Mutual learning, sharing knowledge and particular training initiatives are only prescribed in complex projects. This can be justified by the resources (time, money) that these activities require. Project management tools designed for the category "People and team" are basic and, most likely, do not provide a significant assessment of team cohesion and functionality. Insights Discovery (tool for team composition) is more "advanced" but it is limited to internal use. These activities increase coordination and may improve relationships between project teams and, therefore, foster cooperative behaviours. KSU (customer start up; klant start up) and PSU (project start up) take place when projects start and are only designed to assess client's requirements. During implementation, the customer is kept informed via progress report. KFU (customer follow up) and PFU (project follow up) only take place under specific circumstances. This suggests that interactions and communication are mostly limited to formal moments which are designed to define obligations and requirements rather than coordinate with each other and foster the relationship.

WitteveenBos' note about collaboration in the Afsluitdijk project

Cooperation agreements that specify parties' expectations and obligations are defined in the plan but are unilaterally formulated. Furthermore, the evaluation of the collaboration is limited to performance measurements. Although this is necessary, it overlooks other important aspects of collaboration and creates the risk that cooperation only becomes the fulfilment of an obligation. The selection criteria of team members are stated but recommendations about the assessment of these criteria are missing. Patterns that make difficult cooperation are communicated only to the end of each phase and informal contacts are provided in the plan although in a limited quantity. This emphasizes a lack of coordination as well as sporadic communication and interactions.

WitteveenBos' guidelines for communication

Personal encounter to maintain relationships are promoted. This a positive attitude in order to foster cooperation.

WitteveenBos' step-by-step plan for customer specification

It is true that requirements formulated by the client cannot be fully SMART and, consequently, the contractor is responsible to achieve a SMART formulation. This represents a missed opportunity to embed more coordination in the contract and, also, demonstrates a lack of awareness about the risk of opportunism.

WitteveenBos's note about teamwork

Recognition of the importance of teamwork and necessity to invest in team functioning since the start. Focus on the soft aspects of team functioning based on Lencioni's work. This highlights a positive orientation of the organizational culture of the company.

Rijkswaterstaat's Construction and Maintenance Work Guide

In the IPM model description, it is addressed the possible presence of tensions between role holders due to

divergent interests and the need to make them explicit as early as possible. This implicitly refers to the risk of coordination failure although within the same team. According to the roles defined in the IPM model, the project manager can stimulate collaboration within the project team while the environment manager can ensure a good cooperation with external stakeholders (environment). Moreover, the project control manager can improve the collaboration with client and the flow of information by managing periodic progress reports. This emphasizes the dependency of cooperative behaviours on the personal attitude of managers. Project manager agree with the client the way of communication. This is an opportunity to coordinate an important aspect of cooperation.

Rijkswaterstaat's Interface Management Guide

Interface are managed through development and exchange of documentation. This system does not necessarily resolve communication issues and, even worse, it is a missed opportunity to steer cooperation considering the amount of exchange involved.

ISO Risk Management Guideline

Risk management principles recognize the influence of human behaviour and culture and the role of stakeholders. The risk management framework acknowledges the importance of communication and consultations. These are explicit references to several aspects that are considered to influence cooperation. Risk assessment emphasize the role of knowledge and perspectives of internal and external stakeholders. This can be considered as an essential component of enhanced participation. The importance and limitations of information is stressed in the risk management principles and risk assessment. This confirms the role of information mentioned during the exploratory interviews. Risk sharing is only mentioned as one of the risk treatment options. This does not contribute to clarify the ambiguous concept of risk sharing.

4.3.2. Discussion of results of documents review

The results of the document review do not address the ambiguity related to the concept of risk sharing.

The influence of personal attitude on cooperation is the aspect that, implicitly or explicitly, is found across all documents. On the other hand, the impact of organizational culture is clearly mentioned only by the ISO guideline in the context of risk management. The control function is dominant across the different documents with the exception of the ISO guideline. Communication and interactions are mostly designated to support this function. On the contrary, a lack of coordination is evident. In the case of WitteveenBos, the coordination function is limited to very specific circumstances. In the documents of Rijkswaterstaat, it is mentioned more frequently but it is not considered sufficiently important. The ISO guideline is the only document that refers, although indirectly, to enhanced participation. The complete absence of references to relational norms and/or trust stands out and it is especially meaningful in the case of the chapter "Teamwork and collaboration" from the project management plan developed for the Afsluitdijk project. Likewise, informal interactions are never explicitly mentioned in any of these documents.

It is important to notice that, in the reviewed guidelines and notes, WitteveenBos has the role of contractor while the client is the organization that benefits from the consultancy services (i.e. construction company or contracting authority). Likewise, Rijkswaterstaat has the role of contractor while the client can be either the Ministry of Infrastructure and Water Management (Ministerie van Infrastructuur en Waterstaat) or regional government. This type of relationships is most likely different from the relationship between client and construction companies, particularly when this relationship takes place in the context of Public Private partnership.

4.4. Conceptual model

The conceptual model (figure 4.1) identifies and organizes the significant variables that come out of the analysis of the results of literature review and the exploratory phase. The aim of the model is to illustrate contractual and relational elements that can be added to the current risk sharing in order to promote cooperation. The dependent variable is distinguished between task and relational behaviors based on the suggestions of the literature study.

4.4.1. The proposed elements for risk sharing

The literature review identifies generic contractual and relational elements that impact cooperation. The results of exploratory interviews and document review phase indicate which of these elements are already part

of the current practice and suggest which elements are currently absent or not sufficiently implemented. The following elements are added to risk sharing given their positive impact on cooperation.

Contractual elements

The literature cites control, coordination and adaptation as functions of contract. Although all contribute to stimulate cooperation, the control function prevents the development of goodwill trust which is another contributor of cooperation. Therefore, in a contract, it may be wise to moderate the control function in favor of coordination and adaptation. The current practice, however, reveals a different trend. Respondents argue that both contractors and clients often demonstrate to be excessively concerned with contractual liability and let formal rules be the main driver of their relationships. This is in line with the results of the documents review that clearly demonstrate the prevalence of the control function over the other two. As a result, the coordination and adaptation functions are given priority in the model in order to achieve a contractual formulation that is more advantageous for cooperation.

Relational elements

In addition to contractual mechanisms, the literature emphasizes the role of relational norms and trust in promoting cooperation. However, relational mechanisms are not significantly mentioned in the recommended practice. According to the exploratory interviews results, these mechanisms are absent from current practice too although relational norms and, in particular, open communication and joint management are considered by respondents as desirable improvements. Hence, open communication, joint management and trust are included in the model.

Informal interactions and enhanced participation

The literature emphasizes the role of informal interactions. Furthermore, different authors advocate for enhanced discussion, early involvement of market parties and participatory decision making which are clustered in enhanced participation. The exploratory phase does not indicate the presence of any of these aspects in either the current or prescribed practice. The ISO guideline points out the importance to integrate the knowledge and perspectives of internal and external stakeholder into risk assessment and this can be considered the only (implicit) reference to enhanced participation. Therefore, informal interactions and enhanced participation are part of the model.

The critical role of personal attitude

The literature suggests that personal attitude and organizational culture drive the perspective on project success and, consequently, can steer managers' efforts and attentions towards cooperative behaviors. The influence of personal attitude is widely confirmed throughout the exploratory phase although it is not mentioned in relation to the perspective on project success. On the other hand, the role of organizational culture does not find a meaningful correspondence in practice although the current attitude of the contractor organizations might have triggered the willingness of the public client to enhance cooperation. Thus, the role of organizational culture requires further investigation. Personal attitude, instead, is embedded in all the identified variables and, therefore, it can be argued that people are a critical element of the relationship between risk sharing and cooperation.

4.4.2. The proposed risk sharing mechanisms

The following risk sharing mechanisms are formulated based on the elements mentioned in the previous section.

Joint risk analysis

The first mechanism proposed is joint risk analysis. This is a chance to communicate openly with each other and reach an agreement that considers the different perceptions of the partners which may reduce the chance of having conflicts later on. This combines the dominant coordination function with the necessity to reduce coordination failure. Furthermore, it is also an opportunity to jointly assess available information and parties' capabilities. These criteria can signal whether a risk should be shared and, consequently, encourage partners to jointly manage that specific risk.

Sharing human resources

The second mechanism proposed involves greater movement of people between project teams. This creates a conducive environment for personal encounters, informal interactions and open communication which contribute to trust development and, consequently, reduces opportunism. Furthermore, a higher rate of information exchange is expected which facilitates joint management and stimulate mutual learning.

Sharing knowledge

The third mechanism proposed involves enhanced sharing of knowledge between project teams and with the external environment. This is an opportunity to assess which information are required and which are already available and weight the other parties' internal capabilities. The greater flow of information is expected to facilitate joint management.

Sharing consequences

The fourth mechanism proposed involves drafting the contract in such a way that parties are equally liable for possible negative consequences regardless of the specific circumstances. This includes sharing consequences, from both the economic and reputation perspective. This mechanism is related to scarcity of information which increases the incompleteness of contracts. In the current practice, when unforeseen events occur, the likelihood of the blame game and, consequently, of conflicts and opportunism between partners increase. However, removing the chance of the blame game is expected to create a strong incentive for partners to maximize their efforts to avoid negative consequences, minimizing the chance of opportunistic behaviours and conflicts. Furthermore, this mechanism exploits the 'brute' effect of the contract on cooperation and the enhancing effect on the impact of informal rules.

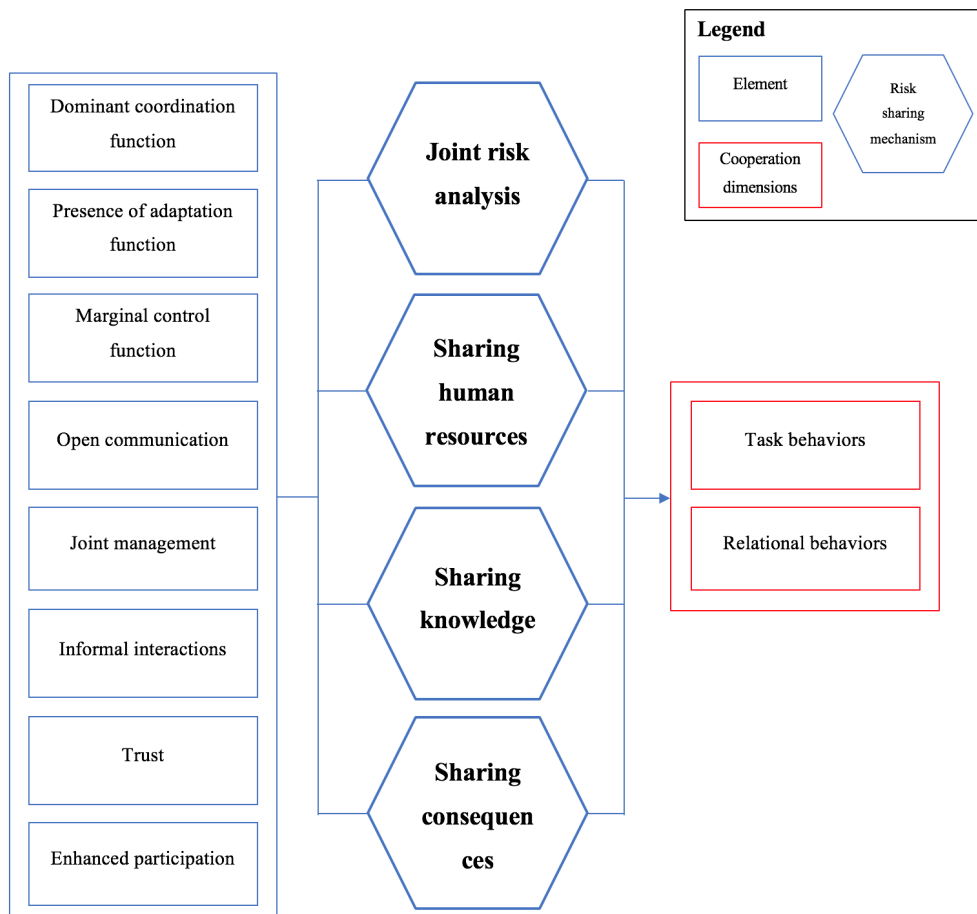


Figure 4.1: Conceptual model that illustrate contractual and relational elements used to elaborate risk sharing mechanisms in order to promote cooperation

4.5. Intermediate conclusions - Exploring the practice

The theoretical perspective on risk sharing highlights a gap which can be explained by the absence of clear and distinct definition, mechanisms and criteria. Likewise, the practical perspective, investigated through exploratory interviews and document review, does not provide additional insights that may be useful to significantly address the gap found in the literature. Hence, based on the results of the literature review and the exploratory phase, the concept of risk sharing remains generally undefined.

On the contrary, the concept of cooperation is clearly addressed in the literature. The influence of contracts, relational norms and trust are extensively debated in the scientific papers. The exploratory phase reveals that both contractors and clients let formal rules be the main driver of cooperation. In particular, the control function of contracts prevails in both the current and the recommended practice. On the other hand, relational norms and trust are not significantly mentioned although respondents suggest that relational mechanisms and, in particular, open communication and joint management can improve the current practice. Furthermore, both the theoretical and practical perspective confirm the influence of personal attitude on cooperative behaviours. The literature also points out the role of informal interactions and enhanced participation in promoting inter-organizational cooperation. However, these aspects are not mentioned in either the current or prescribed practice.

Risk sharing is proposed as strategy to fill the gaps of the current approach with the purpose of stimulating the development of cooperation. However, according to the findings of phase one, current risk sharing mechanisms are just contractual incentives. It is argued, based on the literature review, that this is not sufficient to stimulate cooperation. Therefore, additional risk sharing mechanisms are elaborated based on contractual and relational elements and other factors that are considered in the literature and by respondents to promote cooperation. The proposed mechanisms can be implemented independently but it is assumed that their effects are mutually reinforcing. These generic mechanisms will be discussed in the next phase in order to collect the necessary information to design the risk sharing framework.

5

Discussion with practitioners

In this chapter, the conceptual model formulated based on the outcome of the literature review and the exploratory phase is discussed with practitioners. The results of this activity are analysed in order to refine the proposed mechanisms and obtain detailed measures that form the framework. First, the sample of respondents is described. Then, the results of the analysis are presented and, finally, discussed.

5.1. Introduction

The interviews with practitioners are designed around the proposed risk sharing mechanisms. The respondents are drawn from two major infrastructure PPP projects in the Netherlands. The interviews are expected to provide information useful to refine the generic risk sharing mechanisms and define specific measures that can improve the current practice with the intent of encouraging inter-organizational cooperation.

5.2. The strategic sample

The first step to find respondents is to select projects that match the context of this research. Hence, the search focuses on Dutch infrastructure PPP projects procured in the last eight years using a DBFM contract. The choice of reference period and contract form is not unintentional. The reference period is based on the joint statement signed by the main players of the industry in 2011 to agree to 'more cooperation' [Koops, 2017]. It is preferable to interview parties that are involved in projects started after that explicit commitment because it might have affected people's attitude and common practice. The contractual form criterion is related to the fact that DBFM is the most common contract form [Netherlands Enterprise Agency, 2019] and, among the available contractual choice for PPP (excluding Concession), it involves the greatest risk transfer to the private parties [Burger et al., 2008, Sarmiento and Renneboog, 2016]. An additional criterion is the presence as advisor, either for the contractors or the client, of WitteveenBos. This choice is justified by the advantage of using the network of the company to facilitate the arrangement of the interviews. Considering the available resources and the expected lead time to arrange and conduct the interviews, parties involved in two projects are approached in order to ensure the manageability of the process. The projects are the Afsluitdijk and the Blankenburg connection.

5.2.1. Afsluitdijk

The scope of the Afsluitdijk is to reinforce the 32 km long dyke and increase its drainage capacity [Rijkswaterstaat, 2019]. The client, Rijkswaterstaat (part of the Dutch Ministry of Infrastructure and the Environment), has signed a 25 years design, build, finance, maintain (DBFM) contract with the Level consortium. The contract was signed on the 20th April 2018. The disclosed contract value is 550 million euro [BAM PPP bv, 2019]. The private consortium shareholders are Van Oord (46%), Aberdeen Infrastructure Partners, BAM PPP (46%), PGGM Infrastructure and Rebel (8%), together with joint venture partners Aberdeen Standard Investments, APG Group, PGGM and EPICo. The design, construction and long-term maintenance will be completed by BAM Infra and Van Oord Nederland. The execution phase started officially on the 1st of April 2019 and the work should be ready by the end of 2022. Senior debt will be provided by the European Investment Bank using its Structured Finance Facility.

5.2.2. Blankenburg connection

The scope of the Blankenburg connection is to provide a robust network and improve accessibility to the Rotterdam ports and Rotterdam region by connecting the A20 at Vlaardingen with the A15 in the port area through the new 4 km long A24, including the Blankenburg tunnel. The client, Rijkswaterstaat, has signed a 20 years design, build, finance, maintain (DBFM) contract with the BAAK consortium. The contract was signed on the 17th December 2017 and reached financial close on the 18th October 2018. The disclosed contract value is approximately 1 billion euro [Ballast Nedam, 2019]. The project includes the construction of a submerged tunnel under the Scheur (at the Nieuwe-Waterweg), a land tunnel, 2 junctions (from the A24 to the A20 and the A15) and the widening of the A20 between the A24 and Kethelplein. The shareholders in the project are Macquarie Capital with a 70% interest, and Ballast Nedam Concessions and DEME Concessions Infrastructure, each with a 15% interest. The project will be realized by a consortium of Ballast Nedam Infra, and DIMCO and Dredging International, both part of DEME. In addition, Macquarie Capital acts as the sole financial advisor to the BAAK Blankenburg Connection consortium. Opening of the Blankenburg connection is planned between 2022 and the end of 2024 [Rijkswaterstaat, 2019].

5.2.3. Respondents

The second step is to decide which organization involved in these two projects should be approached. The criteria come obviously from the context of the research. Considering the focus on PPP, organizations that should be contacted must be directly involved in the partnership. Therefore, the sample is limited to the client organization, the contractors that are part of the winning consortium and major financing providers. In total, ten organizations were approached via email to request an interview with project manager or project director involved in the projects. This criterion is related to their strategic position, years of experience and their influence on cooperation. Managers can provide an overview of the main aspects of projects including past events and expectations about future developments. Considering the experience that people in this position are likely to have, they are expected to provide insights about the evolution of the concept of risk sharing and cooperation in the last years. They are in charge of interacting with the partners and are aware of the full details of the cooperation process [Lui and Ngo, 2004]. Furthermore, the results of the empirical phase emphasize the dependency of cooperative behaviours on the personal attitude of managers. The email sent to the organizations includes a brief introduction about the researcher and the research, explains the motive of their presence in the sample and introduces the topics that are part of the interview. Eventually, seven of the ten organizations contacted made themselves available for interviews but only five interviews were conducted because of the unexpected unavailability of two respondents. The details about the identity of the interviewees cannot be disclosed. However, more details about their position and the role of the organisation within the project are reported in the table 5.1.

Role of the respondent within the organization	Role of the organization within the project	Project name	Years of experience
Project director	Financial advisor	Afsluitdijk	25
Project director	Contractor	Afsluitdijk	21
Manager	Financial advisor	Afsluitdijk	10
Commercial director	Contractor	Blankenburg	12
Manager	Lender	Afsluitdijk - Blankenburg	15

Table 5.1: Details about respondents involved in the empirical check

5.3. Analysis of the results: Elements

The first step of the coding process identified several elements that are gradually reviewed and better defined. Elements provide a finer description of the statements collected during the interviews. Eventually, many similarities are found among the different sources as well as distinctive opinions of each respondent. Only elements mentioned by the majority of the sources (figure 5.1 and table 5.2) are considered because these are assumed to reflect the shared perspective on the ideal situation. In contrast, it can be assumed that unique opinions are significantly influenced by personal experience and character and, consequently, do not

constitute a robust basis. It can be noticed that elements' description is sometimes alike and refer to the same statements. This is because the same passage can be interpreted in different ways and has multiple meanings. The purpose of the elements' description is not to illustrate the meaning of the elements because the tag is meant to be self-explanatory. Few example are provided to elucidate the line of reasoning behind the choice of each label.

Elements	Total number of citations	Number of sources that mentioned this label
Balance	9	5
Capability	7	4
Divergence	5	4
Joint efforts	13	4
Liability consequences	12	4
Liability definition	9	4
Assumptions formulation	3	3
Competition	3	3
Cooperation	8	3
Diversity	5	3
Forthcoming attitude	10	3
Information availability	6	3
Integration	9	3
Interdependency	9	3
Limited perspective	7	3
Openness	8	3
Partiality	5	3
Project characteristics	3	3
Public procurement rules	4	3
Reciprocity	3	3
Risk cooperation	4	3
Thoroughness	5	3
Time pressure	3	3
Trust building	3	3
Uncertainty	5	3
Unforeseen events	6	3
Versatile response	5	3

Table 5.2: Elements associated, at least, to the statements of three different sources

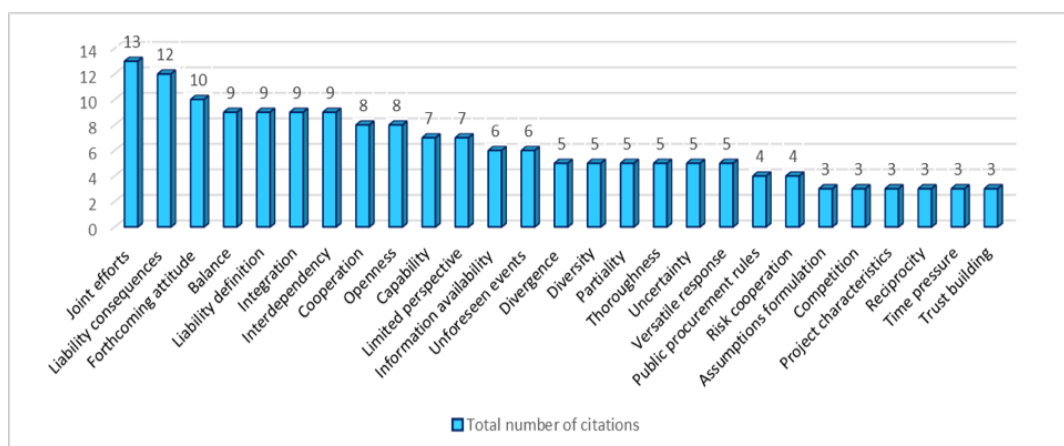


Figure 5.1: Top frequently mentioned elements (associated, at least, to the statements of three different sources)

Joint efforts

The element 'Joint efforts' is associated to activities that are jointly performed by different actors. This label is found only once in the answer to the first question (*What is, in general, your idea of risk sharing?*). The majority of the connections are found in the answers of four different sources to the second question (*Thoughts of the respondent on the proposed risk sharing mechanisms*). One source in particular makes several statements that are associated to this label.

Joint efforts	Source #1	Source #2	Source #3	Source #4	Total citations per question
First question				1	1
Second question	1	8	1	2	12
Total citations					13

Liability consequences

The element 'Liability consequences' is associated to the effects of the presence and extent of liability on actors' attitudes, particularly, cooperative behaviours. This label is found in one answer to the first question (*What is, in general, your idea of risk sharing?*). The majority of the connections are found in the answers of four different sources to the second question (*Thoughts of the respondent on the proposed risk sharing mechanisms*). In this case the statements associated to this element are spread more evenly although most of them comes from only two sources.

Liability consequences	Source #1	Source #2	Source #3	Source #4	Total citations per question
First question				2	2
Second question	3	5	1	1	10
Total citations					12

Forthcoming attitude

The element 'Forthcoming attitude' is associated to statements that describe cooperative behaviours oriented toward the achievement of common goals and mutual benefits. This element is found in two answers to the second question (*Thoughts of the respondent on the proposed risk sharing mechanisms*) and in the answer given by the source number one to the third question (*The impact of risk sharing on cooperation*).

Forthcoming attitude	Source #1	Source #2	Source #4	Total citations per question
Second question		3	4	7
Third question	3			3
Total citations				10

Balance

The element 'Balance' is associated to statements that describe situations, such as allocation of risk, power or information, where an even distribution is the most desirable state but, in reality, a significant disparity is often observed. This element is found in two answers to the first question (*What is, in general, your idea of risk sharing?*) and in the answer given by the source number one to the third question (*The impact of risk sharing on cooperation*). The majority of connections are found in the answers to the second question (*Thoughts of the respondent on the proposed risk sharing mechanisms*) and the statements associated to this label are distributed almost equally among the different sources.

Balance	Source #1	Source #2	Source #3	Source #4	Source #5	Total citations per question
First question			1		1	2
Second question	2	1		2	1	6
Third question	1					1
Total citations						9

Liability definition

The element 'Liability definition' is associated to statements that explain actors' implicit and explicit motivations for the current utilization of contractual liability in addition to the standard role of determining roles and responsibilities. This element is found only once in the answer to the first question (*What is, in general,*

your idea of risk sharing?). The majority of connections are found in the answers to the second question (*Thoughts of the respondent on the proposed risk sharing mechanisms*). In this case the statements associated to this element are distributed almost equally among the different sources.

Liability definition	Source #1	Source #2	Source #3	Source #4	Total citations per question
First question				1	1
Second question	2	2	1	3	8
Total citations					9

Integration

The element 'Integration' is associated to statements that refer to the involvement of different actors, internal and external to the project, in order to exploit their knowledge and benefit from their opinions to improve decision making and stimulate interactions. This label is only found in the answers to the second question (*Thoughts of the respondent on the proposed risk sharing mechanisms*) and it was associated to multiple statements of each source, particularly the number two.

Integration	Source #2	Source #3	Source #4	Total citations per question
Second question	4	2	3	9
Total citations				9

Interdependency

The element 'Interdependency' is associated to statements that indicate the existing dependencies between actors and variables involved in the project and the dynamics related to it. This element is found in three answers to the second question (*Thoughts of the respondent on the proposed risk sharing mechanisms*) and in two answers to the third question (*The impact of risk sharing on cooperation*).

Interdependency	Source #1	Source #2	Source #4	Total citations per question
Second question	1	2	1	4
Third question	1		2	3
Extra	2			2
Total citations				9

Cooperation

The element 'Cooperation' is associated to statements that refer to the attitude of organizations and individuals to cooperate during projects. This attitude can manifest in many behaviors that involve working together, sharing resources and being forthcoming. This element is found in the answer of the source number one to the first question (*What is, in general, your idea of risk sharing?*) and in two answers to the third question (*The impact of risk sharing on cooperation*). Most of the statements associated to this element are found in the answers of the source number one and number two to the second question (*Thoughts of the respondent on the proposed risk sharing mechanisms*).

Cooperation	Source #1	Source #2	Source #4	Total citations per question
First question	1			1
Second question	2	3		5
Third question		1	1	2
Total citations				8

Openness

The element 'Openness' is associated to statements that indicate the attitude of organizations and individuals to include external actors, different perspectives and more details into the dialogue, to share information, to try new approaches. It is appropriate when actors make the process more open to the "outside", when they are more forthcoming with each other and more receptive towards new ideas. This label is only found in the answers to the second question (*Thoughts of the respondent on the proposed risk sharing mechanisms*), particularly in the statements of the source number two and number four.

Openness	Source #1	Source #2	Source #4	Total citations per question
Second question	1	4	3	8
Total citations				8

Capability

The element 'Capability' is associated to statements that refer to the organizations' ability to manage risks and how this can impact the project. This element is found only once in the answer to the first question (*What is, in general, your idea of risk sharing?*) while the majority of connections are found in the answers to the second question (*Thoughts of the respondent on the proposed risk sharing mechanisms*).

Capability	Source #1	Source #2	Source #4	Source #5	Total citations per question
First question				1	1
Second question	3	1	2		6
Total citations					7

Limited perspective

The element 'Limited perspective' is associated to statements that indicate the attitude of organizations and individuals to concentrate entirely on their own perspectives and objectives. It is appropriate when actors lack the ambition and the initiative to build a fruitful cooperation, demonstrate to be short-sighted and focus unreasonably on liability and technicalities. This label is found only once in the answer to the third question (*The impact of risk sharing on cooperation*). The majority of the connections are found in the answers of two sources to the second question (*Thoughts of the respondent on the proposed risk sharing mechanisms*). One source in particular made several statements that were associated to this label.

Limited perspective	Source #1	Source #2	Source #4	Total citations per question
Second question		1	5	6
Third question	1			1
Total citations				7

5.4. Analysis of the results: Clusters

Clusters offer a generic overview of the nature of the subjects addressed during the discussion. Despite the fact that clusters that are identified show many similarities, there are unique peculiarities associated to the meaning of each cluster that justify this division and allow a more detailed analysis of the results. As in the case of the elements, the purpose of the description is to elucidate the line of reasoning behind the choice of each label.

Boundary conditions	Initial conditions	Expectations
Assumptions formulation	Competition	Cooperation
Balance	Divergence	Partiality
Capability	Information availability	Risk cooperation
Diversity	Partiality	
Project characteristics	Public procurement rules	
Time pressure		
Uncertainty		
Unforeseen events		

Positive attitude	Negative attitude	Steering mechanisms
Forthcoming attitude	Liability consequences	Integration
Joint efforts	Limited perspective	Interdependency
Openness		Liability definition
Reciprocity		Trust building
Risk cooperation		
Thoroughness		

Table 5.3: Clusters and elements

Boundary conditions

This cluster includes elements that are associated to facts, actions, processes (within the context of this research) that are independent from the specific characteristics of projects and actors. Boundary conditions can be considered as constant over time and can hardly be affected by individual interventions, at least in the short term. These are often the result of common practices of the industry, legislation and bureaucracy. The elements included in this cluster can be considered the 'rules of the game' and the framework must be designed according to these 'rules'.

'Balance' is included in this cluster because power, i.e. the ability of impose decision, and information availability are variables that change during project development and are rarely distributed equally among the parties. The unbalanced distribution of these variables is a constant of every project.

Initial conditions

This cluster is similar to the previous one but it contains elements that describe circumstances that are true in a specific moment in time. These labels refer to a specific snapshot of the project and, consequently, consider actions, processes and actors that are mostly relevant in that moment. In this case, the elements are related to the planning phase which include tender and award phase.

Positive attitude

This cluster includes elements that describe general or individual attitudes that, according to the interviewees, can raise the quality of the risk sharing process, facilitate decision making and improve cooperation between actors. In this case, attitudes do not strictly refer to actions or decisions but also to the opinions and perspectives of organizations and/or individuals with regards to a given situation or issue. The framework is designed to promote the attitudes associated to the elements included in this cluster.

The element 'Joint efforts' is included in this cluster because the willingness of the actors to share, compare and discuss together is mentioned as one factor to reduce divergence, cope with knowledge scarcity and contribute to align diverse objectives. 'Forthcoming attitude' is included because attitudes such as willingness to cooperate and share regardless of the contractual risk allocation, being sensitive to the issues of the other parties and taking the initiative to help rather than being passive can be described as 'forthcoming' and were mentioned to improve relationships between actors and stimulate cooperation. 'Openness' is included in this cluster because, according to practitioners, the willingness of the actors to be open in terms of transparency and new initiatives, such as accepting new kind of leadership and practices, can help to bring innovative ways of working in the construction industry. Moreover, making information available to all parties, creating opportunities to further discuss, sharing pains and gains can contribute to define a suitable alternative that accommodates different needs and objectives of the parties involved.

Negative attitude

This cluster is the reflection of the previous one but it represents the other side of the coin. The elements included in this cluster indicate general or individual attitudes that, according to the interviewees, can raise the ineffectiveness of the process, hamper decision making and damage cooperation between actors. The framework is designed to reduce or avoid the occurrence of the circumstances described by the elements included in this cluster.

The element 'Liability consequences' is included in this cluster because it was mentioned that when parties are not contractually liable for something, it is likely to observe uncooperative behaviours on their side. 'Limited perspective' is included because when parties are stuck on their position and do not recognize the

opportunities created by cooperation they tend to ignore the common goal of the partnership. As a result, they do not behave like partners but like competitors.

Steering mechanisms

Elements contained in this cluster refer to variables that directly influence the quality of the process and the development of the project. The variables describe a path made of certain attitudes, behaviors and decisions that actors can take to steer the process in the right direction. However, the outcome is uncertain because it also depends on boundary and initial conditions. The framework is design to exploit the positive effect of these mechanisms within the existing limitations.

The element 'Liability definition' is included in this cluster because, according to respondents, liability is a powerful mean to influence parties' behaviours within the project. For instance, when uncertainty is high, it is important to clarify how to deal with unforeseen events rather than include as many circumstances as possible. In this way, actors can be more flexible and a more cooperative environment can be created. 'Integration' is included because, according to practitioners, early contractors' involvement can stimulate their willingness to participate. Moreover, integration can promote cooperation because parties have the opportunity to express their opinions and steer the process which, consequently, increases acceptance and security.

Expectations

This cluster includes elements that describe the unique thoughts of the interviewees. This includes possible explanations for the current flaws of process, potential improvements and expectations about the future.

The element 'Cooperation' is included in this cluster because the parties' commitment to cooperate is expected to be one factor that characterize successful projects. In particular, respondents think that risk sharing and cooperation can influence and improve each other. It is mentioned that cooperation can get better if parties share risks and that cooperation can facilitate the implementation of risk sharing mechanisms.

5.5. Discussion of the results of the analysis

5.5.1. 1st question

The analysis of the answers given to the question "*What is, in general, your idea of risk sharing?*" does not indicate a clear and uniform perspective of this topic because there are not many similarities among the answers. The first source emphasizes the importance of information availability when sharing risks and claimed that cooperating is the only viable solution when information is scarce and uncertainty is high. The second source state that a "balanced" risk sharing draws the line between successful and "bad" projects. According to this source, acceptance and awareness of risks contribute to make risk sharing balanced. The third source also emphasizes the importance of a "balanced" risk sharing although in a different way. According to this source, balanced risk sharing depends on parties' capabilities and the extent of compensation given to risk owners. The fourth source highlights the opportunity given by sharing responsibilities and consequences but clarified that liability has to be unambiguously defined. The fifth source states that risk sharing means allocating risks to willing and capable parties that should, then, charge a price for the liability. In this case, too, it can be argued that an implicit reference to balance is made.

5.5.2. 2nd question

The analysis of the answers given to the question "*Thoughts of the respondent on the proposed risk sharing mechanisms*" indicates that respondents agree on few points, particularly on the boundary conditions of the process and some positive attitudes. There is more disagreement about the negative attitudes and misbehaviours that damage the process. Despite the dissimilarities, significant contrasting views are absent. According to the sources, joint risk analysis already occurs in projects during the competitive dialogue. However, only one source claims to be satisfied with the current practice. The other respondents discussed a quantitative and a qualitative issue. On the quantitative side, the current discussion is constrained by the time available. On the qualitative side, high uncertainty, particularly at the start of the project, and different interpretations given by participants undermine the reliability of the analysis and can cause conflicts later on. Respondents agree that pooling human resources is a suitable way to ensure that risks are analysed properly, particularly, when knowledge on the topic is scarce. When this occurs, know-how is automatically exchanged. Integration and openness are necessary attitudes to gain the benefits of sharing resources and know-how. However, different sources pointed out that parties are unwilling to share strategic information before and during tender. This trend was described by elements 'Public procurement rules' and 'Competi-

tion'. The former is included in the cluster 'Boundary conditions' and it cannot be reasonably expected to change significantly. The latter is included in the cluster 'Initial conditions' because concerns about being competitive are at their peak at the start of the tender. Hence, it is unlikely to observe positive attitudes during this stage. Finally, the most controversial mechanism is sharing consequences. Despite the different reactions of the respondents to this point, they agree that risk sharing mechanisms have to be found particularly when none of the parties has enough information to reasonably manage a specific risk. Nevertheless, the idea of sharing consequences equally raised several doubts. It is mentioned that it is not a suitable solution because one party is always more 'involved' in the occurrence of the risk. The ability to manage a specific risk as well as the capacity to absorb potential negative consequences are not equally distributed between parties. Hence, sharing consequences equally regardless of the circumstances is considered to be unfair and unappealing. On the other hand, the current practice allows only one party to be appointed as risk owner, i.e. to be contractually liable. This requirement, included in the label 'Liability definition', is not itself an issue because it does not exclude the possibility of cooperating. However, it is considered by respondents to be the cause of absent or flawed risk sharing mechanisms. It is stated that client organizations exploit the 'one risk-owner' rule to shift most of the risks to contractors. This attitude is at the core of the current debate between the public authority and the construction industry. Furthermore, according to respondents, parties tend to be uncooperative when they are not liable. It is evident that 'Liability definition' influence parties' behaviours and it is for this reason that it is also included in the cluster 'Steering mechanisms'.

5.5.3. 3rd question

The analysis of the results given to the question "*In your opinion, can risk sharing, as we discussed, impact cooperation?*" indicate that respondents agree on the positive impact of the proposed risk sharing mechanisms on cooperation. However, different premises are provided by each source to explain how this may occur. Three different explanations can be identified, two are relatively divergent while the third one lies in the middle. One source argues that risk sharing creates dependency and, consequently, this forces parties to invest in cooperation. The respondent suggests that new dependencies can be intentionally developed in order to enhance the positive effect of risk sharing on cooperation. This is why the element 'Interdependency' is included in the cluster 'Steering mechanisms'. Another source explains that risk sharing creates favourable conditions and give parties the opportunity to demonstrate attitudes that are conducive for cooperation. In particular, attitudes that are mentioned are associated to the elements 'Reciprocity' and 'Forthcoming attitude'. The third source claim that risk sharing promotes cooperation when parties are bounded to share risks by certain contractual relationships. He suggests that when people are aware of these obligations, they are 'forced' to trust each other. However, he warns that trust needs to be continuously sustained and this depends on people's attitudes like openness and transparency.

5.6. Intermediate conclusions – Discussion with practitioners

The results of this phase complement the practical perspective on risk sharing. Despite the differences, the first, the third and the fifth source refer to "allocation" or "allocating" in their answer to this question. This confirms the ambiguity found in the literature and confirmed in the exploratory phase that do not distinguish between risk sharing and allocation. This match is a sound demonstration that risk sharing and risk allocation are most of the times considered the same thing. Information availability, acceptance and awareness of risks, parties' capabilities and rewards are mentioned to influence risk sharing. The second and the third factor are already mentioned during the exploratory interviews. Hence, it can be argued that these two criteria should be considered by practitioners when deciding whether a risk should be shared. Overall, the results of the empirical testing do not bring any new significant addition to the concept of risk sharing. Therefore, the theoretical and practical perspectives do not substantially distinguish risk sharing from risk allocation. Nevertheless, both theoretical and practical perspective suggest that, in the ideal practice, risk sharing differs from risk allocation because it is based on a careful evaluation of available information and parties' capabilities, considers different perspectives and interests, involves a more balanced trade-off between liabilities and rewards and it is generally more cooperation oriented.

The statements made with regards to the proposed risk sharing mechanisms suggest how these can be design in order to be integrated into the current practice with the purpose of stimulating cooperation.

According to respondents, joint risk analysis occurs, to some extent, during the competitive dialogue. However, the majority claims to be unsatisfied with the process because the allocated time is insufficient to address the different parties' interpretations. The risk of different interpretations can hardly be reduced in the

absence of an exhaustive dialogue between the parties. Respondents argue that more occasions to allow a sufficient exchange of information are needed.

According to the respondents, sharing human resources automatically lead to sharing knowledge. However, they argue that existing competition and the current organization of the tender procedure prevent the achievement of a significant exchange. Respondents indicate different ways that can lead to a better practice. It is suggested to approach the construction community and consider their opinion. Also, respondents solicit the client organization to provide for more chances to discuss and argue that, ideally, information sharing should not be restrained. They specify that these measures are dependent on the parties' openness to share and their willingness to include external perspectives. However, these positive attitudes are overwhelmed by parties need to be competitive and the restrictions imposed by current regulation.

According to respondents, equally sharing consequences among the parties neglects the fact that parties have different capabilities and control over specific risks. However, this statement triggers the question of whether traditional risk allocation brings the exact same disadvantages when risks are allocated to only one side although none of the parties can reasonably be expected to manage it. In this case, respondent suggest that risk sharing mechanisms should be found but, apart from contractual incentives, they do not suggest alternative measures to deal with these circumstances. Furthermore, one respondent points out that, contractually, only one party can be held liable. Interviewees sustain that this legal boundary is one of the root causes of uncooperative behaviours. On the other hand, they confirm that cooperative behaviours are strongly dependent on the attitude and willingness of people to be forthcoming and help each other. Therefore, they suggest to exploit the contract to 'push' parties to cooperate. Nevertheless, contract can only act as guidance, as mentioned during the exploratory interviews, but personal attitude is what really determine cooperative behaviours.

The majority of respondents support the view that the effect of risk sharing on cooperation depends on people's attitude more than formal arrangements. This confirms the findings of the literature review where the attitude and willingness of partners to engage in cooperative behaviours is stimulated more by the relational elements, through trust and relational norms, than formal enforceable rules. Nevertheless, several reference to contractual relationships and formal agreements are made during the interviews and cannot be ignored. Therefore, formal rules that make partners' commitment to share risks explicit are most likely needed to drive people and create the right conditions to develop certain type of cooperative relationships but these are not sufficient on their own. Eventually, it is always up to individuals to make things work and, consequently, risk sharing should be designed in order to create a project environment that facilitate people in developing and showing attitudes and behaviours that are conducive for cooperation.

6

The risk sharing framework

In this chapter, the detailed measures that form the risk sharing framework are defined based on the results of the discussion with practitioners supported by additional literature and considerations from the documentations review. The purpose of the framework is to guide organizations in implementing risk sharing with the purpose of stimulating the development of cooperation. Next, the proposed measures are validated with employees of WitteveenBos to assess whether the framework satisfies the requirements of its intended users and which are the hurdles to its implementation.

6.1. The proposed risk sharing measures

According to practitioners, joint risk analysis occurs, to some extent, during the competitive dialogue. However, they indicate that positive effects of this process are restricted by the time available, the high uncertainty and different interpretations. They argue that more occasions to allow a sufficient exchange of information are needed. Therefore:

1. *More time allocated to discussion between contracting authority and contractors during the competitive dialogue may reduce the risk of divergent interpretations. In alternative, the 'two phase process' may be preferred to the current procurement strategy because it can facilitate exchange of information between contracting authority and contractors.*

The ISO risk management guideline emphasizes the importance to collect knowledge and perspectives of internal and external stakeholders during risk assessment. According to statements collected during both the exploratory interviews and the discussion with practitioners, information availability is a criterion that should be considered when making decisions about risk sharing. Decisions based on this criterion may improve the bidder's perception of fairness and, consequently, positively impact the cooperative attitudes of future partners. Therefore:

2. *An online forum can be organized to allow questions from bidders on project matters. The distribution of questions may highlight issues that are particularly challenging, unclear or require knowledge that is unavailable. This can signal the contracting authority the necessity to openly discuss the issue with all the bidders and, together, define alternative solutions.*

This kind of initiative can support participatory decision making which, according to Das and Teng [2001], facilitate the implementation of relational mechanisms. Furthermore, this shows that contracting authority is willing to communicate openly and consider responses of bidders. This can be considered a demonstration of relational behaviours on the client side, which according to Fu et al. [2015], stimulate relational behaviours of the contractor.

According to practitioners, pooling human resources is a suitable way to enhance risk analysis, particularly, when knowledge on the topic is scarce. They claim that exchange of know-how automatically results from circulation of people. However, they say that bidders concern about being competitive and the restrictions imposed by current regulation prevent an actual exchange of people and knowledge. Therefore:

3. *A period of time may be allocated to discuss and address uncertainties after bids are submitted so competition is no longer a major concern. Participation may be extended to external parties (like Neerlands diep) that can contribute with their knowledge and perspective.*
4. *Alternatively, a workshop may be organized post-award but before the start of the project to assess what knowledge is required by contractors, where and if this knowledge can be found. In this way, the efforts to supply the required knowledge can be shared by all participants rather than being sustained only by the party that requires the information.*

It can be argued that these represent forms of enhanced discussion advocated by [Charoenngam and Yeh, 1999, Sarmiento and Renneboog, 2016]. According to the literature, this can reduce information asymmetry and facilitate the development and implementation of relational elements [Benítez-Ávila et al., 2018, Cao and Lumineau, 2015, Das and Teng, 2001]. On the other hand, these measures are based on the assumption that participants show the required attitude because, as emphasized by respondents of the exploratory interviews, open communication is strongly dependent on the personal attitude of people. According to practitioners, it is essential to encourage openness and integration in order to increase the positive effects of these measures on cooperation. Likewise, Wiewiora et al. [2014] claim that attitude toward knowledge sharing also depends on organizational culture. Therefore, if these measures can help to overcome the boundaries created by competition and regulation, the attitude toward knowledge sharing which determines the effectiveness of information exchange still depends on organizational culture and personal attitude. According to the role description included in the Rijkswaterstaat's Construction and Maintenance Work Guide and WitteveenBos's Quality Manual, it can be argued that project leaders and managers have the authority and power required to promote the required attitudes. As suggested by Gratton and Erickson [2007], informal mentoring and coaching can help people to establish the networks they need to collaborate beyond team and organization boundaries. According to Mintzberg [1998] leadership can be exercised on the individual, through coaching and mentoring, on the group, through team building and conflicts resolution and, finally, on the organizational level by establishing organizational culture. Moreover, the author argues that leading a group of professionals is not exercised through orders or formal information but it is much more about inspiration. He suggests that people are inspired and culture is built by daily attitudes and activities of leaders. Therefore:

5. *The required attitudes and behaviours of project members can be promoted by project leaders and managers by showing cooperative behaviours themselves and set an example for team members to follow. Furthermore, project managers can improve their leadership style by adapting to the specific personality traits of the team.*

However, as suggested by Mintzberg [1998], leadership can also be exercised through team building. There are few suggestions from the researches in the field of human resource management that can support HR officers and project managers in their decisions of team members. Gratton and Erickson [2007] suggest to put at least a few people who know one another on the team. According to Hollenbeck et al. [2004] generic team work skills and teamwork KSAs (knowledge, skills, abilities) have a greater impact on team functioning than individual-level technical KSAs. The authors indicate that the mean score technique is often used to describe a specific trait (ex. extroversion). However, they argue that individual traits may be best described by method of aggregation based on maximum, minimum or variability score according to the nature of the trait and the characteristic of the task to be performed. Moreover, they suggest that aggregation technique may be replaced with team consensus ratings where a single questionnaire is filled by the team together. Team diversity and, more specifically, psychological diversity is another important factor to be considered because it has implications on the management style of project leaders and managers [Harrison et al., 2002]. According to Schippers et al. [2003] more diverse team have a stronger need for clear goals and feedbacks on team performance because members of such teams tend to distance themselves from each other when perspectives prove incompatible. On the other hand, the authors argue that less diverse teams tend to be more reflexive ("extent to which teams reflect upon and modify their functioning") when outcome interdependence is low and, consequently, do not necessitate such a managerial emphasis on shared objective.

6. *Client and contractor organizations may invest more time in the research and selection of team members in order to ensure the optimal functioning of the project team. This may require organizations to acquire further knowledge about the influence of team composition on team functioning.*

Another factor that influence the exchange is the mean of communication. Although the literature emphasizes the importance of informal interactions in promoting cooperation, the exploratory phase reveals

that these are not observed in the current or prescribed practice. Furthermore, the documentations review shows that, generally, interactions and communication between parties are mostly limited to formal moments. Therefore, it can be argued that the majority of information are exchanged virtually. Although, virtual communication offers many opportunities, the performance of this mean of communication depends on the users. Tan et al. [2000] propose a dialogue technique to improve common understanding in virtual teams. This technique is based on three steps. The first step aims to promote open communication by the creation of a 'space' (not a physical space) where members can exchange information that are unrelated to their formal roles and tasks. In the second step, members share and discuss their considerations about good communications practices. This helps to build a common view of what is considered to be 'good' communication. During this step, criticisms and defensive behaviours should be avoided. In the last step, team members compare past experiences and develop a shared model that includes all positive communication practices to be implemented during teamwork. It can be argued that this technique constitutes a good reference to improve in-person communication and can be applied to work out divergent opinions during the project. Hrastinski [2008] suggest that information richness and the degree of real-time interaction determine the most effective communication tool. The author investigates whether synchronous (real-time) communication (ex. chat), as a complement to asynchronous communication (ex. bulletin boards), can influence participation in online discussions. He found that asynchronous discussions are more oriented toward exchanging information while synchronous discussions are more interactive and promote personal participation (figure 6.1). He claims that real-time communication makes participants feel more connected to their peers because they more free to deviate from the subject of discussion and focus on social exchange. Hill and Bartol [2018] found that more effective virtual communication raises overall team performance. The authors suggest that the delivery mechanism should be to selected according to the message that has to be delivered. When the purpose of communication is to deliver sensitive messages, like discussing interpersonal issues, a tool (ex. video conference) that resembles personal contact should be preferred. They sustain that communication in general and, more specifically, written communication often requires interpretation and assumptions from the receiver. This can easily lead to misunderstanding among team members which, in turn, can lead to poor performance, hard feelings, lack of motivation and, possibly, conflicts [Brewer and Holmes, 2016]. This is why it is crucial to raise awareness about the danger of miscommunication and the trial conducted by Brewer and Holmes [2016] is a good example of how this task can be fulfilled. They used a communication exercise to emphasize the different interpretations that team members give to the same definition. The exercise was conducted at the beginning of team development and consisted in identical questionnaires given to a group of students. They were asked to give their subjective measure of ten different words associated to the concept of probability and time. At the end of the experiment, the results were displayed on a big screen and discussed with the students. The results demonstrated how meaning given to 'obvious' concepts is often taken for granted when, in reality, can vary significantly among people. The authors observed that this exercise helps to reduce miscommunication problems and, also, encourages teams to discuss their differences. Hill and Bartol [2018] recommend to make sure that relevant information is received by all team members and, most importantly, asking for clarification when something is unclear is preferable to draw a conclusion based on partial information and assumptions. Furthermore, they advocate for a responsive and supportive attitude. This means that all members should be proactive in promoting quick response to requests, ensuring significant feedbacks, proposing solutions to team's issues and keeping the team informed about individual priorities and setbacks. They warn that virtual communication may, sometimes, discourage participation and reduce the flow of information between dispersed teams. Hence, they recommended to actively seek the participation of all team(s) members in order to achieve open and inclusive communication. Finally, they argue that managers should not assume that all team(s) members are aware of what is positive and what is negative for communication. They propose to discuss with the team(s) and, then, make an explicit statement (chart) on the communication norms that have been agreed. Therefore:

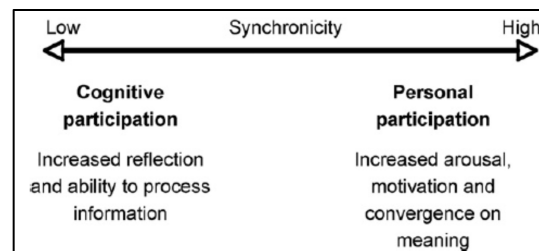


Figure 6.1: Cognitive and personal participation, retrieved from [Hrastinski, 2008]

They sustain that communication in general and, more specifically, written communication often requires interpretation and assumptions from the receiver. This can easily lead to misunderstanding among team members which, in turn, can lead to poor performance, hard feelings, lack of motivation and, possibly, conflicts [Brewer and Holmes, 2016]. This is why it is crucial to raise awareness about the danger of miscommunication and the trial conducted by Brewer and Holmes [2016] is a good example of how this task can be fulfilled. They used a communication exercise to emphasize the different interpretations that team members give to the same definition. The exercise was conducted at the beginning of team development and consisted in identical questionnaires given to a group of students. They were asked to give their subjective measure of ten different words associated to the concept of probability and time. At the end of the experiment, the results were displayed on a big screen and discussed with the students. The results demonstrated how meaning given to 'obvious' concepts is often taken for granted when, in reality, can vary significantly among people. The authors observed that this exercise helps to reduce miscommunication problems and, also, encourages teams to discuss their differences. Hill and Bartol [2018] recommend to make sure that relevant information is received by all team members and, most importantly, asking for clarification when something is unclear is preferable to draw a conclusion based on partial information and assumptions. Furthermore, they advocate for a responsive and supportive attitude. This means that all members should be proactive in promoting quick response to requests, ensuring significant feedbacks, proposing solutions to team's issues and keeping the team informed about individual priorities and setbacks. They warn that virtual communication may, sometimes, discourage participation and reduce the flow of information between dispersed teams. Hence, they recommended to actively seek the participation of all team(s) members in order to achieve open and inclusive communication. Finally, they argue that managers should not assume that all team(s) members are aware of what is positive and what is negative for communication. They propose to discuss with the team(s) and, then, make an explicit statement (chart) on the communication norms that have been agreed. Therefore:

7. *Client and contractor organizations may implement workshops and guidelines to train and inform teams on how to communicate effectively and raise awareness about the risk of miscommunication. It may be*

useful to involve an external independent team to support communication between teams, particularly at the start of the project. Develop and/or adapt communication platforms to facilitate effective communication. In general, encourage face to face and informal interactions.

According to practitioners, sharing consequences equally regardless of the circumstances is considered to be unfair and unappealing for different reasons. They provided different reasons to justify this statement. First, they indicate that the ability to manage a specific risk as well as the capacity to absorb potential negative consequences are not equally distributed between parties. Second, they argue one party is always more 'involved' in the occurrence of the risk. Third, they mention that risk sharing clauses that are not perceived as fair and reasonable may lead to disputes over the contract and, consequently, damage the smooth development of the project and project performance. Furthermore, they specify that the current contractual forms allow only one party to be appointed as risk owner, i.e. to be contractually liable. Nevertheless, practitioners agree that risk sharing mechanisms have to be found particularly when none of the parties has enough information to reasonably manage a specific risk. Therefore:

8. *Contractual provisions can be designed to stimulate parties' cooperative behaviours. For instance, the contracting parties can agree to include incentives that define responsibilities of the contractor and the maximum amount of economic damage over which the client is responsible. In addition, parties can include clauses in the collaboration plan that define obligations to engage in certain activities and explicit expectations with regards to cooperative attitudes and behaviours.*

According to the theory, the contract addresses the different perspectives on projects issues by clearly define roles and responsibilities [Fu et al., 2015]. According to practitioners, parties tend to be uncooperative when they are not liable. On the other hand, they suggest that liability can be used to stimulate parties' collaborative behaviours. In short, it can be argued that the contract influences parties' behaviors and the contract formulation determine whether these are more likely to be cooperative or uncooperative.

6.2. Validation

The purpose of the validation process is to evaluate the applicability of the proposed measures in practice. In particular, the validation aims to assess whether the framework meets the economic and functional requirements of its intended users and fits within the restrictions imposed by the current practice.

6.2.1. Validation results

These are the comments made with regards to the proposed framework. The following contents reflect exactly the position of the validators.

According to the validators, the chances to allocate more time to discuss are limited because the competitive dialogue takes already more than a year which involves a very intense procedure that includes many meetings between bidders and client. However, they argue that the client should spend more time to identify information that are needed by contractors to make a good bid because the current trend, particularly with the digitalization of information, is to transfer a huge amount of information to contractors without an appropriate selection. As a result, they observe that contractors first need to decide what is relevant and, then, give their interpretation. They specify that this occurs not only in the competitive dialogue but in all type of tender procedures.

The other issue with the discussion during the tender phase is, according to the validators, that bidders behave strategically during the discussion and are not willing to disclose information because these represents their strategic advantage. The validators indicate that, currently, contractors can ask for clarifications openly or confidentially and the client decide whether or not to the question can be confidential. However, they argue that if contractors are aware that all questions are made publicly available after the tender, they may avoid to formulate questions in the first place in order to avoid revealing strategic information to the other bidders. They argue that the best value approach² includes a more favourable tender procedure for the proposed type

²Best Value Procurement (BVP) was created by Dean Kashiwagi at Arizona State University and it focuses on selecting the contractor that is most suitable for the job and minimizing the client's decision making [Storteboom et al., 2017, Wondimu et al., 2018]. According to Storteboom et al. [2017] BVP represents a way of thinking that emphasizes transparency and accountability and, consequently, is not limited to a single procurement method. The contractor selection with the BVP approach considers both price and performance [Wondimu et al., 2018]. Tender criteria other than price are commonly used in the Dutch construction industry as demonstrated by the significant use of most economically advantageous tender (MEAT) by Rijkswaterstaat. This organization has been an early user of BVP and has adapted the original methodology to their specific procurement strategy [Storteboom et al., 2017]

of discussion and exchange of information. Validators confirm that Rijkswaterstaat has a department that advises only on projects procured with the best value approach. However, they warn that, although best value approach is much more cooperative oriented, it requires both the client and the market to be ready and willing to embrace this new attitude. According to validators, the status of the information provided is a further constraint to information exchange. They indicate that all major projects have very well-developed systems of documentation to exchange information and control developments and it is a very strict and structured system. They specify that the status of the information obtained through this platform can be used for liability claims. Therefore, they argue that a more informal system without rules where information given or received are part of informal exchanges and, consequently, cannot be used for liability claims can only be developed as complement of the first. With regards to the role of project leaders and managers in steering team members behaviours, validators argue that this managerial approach has to be observed on both sides in order to be effective. Furthermore, they suggest that the only way to steer the right attitude is to continuously observe and advice people on their behaviours and these efforts have to be constant from the start to the end of the project. However, they indicate that managers and executives often supervise more projects at the same time and, therefore, the most likely do not have sufficient time. With regards to team composition, validators argue that one single element in the team can disturb the equilibrium and prevent the development of cooperation. Thus, they suggest that coordination is needed when project teams are formed and changes in the composition during development should be carefully evaluated. Moreover, they recommended that it is important to evaluate if teams still have the required resources and knowledge during project development. According to validators, there are countries, even in Europe, where informal interactions and communication are not part of people's culture. They specify that some people necessitate formal rules and are strongly committed to work according to the hierarchical structure and, in these cases, informal communication is not an available option. With regards to the use of contractual provisions to stimulate behaviours, validators argue that this depends on the parties' approach to contracting. They provide the example of two opposing views on the matter of risk identification and allocation. They indicate that one approach is to decide a priori how to deal (who should be liable) with risks that may occur until the end of the project. The other approach described recognizes that it is impossible to forecast what is going to happen in the future and, therefore, it focuses more on developing a good process to agree on what has to be done when an unforeseen risk occurs. Validators claim that this second approach is much more flexible but requires a good degree of trust between parties. With regards to the final three questions, validators indicate that WitteveenBos is already investing in improving team composition through the application of a digital tool called 'Insight Discovery' and the support of experts in this subject. Moreover, they state that WitteveenBos makes use of external advisors to improve internal communication and suggests to its clients to involve external experts that can advise on collaboration. Furthermore, they point out that WitteveenBos has committed to develop a new Bouwteam agreement that meet the current requirements and comply with the existing standards. They suggest that Rijkswaterstaat is also looking into more cooperative relationships with market parties as demonstrated by its adherence to the Market Vision (*De Marktvisie*) and DOEN philosophy. However, they point out that Rijkswaterstaat is unlikely to use platform for informal exchange of information but they promote the 'two-phase' model which support a greater exchange on information between client and contractor in order to reduce uncertainties and financial risks.

6.3. Intermediate conclusions – The risk sharing framework

The first measure does not fit within the restrictions imposed by the competitive dialogue. The second measure is strongly limited by the need of bidders to be competitive. The third and fourth measure are applicable and, according to the description provided by validators, can be related to the procurement procedure of the best value approach which is currently applied. The fifth measure is limited by time availability. The sixth measure is applicable and matches the current practice of employing the support of software and advisors to improve team composition. The seventh measure is applicable but it depends on the organizational and national culture. The eighth measure is considered applicable but it depends on the approach to contracting of the organization.

Overall, the barriers for the framework implementation are time, competition, personal attitude and organizational culture. However, according to the validators, the major challenge is to convince the client to follow these advices. They suggest that people at the project level, particularly young people, are easy to change. They argue that the true resistance is the people above the project level, top executives that have been working for 25-30 years in the construction industry who are reluctant to change. This raises the question of what

may trigger these people to change.

7

Conclusion

The current approach to risk management of public clients and contractors is one of the factors that prevent the development of structural changes in cooperation within the Dutch construction sector and, more specifically, the realisation of the goals set in the "Market Vision" (*De Marktvisie*). It is evident that a change in the way risks are managed by public and private partners is needed. Hence, the objective of this research is to provide partner organizations with a framework to share risk at the project level in order to foster commitment and cooperation for the long duration of the partnerships. Accordingly, the main research question is:

"How can risk sharing be designed at the project level in order to improve cooperation between public and private partners in infrastructure projects?"

In this chapter, the results of the research are presented. First, the research question and sub-questions are answered. Second, practical implications are provided to illustrate how the outcome of this research can be applied by managers at the project level. Third, general recommendations are provided to the different actors involved in the construction process based on the overall findings of the research. Finally, limitations and suggestions for future research are discussed.

7.1. Answers to research question and sub-questions

Answer to first sub-question:

"What is the current understanding of risk sharing from a theoretical and practical perspective?"

The results of the literature study highlight a gap with regards to the theoretical perspective on risk sharing. The gap results from the ambiguous definition observed in different papers (references) where the wording 'risk sharing' is used as a synonym for risk allocation or distribution. The other limitation observed in the literature, perhaps related to the ambiguity in the wording is the lack of criteria to assess whether a risk is eligible for sharing. Furthermore, the risk sharing mechanisms applied in the construction sector mentioned in the literature refer to financial incentives such as government guarantees, target cost contracts, etc.

The practical perspective on risk sharing is investigated during the exploratory phase and the discussion with practitioners. The ambiguity found in the literature matches the confusion observed in the respondents during the exploratory interviews. They do not distinguish between the concept of risk sharing and the process of risk allocation. Similarly, three practitioners refer to "allocation" or "allocating" in their answer to the first question (*"What is, in general, your idea of risk sharing?"*) during the discussion. Risk sharing is mentioned as risk treatment option in the ISO 31000 but that is the only reference found in the reviewed documents.

It can be concluded that theoretical and practical perspective do not substantially distinguish risk sharing from risk allocation. On the other hand, several statements are collected during exploratory interviews and discussion with practitioners with regards to:

- Sharing the consequences of risk;
- Jointly manage unforeseen events;

- Mutual help to manage risks regardless of contractual liability;

These statements are only associated to the respondents' vision of an ideal practice but suggest that people in the field implicitly recognize the difference between risk sharing and risk allocation.

Answer to second sub-question:

“What are the contractual and relational elements that impact cooperation between public and private partners?”

According to the results of the literature study, contractual and relational elements have different effects on the dimensions of cooperation but, overall, are considered to promote inter-organizational cooperation. “Legal safeguards” refer to effect of contractual elements on inter-organizational cooperation. The literature cites control, coordination and adaptation as contract's functions. “Social control” refer to the effect of relational elements on inter-organizational cooperation. The most cited relational elements are trust and relational norms. Contracts serve as a framework to indicate acceptable or desirable behaviours that are the basis for managers to develop relational rules for interacting and handling issues on a daily basis in the project. The literature study suggests that the attitude and willingness of partners to engage in cooperative behaviors is stimulated more by trust and relational norms than formal enforceable rules. The literature also points out the role of:

- Informal interactions
- Enhanced participation

in promoting inter-organizational cooperation. However, according to the literature, current risk sharing only consists of contractual incentives that can be associated to the control function of contracts. Therefore, it can be argued that risk sharing requires additional elements in order to promote cooperation.

Answer to third sub-question:

“Which contractual and relational elements can be added to the current risk sharing to promote cooperation?”

The following elements can be added to the current risk sharing:

1. Coordination function
2. Adaptation function
3. Trust
4. Open communication
5. Informal interactions
6. Joint management
7. Enhanced participation

The elements (1), (2), (3), (5), (7) are considered because they are mentioned in the literature to stimulate cooperation. Likewise, the elements (4) and (6) are considered because respondents of the exploratory interviews suggest that, in the current practice, cooperation can benefit from these changes. These elements are combined into four mechanisms:

Joint risk analysis

The first mechanism proposed is joint risk analysis. This is a chance to communicate openly with each other and reach an agreement that considers the different perceptions of the partners which may reduce the chance of having conflicts later on. This combines the coordination function with the necessity to reduce coordination failure. Furthermore, it is also an opportunity to jointly assess available information and parties' capabilities. These criteria can signal whether a risk should be shared and, consequently, encourage partners to jointly manage that specific risk.

Sharing human resources

The second mechanism proposed involves greater movement of people between project teams. This creates a conducive environment for personal encounters, informal interactions and open communication which contribute to trust development and, consequently, reduces opportunism. Furthermore, a higher rate of information exchange is expected which facilitates joint management and stimulate mutual learning.

Sharing knowledge

The third mechanism proposed involves greater sharing of knowledge between project teams and with the external environment. This is an opportunity to assess which information are required and which are already available and weight the other parties' internal capabilities. The greater flow of information is expected to facilitate joint management.

Sharing consequences

The fourth mechanism proposed involves drafting the contract in such a way that parties equally share the possible negative consequences regardless of the specific circumstances. In the current practice, when unforeseen events occur, the likelihood of the blame game and, consequently, of conflicts and opportunism between partners increase. However, removing the chance of the blame game is expected to create a strong incentive for partners to maximize their efforts to avoid negative consequences, minimizing the chance of opportunistic behaviours and conflicts.

Answer to fourth sub-question:

"Which measures can be developed, based on the current practice, to enhance the effect of risk sharing on cooperation?"

The mechanisms described in the answer to the third sub-question are discussed with practitioners. Combining the results of the discussion with the insights collected in the previous phases the proposed risk sharing mechanisms are refined obtaining a framework formed by the following measures:

1. More time allocated to discussion between contracting authority and contractors during the competitive dialogue may reduce the risk of divergent interpretations. In alternative, the 'two phase process' may be preferred to the current procurement strategy because it can facilitate exchange of information between contracting authority and contractors.
2. An online forum can be organized to allow questions from bidders on project matters. The distribution of questions may highlight issues that are particularly challenging, unclear or require knowledge that is unavailable. This can signal the contracting authority the necessity to openly discuss the issue with all the bidders and, together, define alternative solutions.
3. A period of time may be allocated to discuss and address uncertainties after bids are submitted so competition is no longer a major concern. Participation may be extended to external parties (like Neerlands diep) that can contribute with their knowledge and perspective.
4. Alternatively, a workshop may be organized post-award but before the start of the project to assess what knowledge is required by contractors, where and if this knowledge can be found. In this way, the efforts to supply the required knowledge can be shared by all participants rather than being sustained only by the party that requires the information.
5. The required attitudes and behaviours of project members can be promoted by project leaders and managers by showing cooperative behaviours themselves and set an example for team members to follow. Furthermore, project managers can improve their leadership style by adapting to the specific personality traits of the team.
6. Client and contractor organizations may invest more time in the research and selection of team members in order to ensure the optimal functioning of the project team. This may require organizations to acquire further knowledge about the influence of team composition on team functioning.

7. Client and contractor organizations may implement workshops and guidelines to train and inform teams on how to communicate effectively and raise awareness about the risk of miscommunication. It may be useful to involve an external independent team to support communication between teams, particularly at the start of the project. Develop and/or adapt communication platforms to facilitate effective communication. In general, encourage face to face and informal interactions.
8. Contractual provisions can be designed to stimulate parties' cooperative behaviours. For instance, the contracting parties can agree to include incentives that define responsibilities of the contractor and the maximum amount of economic damage over which the client is responsible. In addition, parties can include clauses in the collaboration plan that define obligations to engage in certain activities and explicit expectations with regards to cooperative attitudes and behaviours.

Answer to fifth sub-question:

"To what extent are the proposed measures applicable in practice?"

The validation highlights barriers that constraint the applicability of the proposed measures in practice. According to the validators, the opportunities to allocate more time to discuss are limited because the competitive dialogue involves a very intense procedure that includes many meetings between bidders and client which takes already more than a year. Furthermore, bidders behave strategically during the dialogue and are not willing to disclose information because these represent their strategic advantage. In addition, the status (formal vs informative) of the information provided is a further constraint to information exchange. In general, they indicate that the way organizations interact and communicate depends on people and organizational culture. Validators warn that procurement strategies, like 'best value' and 'two phase process', that are more cooperative oriented require both clients and market parties to be willing to embrace this new way of working. According to validators, the proposed role of project leaders and managers in steering team members behaviors is limited by time availability. They argue that the effect of team composition on cooperation depends on the willingness of the party to coordinate with each other, adjust according to performance during the project and invest in software and external support to increase knowledge about this factor. The willingness to include specific contractual provisions regarding, for instance, incentives or cooperative behaviors depends, according to validators, on the parties' approach to contracting. In brief, barriers for the framework implementation are time, competition, personal attitude and organizational culture. According to validators, the main challenge is to convince the executives above the project level to make the necessary changes to remove or by pass these barriers.

Answer to Research Question:

"How can risk sharing be designed at the project level in order to improve cooperation between public and private partners in infrastructure projects?"

When the goal is to promote cooperation, risk sharing cannot consist only of financial incentives. The ambition to improve cooperation through risk sharing requires a different approach to contracting together with several relational elements. The framework formed by the measures proposed in the answer to the fourth sub-question achieves this objective and contribute to achieve the goals envisaged in the "Market Vision" (De Marktvisie). However, the proposed risk sharing design requires certain personal attitudes of team members in order to be effective. According to practitioners, partners should:

- seek the participation of all team(s) members, internal and external;
- take the initiative to help rather than being passive;
- show behaviours oriented toward the achievement of common goals and mutual benefits;
- be open and receptive to new ideas, different perspectives, external influence;

Furthermore, an essential attitude is to accept and embrace the idea that risk ownership does not exclude the chance of managing a risk together. The legal boundary of having one risk owner should not prevent partners from being forthcoming and providing support to control risks. Based on the results of the discussion with

practitioners, the proposed risk sharing design is effective in stimulating cooperation only if partners coordinate with each other and commit to implement these measures together. It can be argued that the joint efforts required to organize risk sharing are the first important contribution to stimulate inter-organizational cooperation. Finally, the effectiveness of the proposed risk sharing design depends on whether partners meet the challenges highlighted during validation. This implies accepting the disadvantages of these measures, such as higher costs upfront, reduced competitive pressure, etc. in order to secure the benefits of enhanced cooperation, such as reduced transaction costs and conflicts, mutual learning, etc.

7.2. Practical implications

The following instructions explain how practitioners from different organisations (clients, contractors, advisors, financiers) involved in infrastructure projects can apply the outcomes of this research in their daily practice.

- Clients should make a more accurate selection of documents provided to bidders prior to the start of the tender in order to avoid the transfer of redundant or unnecessary information.
- Clients should consult contractors to expose part of the projects that are particularly challenging and may need further investigation. External parties should be involved as well in order to have impartial opinions.
- Contractors should use the process to determine client's requirements (KES - Stappenplan klanteisen-specificatie is a specific example of this process) to steer decisions and avoid unfeasible solutions. Client's requirements should also be discussed from the viewpoint of the risks that arise from these.
- Partners should discuss and compare their expectations regarding contents like rules for external involvement, team assessment technique and criteria, communication protocol in order to reach an agreement that aligns and satisfies the requirements of both sides. Managers should consult their team before discussing with each other and trigger new discussions when the outcome of the decisions made is unsatisfactory.
- Managers should inspire their team members. They should demonstrate to be capable of admitting their mistakes and limitations. They should address issues in a constructive way rather than fostering a blaming culture.

7.3. Recommendations

The following recommendations are formulated based on the findings of this research and aim to support the transition of the Dutch civil engineering sector to a financially healthy, competitive, innovative, cost-effective and sustainable industry. The perspective of the client can be deduced by the statements given during the exploratory interviews by employees of WitteveenBos that work with the client organization. Furthermore, it is integrated by the analysis of internal documents and the report released in 2019. The contractors' perspective is represented by the statements collected during the empirical check. WitteveenBos' perspective is assessed through the direct working experience in the company and the analysis of internal documents. The advices are directed at the organizational level of client, contractor, WitteveenBos and, more generally, to the whole construction industry.

7.3.1. Client

- Rijkswaterstaat is recommended to hire new personnel rather than keep reducing staff. This is essential to ensure a sufficient exchange of people and knowledge with contractors and, consequently, stimulate cooperation.
- Rijkswaterstaat is recommended to consider the portfolio approach to procure large projects. This is particularly relevant considering the limited numbers of contractors for this kind of projects. The portfolio approach gives certainty about future works and, consequently, creates a long-term perspective for construction companies. Hence, they are incentivized to invest in innovation and, furthermore, to develop trustworthy relationships with the client. In addition, the project pipeline creates favourable conditions for knowledge sharing.

- Rijkswaterstaat is recommended to employ outside consultants prior to the tender in order to gather sufficient, high-quality information that are necessary to determine the actual risk profile of projects. This helps to calculate an adequate return for market parties.

7.3.2. Contractor

- Contractors are recommended to improve their risk analysis. This should be realistic and reflect the actual risk profile of the project. In the long run, this may contribute to increase the risk-return ratio. They should avoid to downplay risk estimation to gain competitive advantage because this distorts the bidding process and, eventually, may lead to financial and reputational loss for themselves.
- Contractors are advised to actively engage subcontractors in order to foster cooperation within the supply chain. Smaller companies are often more specialized than major contractors because they focus only on specific activities. Therefore, they may be more knowledgeable about certain issues or risks. Closer relationships with subcontractors may facilitate the transfer of their knowledge to contractors which may contribute to develop innovative solutions.

7.3.3. WitteveenBos

- WitteveenBos is recommended to introduce new services in its portfolio. The core business is designing technical solutions but the construction industry is also in need of consultancy services related to more soft aspects (team functionality, meeting organization, etc.). This is an opportunity for the company to increase its market share and attract new clients. The new services can be the result of a partnership with other companies or the creation of a new PMC unit.
- WitteveenBos is recommended to have more direct and frequent contacts with clients. It is mentioned that one of the risks for the company is that clients are unable to make decisions and require additional information. This means extra work which may not be billable. Closer interaction may help to mitigate this risk. In particular, the formulation of client's requirements is a critical moment that should be designed in order to mitigate the risk of future claims.
- WitteveenBos is recommended to define measures of cooperation to be included in supplier and partners evaluation, e.g. number of legal disputes in the last assignment. These measures should reflect the company's perspective of good cooperation.

7.3.4. Industry

- The industry is recommended to spread the new paradigm of risk sharing across the entire supply chain. This is needed to foster the necessary attitudes and behaviours that can make the civil engineering sector more profitable and innovative.
- The industry is recommended to steer the perspective on project success in order to include criteria related to cooperation.
- The industry is advised to increase investments in R&D and digitalization. The following area can be targeted: team composition, communication techniques, data collection, statistical analysis. The first two areas can support the development of cooperation while the last two can result in better forecasting ability which can improve risk management. In general, this should contribute to increase the productivity of this sector.
- The industry is advised to initiate a dialogue with the regulatory authorities (e.g. European Union) in order to review the current tendering regulation and make it more conducive for cooperation.

7.4. Limitations

This paragraph discusses the most important limitations of this research which are associated to the following points:

- Definition of core concepts
- Representativeness of respondents
- Results interpretation

Definition of core concepts

The formulation of risk sharing used to develop the framework is based on the assumptions that both partners are risk adverse, have a common goal but divergent interests and their relationship is market oriented which most likely results in absence of trust. These assumptions are formulated according to the description of the current situation in the industry provided by literature and interviews. However, it is possible to find different circumstances in the same context. The concept of cooperation is limited to task and relational behaviours. However, it is probably possible to break down cooperation in more specific attitudes and behaviours. Furthermore, the theoretical perspective does not strictly refer to cooperation between public and private partners in infrastructure projects. As a result, the impact of contractual and relational mechanisms may be different in the specific context. Finally, the framework assumes that risk sharing influences cooperation but it neglects the potential effect that cooperation may have on risk sharing.

Representativeness of respondents

During the exploratory phase, only employees of WitteveenBos are interviewed. Likewise, the majority of the documents reviewed are company's internal documents. As a result, the practical perspective and the analysis of current practice included in the conceptual model is mostly limited to the position of this company. The sample studied during the empirical check is limited to few organizations which does not include clients. Therefore, the risk sharing framework is biased towards the position of private partners.

Results interpretation

The results of the empirical testing are analysed through the coding method which involves a certain degree of interpretation of the data. This may cause disagreement about the result of the qualitative analysis.

7.5. Future research

This research elaborates on the relation between risk sharing and cooperation in the context of PPP infrastructure projects. This paragraph provides inputs for future research related to the same subject.

The role of subcontractors

The framework focuses on the role of client and contractors. However, the desired transition of the civil engineering sector involves the whole supply chain. Hence, in future research, the suggested framework may be enhanced by including the role and perspectives of subcontractors.

Two phase process

The risk sharing framework is developed considering the circumstances of the tender procedure commonly used by Rijkswaterstaat. In future research, it is interesting to evaluate the implications of the 'two-phase' process on the risk sharing framework.

Best value procurement

It is suggested that best value approach is more cooperative oriented than competitive dialogue. In future research, it is interesting to collect empirical evidence to demonstrate this statement and illustrate what is the trade-off required by this approach.

Feedback relationship

In future research, it is interesting to evaluate how the risk sharing framework changes if the relationship with cooperation is assumed to be characterised by feedback effect. This research can be divided in two parts. The first part can use an analytical approach and apply mathematical modelling to investigate the relationship starting from the basic assumptions of this conceptual model. The second part can use an empirical approach through the investigation of case studies to verify the findings of the mathematical model and consequently adapt the risk sharing framework.

Trade-off between competition and cooperation

Risk sharing is assumed to stimulate competition because it increases the risk-return ratio and facilitate the participation of individual companies. On the other hand, it stimulates cooperation as well. In future research, it is interesting to investigate whether these two effects can coexist.

Reflections

The features of the relationships between organisations operating in the construction sector are not conducive to cooperative relations between public and private partners. Moreover, competitive pressure and unattractive risk-return profile of large infrastructure projects hinder the development of cooperation. The lack of cooperation undermines the social task of providing public infrastructures. Hence, cooperation in the construction sector is not only desirable but necessary.

The outcome of this research represents a valid solution to address this issue because cooperation is a necessary but not sufficient condition of the proposed risk sharing framework. Therefore, the implementation of the framework fosters the development of cooperative behaviours of public and private partners. The outcome, at the very least, stimulates organisations to reflect and reconsider their way of interacting and working together. However, the proposed risk sharing framework requires certain conditions in order to be effective in promoting cooperation. The attitudes and behaviours of people and organisations at the project level and above need to change.

I believe that market parties and public clients are not ready yet to make these changes not because they do not perceive the urge, but because the surrounding environment is still immature to foster this kind of changes. We grow up in an increasing competitive world, when someone fails there is someone else ready to take the spot. People and organisations are just overwhelmed with expectations and obligations. People are expected to perform at the best all the time and have always the right answer. Organisations are concerned with profit, shareholders, stock market, accountability and reputation. However, I believe that a profound change will occur in the coming years when people realise that it is the only way to meet contemporary challenges. We need to move from a perspective based on competition to one founded upon collaboration and revise our expectations accordingly. This can be difficult, particularly for private partners, because the profit and reputation resulting from being competitive are realized in the short term and increase the value of the individual company, whereas the benefits of enhanced cooperation are realized on the long term and shared with the other stakeholders. This is why it is essential to shift the focus of the economic system from profit maximisation to wealth distribution.

Bibliography

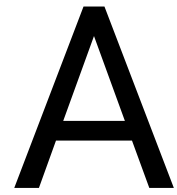
- Rudiger Ahrend, Jens Arnold, and Charlotte Moeser. The sharing of macroeconomic risk. Technical Report 877, OECD, 2011. URL <https://www.oecd-ilibrary.org/content/paper/5kg8hw5467wd-en>.
- Daniel Albalade, Germa Bel, Paula Bel-Piñana, and Richard Geddes. Risk mitigation and sharing in motorway ppps: A comparative policy analysis of alternative approaches. *Journal of Comparative Policy Analysis*, 17, 03 2015. doi: 10.1080/13876988.2015.1010788.
- Ulrika Badenfelt. The selection of sharing ratios in target cost contracts. *Engineering, Construction and Architectural Management*, 15:54–65, 01 2008. doi: 10.1108/09699980810842061.
- Ballast Nedam. Financial close for ppp project a24 blankenburg connection, 2019. <https://www.ballast-nedam.nl/nieuws/2018/10/18/financial-close-voor-pps-project-a24-blankenburg-verb> [Accessed: 2019-07-16].
- BAM PPP bv. Level reaches financial close on afsluitdijk project successfully, 2019. <https://www.bam.com/en/press/press-releases/2018/5/level-reaches-financial-close-on-afsluitdijk-project-successfully> [Accessed: 2019-07-16].
- Pat Bazeley. *QUALITATIVE DATA ANALYSIS: practical strategies*. SAGE PUBLICATIONS, 2014.
- Camilo Benítez-Ávila, Andreas Hartmann, Geert Dewulf, and Jörg Henseler. Interplay of relational and contractual governance in public-private partnerships: The mediating role of relational norms, trust and partners' contribution. *International Journal of Project Management*, 36(3):429 – 443, 2018. ISSN 0263-7863. doi: <https://doi.org/10.1016/j.ijproman.2017.12.005>. URL <http://www.sciencedirect.com/science/article/pii/S0263786316304422>.
- Maura Borrego, Elliot Douglas, and Catherine Amelink. Quantitative, qualitative, and mixed research methods in engineering education. *Journal of Engineering Education*, 98, 01 2009. doi: 10.1002/j.2168-9830.2009.tb01005.x.
- Edward Brewer and Terence Holmes. Better communication = better teams: A communication exercise to improve team performance. *IEEE Transactions on Professional Communication*, 59:1–11, 08 2016. doi: 10.1109/TPC.2016.2590018.
- H. Brink. Validity and reliability in qualitative research. *Curationis*, 16:35–8, 07 1993. doi: 10.4102/curationis.v16i2.1396.
- Jon Broome and John Perry. How practioners share fractions in target cost contracts. *International Journal of Project Management - INTJ PROJ MANAG*, 20:59–66, 01 2002. doi: 10.1016/S0263-7863(00)00035-1.
- Philippe Burger, Daniel Bergvall, and Jacobzone Stephane. *Public-private partnerships: in pursuit of risk sharing and value for money*. OECD publishing, 2008.
- Richard Burke and Istemi Demirag. Risk management by spv partners in toll road public private partnerships. *Public Management Review*, 21:1–21, 10 2018. doi: 10.1080/14719037.2018.1523450.
- Zhi Cao and Fabrice Lumineau. Revisiting the interplay between contractual and relational governance: A qualitative and meta-analytic investigation. *Journal of Operations Management*, 33-34:15 – 42, 2015. ISSN 0272-6963. doi: <https://doi.org/10.1016/j.jom.2014.09.009>. URL <http://www.sciencedirect.com/science/article/pii/S0272696314000680>.
- Rajesh Chakrabarti and Kumar Pratap. *PUBLIC-PRIVATE PARTNERSHIPS IN INFRASTRUCTURE: managing the challenges*. SPRINGER VERLAG, SINGAPOR, 2018.

- Daniel W. M. Chan, Albert P. C. Chan, Patrick T. I. Lam, and James M. W. Wong. Empirical study of the risks and difficulties in implementing guaranteed maximum price and target cost contracts in construction. *Journal of Construction Engineering and Management*, 136(5):495–507, 2010. doi: 10.1061/(ASCE)CO.1943-7862.0000153.
- Dr Daniel Chan, Albert Chan, Patrick Lam, and James Wong. An empirical survey of the motives and benefits of adopting guaranteed maximum price and target cost contracts in construction. *International Journal of Project Management*, 29:577–590, 07 2011. doi: 10.1016/j.ijproman.2010.04.002.
- Chotchai Charoenngam and Chien-Yuan Yeh. Contractual risk and liability sharing in hydropower construction. *International Journal of Project Management*, 17(1):29 – 37, 1999. ISSN 0263-7863. doi: [https://doi.org/10.1016/S0263-7863\(97\)00064-1](https://doi.org/10.1016/S0263-7863(97)00064-1).
- Jacopo Cimadomo, Sebastian Hauptmeier, Alessandra Anna Palazzo, and Alexander Popov. Risk sharing in the euro area. Technical Report 3, ECB, 2018.
- Dale F Cooper, Stephen Grey, Geoffrey Raymond, and Phil Walker. *Project risk management guidelines: managing risk in large projects and complex procurements*. Wiley Chichester, 2005.
- Carlos Cruz and Rui Marques. *Infrastructure Public Private Partnerships: Decision, Management and Development*. Springer, 05 2013. ISBN 3642369094. doi: 10.1007/978-3-642-36910-0.
- T. K. Das and Bing-Sheng Teng. Trust, control, and risk in strategic alliances: An integrated framework. *Organization Studies*, 22(2):251–283, 2001. doi: 10.1177/0170840601222004.
- Barbara B. Flynn, Sadao Sakakibara, Roger G. Schroeder, Kimberly A. Bates, and E. James Flynn. Empirical research methods in operations management. *Journal of Operations Management*, 9(2):250 – 284, 1990. ISSN 0272-6963. doi: [https://doi.org/10.1016/0272-6963\(90\)90098-X](https://doi.org/10.1016/0272-6963(90)90098-X). URL <http://www.sciencedirect.com/science/article/pii/027269639090098X>.
- Bent Flyvbjerg, Nils Bruzelius, and Werner Rothengatter. *Megaprojects and risk: an anatomy of ambition*. Cambridge University Press, 2003.
- Yongcheng Fu, Yongqiang Chen, Shuibo Zhang, and Wenqian Wang. Promoting cooperation in construction projects: an integrated approach of contractual incentive and trust. *Construction Management and Economics*, 33, 08 2015. doi: 10.1080/01446193.2015.1087646.
- Lars-Erik Gadde and Anna Dubois. Partnering in the construction industry—problems and opportunities. *Journal of Purchasing and Supply Management*, 16:254–263, 12 2010. doi: 10.1016/j.pursup.2010.09.002.
- Lynda Gratton and Tamara Erickson. Eight ways to build collaborative teams. *Harvard business review*, 85: 100–9, 153, 12 2007.
- Hans Ham and Joop Koppenjan. Building public-private partnerships: Assessing and managing risks in port development. *Public Management Review - PUBLIC MANAG REV*, 3:593–616, 12 2001. doi: 10.1080/14616670110070622.
- David Harrison, Kenneth Price, Joanne Gavin, and Anna Florey. Time, teams, and task performance: Changing effects of surface and deep-level diversity on group functioning. *Academy of Management Journal*, 45: 1029–1045, 10 2002. doi: 10.2307/3069328.
- N. Sharon Hill and Kathryn M. Bartol. Five ways to improve communication in virtual teams. *MIT Sloan Management Review*, 2018.
- John Hollenbeck, D. DeRue, and Rick Guzzo. Bridging the gap between i/o research and hr practice: Improving team composition, team training, and team task design. *Human Resource Management*, 43:353 – 366, 12 2004. doi: 10.1002/hrm.20029.
- Stefan Hrastinski. The potential of synchronous communication to enhance participation in online discussions: A case study of two e-learning courses. *Information and Management*, 45:499–506, 11 2008. doi: 10.1016/j.im.2008.07.005.

- Leonie Koops, Marian Bosch-Rekvelde, Laura Coman, Marcel Hertogh, and Hans Bakker. Identifying perspectives of public project managers on project success: Comparing viewpoints of managers from five countries in north-west europe. *International Journal of Project Management*, 34(5):874–889, 2016.
- L.S.W. Koops. *Creating public value: Optimizing cooperation Between public and private Partners in infrastructure Projects*. PhD thesis, Delft University of Technology, 2017.
- Samuel Laryea. Risk apportionment in target cost contracts. *Proceedings of the Institution of Civil Engineers - Management, Procurement and Law*, 169:1–10, 10 2016. doi: 10.1680/jmapl.15.00046.
- Teh-Chang Lee, Ta-Hsing Lee, and Ching-Hwang Wang. Decision analysis for construction contract risk-sharing. *Journal of Marine Science and Technology*, 17, 06 2009.
- Steven S. Lui and Hang-Yue Ngo. The role of trust and contractual safeguards on cooperation in non-equity alliances. *Journal of Management*, 30(4):471–485, 2004. doi: 10.1016/j.jm.2004.02.002.
- D. Malhotra and F. Lumineau. Trust and collaboration in the aftermath of conflict: The effects of contract structure. *Academy of Management Journal*, 54(5):981–998, 2011. URL www.scopus.com. Cited By:175.
- Francesca Medda. A game theory approach for the allocation of risks in transport public private partnerships. *International Journal of Project Management*, 25(3):213 – 218, 2007. ISSN 0263-7863. doi: <https://doi.org/10.1016/j.ijproman.2006.06.003>. URL <http://www.sciencedirect.com/science/article/pii/S0263786306001013>.
- Matthew B. Miles and A. Michael Huberman. *Qualitative data analysis: an expanded sourcebook*. Sage, 1994.
- Roger Miller and Donald Lessard. Understanding and managing risks in large engineering projects. *International Journal of Project Management*, 19(8):437 – 443, 2001. ISSN 0263-7863. doi: [https://doi.org/10.1016/S0263-7863\(01\)00045-X](https://doi.org/10.1016/S0263-7863(01)00045-X). URL <http://www.sciencedirect.com/science/article/pii/S026378630100045X>.
- H Mintzberg. Covert leadership: notes on managing professionals. knowledge workers respond to inspiration, not supervision. *Harvard business review*, 76(6):140—147, 1998. ISSN 0017-8012. URL <http://europepmc.org/abstract/MED/10187244>.
- RVO Netherlands Enterprise Agency. Public-private partnership (ppp), 2019. <https://business.gov.nl/regulation/public-private-partnership> [Accessed: 2019-07-16].
- A. Ng and Martin Loosemore. Risk allocation in the private provision of public infrastructure. *International Journal of Project Management*, 25(1):66 – 76, 2007. ISSN 0263-7863. doi: <https://doi.org/10.1016/j.ijproman.2006.06.005>. URL <http://www.sciencedirect.com/science/article/pii/S0263786306001001>.
- Gordon O'Brien. The measurement of cooperation. *Organizational Behavior and Human Performance*, 3(4): 427 – 439, 1968. ISSN 0030-5073. doi: [https://doi.org/10.1016/0030-5073\(68\)90019-6](https://doi.org/10.1016/0030-5073(68)90019-6).
- Trond E. Olsen and Petter Osmundsen. Sharing of endogenous risk in construction. *Journal of Economic Behavior and Organization*, 58(4):511 – 526, 2005. ISSN 0167-2681. doi: <https://doi.org/10.1016/j.jebo.2003.09.019>. URL <http://www.sciencedirect.com/science/article/pii/S0167268104001982>.
- Masamitsu Onishi, Toshihiko Omoto, and Kiyoshi Kobayashi. Risk-sharing rule in project contracts. *IEEE International Conference on Systems, Man and Cybernetics*, 6:6 pp. vol.6–, 2002.
- Athena Panayiotou and Francesca Medda. Attracting private sector participation in transport investment. *Procedia - Social and Behavioral Sciences*, 111:424–431, 02 2014. doi: 10.1016/j.sbspro.2014.01.075.
- Rijkswaterstaat. Toekomstige opgave rijkswaterstaat: Perspectief op de uitdagingen en verbetermogelijkheden in de gww-sector. Technical report, Rijkswaterstaat, 2019.
- Johnny Saldana. *The Coding manual for qualitative researchers*. SAGE, 2016.
- Joaquim Miranda Sarmiento and Luc Renneboog. Anatomy of public-private partnerships: their creation, financing and renegotiations. *International Journal of Managing Projects in Business*, 9(1):94–122, 2016.

- M.C. Schippers, D.N. den Hartog, P.L. Koopman, and J.A. Wienk. Diversity and team outcomes: The moderating effects of outcome interdependence and group longevity and the mediating effect of reflexivity. *Journal of Organizational Behavior*, 24:779–802, 2003. ISSN 0894-3796. doi: 10.1002/job.220.
- John A. Sokolowski and Catherine M. Banks. *Modeling and simulation fundamentals: theoretical underpinnings and practical domains*. John Wiley, 2010.
- Arnoud Storteboom, Paulos Wondimu, Jardar Lohne, and Ola Laedrea. Best value procurement - the practical approach in the netherlands. *Procedia Computer Science*, 121:398–406, 2017. ISSN 1877-0509. doi: <https://doi.org/10.1016/j.procs.2017.11.054>. URL <http://www.sciencedirect.com/science/article/pii/S1877050917322470>.
- Antonio Sánchez Soliño. Analysis of the optimal sharing of construction risk in public procurement contracts. *Revista de la construcción*, 13:74–80, 04 2014. doi: 10.4067/S0718-915X2014000100009.
- Boon yeow Tan, Kwok-Kee Wei, Wayne Huang, and Guet-Ngoh Ng. A dialogue technique to enhance electronic communication in virtual teams. *Professional Communication, IEEE Transactions on*, 43:153–165, 07 2000. doi: 10.1109/47.843643.
- P.J.M Verschuren, Hans Doorewaard, R. Poper, and M.J Mellion. *Designing a research project*. Eleven International Publishing, 2010.
- S Wamuziri and A Seywright. Risk sharing and effective incentives in collaborative procurement. 21st Annual ARCOM Conference, 2005.
- Yinglin Wang, Huaizhu Oliver Gao, and Jicai Liu. Incentive game of investor speculation in PPP highway projects based on the government minimum revenue guarantee. *Transportation Research Part A: Policy and Practice*, 125(C):20–34, 2019. doi: 10.1016/j.tra.2019.05.006.
- Anna Wiewiora, Glen Murphy, Bambang Trigunarsyah, and Kerry Brown. Interactions between organizational culture, trustworthiness, and mechanisms for inter-project knowledge sharing. *Project Management Journal*, 45, 02 2014. doi: 10.1002/pmj.21407.
- Paulos Wondimu, Ole Klakegg, Ola Lædre, and Glenn Ballard. A comparison of competitive dialogue and best value procurement, 07 2018.

Appendices



Exploratory interviews protocol

First, general information about the researcher (faculty, course), the research (motivations, objectives, research question) and the respondent (role, previous experiences, education background) are exchanged.

First section: *Evaluate context, project complexity and uncertainty*

1. In which PPP projects are/were you involved as employee of WitteveenBos?
2. Who was the client?
3. Which party do/did you advice and on which aspects?
4. Which aspect of the project were more uncertain?

Second section: *Identify risk classification and current criteria*

5. Which are/were the most relevant risks identified in the project during your assignment?
15. What is the influence of information availability on risk management? (this question was added later because from previous interviews emerged that information are important to determine whether a risk should be shared)

Third section: *Assess current organizational attitude with regards to risk sharing and cooperation and investigate the balance of contractual and relational mechanisms*

6. Who does/did carry these risks?
7. If the risk occurs, how do/did parties deal with the consequences?
8. Which one of these risks should be allocated to a different party or shared? Motivate your answer.
9. Did any unforeseen event occur? If so, how was it addressed?
12. Did any major conflict occur? If so, what was the cause and how was it addressed?

Fourth section: *Assess personal attitude, evaluate current practice and identify potential improvements*

10. How do you deal with unforeseen events?
11. Do you think your approach corresponds to the average?
13. How do you deal with conflicts?
14. Do you think your approach corresponds is the average?

B

List of documents resulted from preliminary search

- Several guidelines for systems engineering within the civil engineering sector released by different Dutch organizations including step-by-step plans for contract and demands specification;
- Method description for interface management issued by Rijkswaterstaat;
- Construction and Maintenance Work Guide issued by Rijkswaterstaat;
- Project management handbook issued by WitteveenBos;
- Step-by-step plan for customer specification issued by WitteveenBos;
- Legal manual for every project manager issued by WitteveenBos;
- Guidelines for communication issued by WitteveenBos;
- Internal note about teamwork issued by WitteveenBos;
- The chapter 'Cooperation' from the offer and PMP of the Afsluitdijk issued by WitteveenBos;
- Quality Manual issued by WitteveenBos;
- Internal note about objectives control for public participation issued by WitteveenBos;
- The international guideline for project management issued by ISO;
- Document Management - Part 1: Principles and methods issued by IEC;
- Guidance on project management issued by ISO;
- Guideline on preparation of maintenance contracts issued by CEN;
- Project, programme and portfolio management - Guidance on governance issued by ISO;
- Quality management - Quality of an organization - Guidance to achieve sustained success issued by ISO;
- Risk management - Guidelines issued by ISO;
- Risk management - Risk assessment techniques issued by ISO;
- Sustainable procurement - Guidance issued by ISO;

C

WitteveenBos' Quality Manual

The relevant contents of this documents are reported.

Project organization

The Quality Manual first illustrates the whole organization structure and, then, the general set-up of project organization. Project organizations are created to draw up contracts, carry out preparations, perform work, and provide after-care for specific projects. A project team (figure ??) consists of a Project Director, a Project Leader and possibly Project Members.

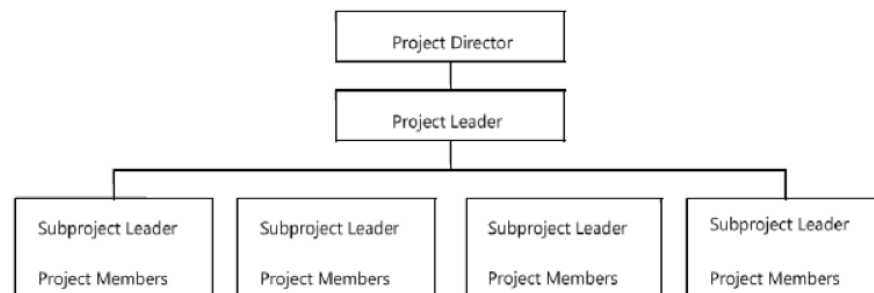


Figure C.1: Project team structure

On behalf of WitteveenBos, the project director (PD) is responsible for quality, organization, compliance, finances, time, risk management, and information provision. The project director appoints the project leader. The project leader (PL) composes a project team paying attention to expertise and team composition. The project leader is responsible for ensuring that all work is performed in conformity with the arrangements concerning quality, organization, finances, time management, risk management and information provision as laid down in the contract concluded with the client. The project leader is also responsible for implementing the quality management system during the project. The project leader instructs the project team members about the organization and execution of the project. The project leader reports to the project director. The two roles must never be fulfilled by the same person. The subproject leader is responsible for the execution of a specific part of the project and managing the relevant project members. The project leader composes a project team in consultation with the line managers. Team members are selected on the basis of the following considerations:

- Experience.
- Training and education.
- Competencies.
- Knowledge of the relevant disciplines.

- Social skills.
- Team composition.
- Specific characteristics of the project.
- Possible additional requirements defined by the client.

Suppliers and partners

During the offer stage, the Project Director must decide if a supplier should be engaged. In some cases, it may be desirable to work with one or more third parties (hereinafter also referred to as 'partners') in carrying out a project. WitteveenBos can choose to collaborate with third parties because the company lacks specific expertise, (temporarily) has insufficient capacity, or has different (commercial) interests. Collaboration should be clearly distinguished from the engagement of suppliers. In the case of collaboration, the parties work together as equals. This means that both parties are responsible for the product they deliver, and are also severally liable to a client or third party if the product does not possess the desired characteristics. During the offer stage, the Project Director and Project Leader must decide if collaboration with one or more partners is appropriate.

Project execution

At the start of each project, the project scope is defined in the project execution plan. During the execution of the project, the project leader's main responsibility is to ensure that the work is performed in accordance with the defined scope. Project leader checks whether the project is being executed according to plan with reference to the PM aspects or if adjustments are required:

- **Money:** Monitoring budget expenditure in relation to progress; timely dispatch of invoices for work performed; making adjustments if necessary.
- **Risks and opportunities:** Monitoring risks and opportunities incurred by WitteveenBos, preferably based on a risk and opportunities analysis and risk and opportunities management plan drawn up at the start of the project; making adjustments to respond to new project-related developments.
- **Organization:** Team composition and functioning, including suppliers and partners; making adjustments in the case of bottlenecks and conflicts, if necessary.
- **Quality:** Quality management of technical content, with due attention to interaction between different disciplines and interfaces.
- **Information:** Ensuring that all team members and external stakeholders have timely access to the project information that is relevant to them.
- **Time:** Monitoring progress and identifying deviations from the predefined schedule; taking measures in the case of non-conformities.

Shortly after the start of a project, it may turn out that the actual situation does not correspond to the project execution plan, for instance because the information supplied is not usable or because the actual situation differs from the drawing. During the execution of a project, new information may emerge that must be taken into account. In addition, clients frequently add new requirements, submit requests for additional work, or change their minds about choices made in the past. In such cases, the deviations from the original order require additional work by WitteveenBos and/or result in changes to the PM aspects (e.g. Time, Risks). The Project Leader must identify and document these deviations and report them to the client. It is essential for the Project Leader to be very alert on deviations during the execution of the project. This applies in particular to situations in which the client does not explicitly request additional work but which do require additional work by WitteveenBos, such as introducing new information, deviating from previously made decisions, etc. By immediately contacting the client in the case of deviations and extensions to the scope in the form of requests for additional work, we can make sure that we have sufficient time and budget to execute and complete the project successfully.

Analysis and Improvement

The process of measurement, analysis and improvement is aimed at enhancing performance, increasing client satisfaction, and optimizing operational processes. Different internal and external aspects are included

in the analysis. Client satisfaction is part of the external analysis and is measured by systematically analyzing the extent to which WitteveenBos has fulfilled the client's requirements and expectations. The client's perception of quality is determined not only by the services provided, but also by how those services were provided, assessed against the client's explicit and implicit expectations. The perception of the client's contact person is often the determining factor. This also means that client satisfaction is subjective and difficult to measure. It is very important to listen carefully to the client. The PMC Leader determines the method(s), frequency and criteria by which client satisfaction is measured. Client satisfaction can be measured using the following information sources and indicators:

- External project evaluation during a discussion with the client.
- Complaints (submitted directly or via employees and/or Project Leaders).
- Claims.
- Follow-up orders.
- Payment practices and questions about invoices.
- Client base and revenue per client or client group.
- Benchmarking.
- Offer scores.
- Performance measurement.

Suppliers and (project) partners are evaluated in order to ascertain if they are performing as required. PMC-leaders/Heads of Departments decides which suppliers/(project) partners should be evaluated. Poorly performing suppliers and (project) partners may be excluded from future projects, especially if there is no confidence that their performance will improve. A standard evaluation form is available on the In-site. The secretariat places the evaluations in vtiger CRM tool, so that these can be retrieved by every employee, including other PMCs.

D

WitteveenBos' Project Management Handbook

The relevant contents of this documents are reported.

Project management approaches

The handbook distinguishes three project management approaches according to the risk profile of the project. The table D.1 illustrates the characteristics of each approach.

According to the table D.1, larger and complex projects require the use of PM tools and methodologies based on prior risk assessment. In the case of complex projects, it is recommended to improve knowledge sharing through frequent work sessions and participate to external program (examples Rijksbouwacademie or Neerlands diep of Baanbrekers).

IPM model

Different PM methodologies are described in the handbook. The Integrated Project Management Model (IPM) is particularly relevant because it is mainly used by Rijkswaterstaat and provinces. The IPM model is aimed at risk management and prescribe a standard project organization: the five-role model:

- Project manager is responsible for achieving the project objectives and managing the project team, monitors the mutual interfaces within the team and ensures a cohesive leadership;
- Project control manager is responsible for planning and budget aspects, scope/quality and risk management, project-wide progress reports and document management;
- Environment manager is responsible for, among other things, contact with the environment and the planning procedures, permits;
- Technical manager is responsible for the technical substantive input to the project, via SE and SCB;
- Contract manager is responsible for the entire process of contract preparation and execution towards different market parties. Including the procurement strategy, contract form, contracting and the associated tender and contract (control) documents.

These five roles are supported by their own team.

PM tools

Furthermore, the handbook includes a framework that identifies a number of main themes and associates PM tools to each one. The themes are:

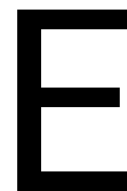
- Customer and Environment, with particular attention to customer contact, stakeholder management etc;
- Approach and Control, with particular attention to controlling time, money, quality, risks, organization and information (GOKRIT; tijd, geld, kwaliteit, risico's, organisatie en informatie);
- People and team, more focused on roles and cooperation / interaction within a project.

<i>Project phase</i>	Starting up project	Executing project	Finalizing project
<i>Customer & environment</i>	Customer Start Up (KSU) KPI monitor Stakeholder analysis		Customer satisfaction form Satisfaction statement
<i>Implement & control</i>	Project Management Plan Work Breakdown Structure Deliverable list Project Start Up Overview of contract changes Time and Money (forecast) monitor Advisory cost estimate Risk management tool Document management / LACTI chart Interface table	Project evaluation Request for change Offer additional work Progress reporting	Scope change Project Follow Up
<i>People & team</i>	Project Management Plan Project organization Insight Discovery		

Table D.2: Layout of the framework for the tools

	Small	Medium	Large
<i>Projects differentiation</i>	Majority of "jobs" basis of regular planning to work	"Real" projects with such risks that a project management approach is necessary	"Complex projects" (Ex. for RIJKSWATERSTAAT - framework contracts)
	Criterion is under € 30,000 unless the PL demonstrates that, based on the risk registry, risk is low enough	Special risks such as: - budget and financial risks - lead time - team stake (from others PMC or vest.) - (un) familiarity with OG (client) and / or requirements - concreteness of the task (process aspects)	- Relatively many team members from outside the "own" PMC - multidisciplinary - contract management statement - special abroad projects
<i>Rules and procedures</i>	work according to the W + B quality manual	work according to the extra rules in the project plan (possibly a small supplement in the quality manual)	client explicitly states requirements for the PM system to be used
<i>Process</i>	process diagram (H3) "Step-by-step plan for project manager"	process diagram (H3) "Step-by-step plan for project manager"	customization
<i>Tools</i>	basic tools conform to process diagram	basic tools and extra tools that can be used according to occurrence of certain problems	extensive collection of state of the art tools
<i>Working style</i>	unchanged in the line	"enforce" the application of certain instruments	project-based approach / culture ("Project office") and tailored made project management plan (PMP)
<i>Type PL (project leader)</i>	unchanged (assisting foreman)	willing and able to handle the PM tasks take it seriously with the necessary discipline	must be people who have a core task in project management (organize and control)
<i>Time consuming</i>	not significant	at least 5% of project budget	requires a substantial amount of time and attention
<i>Improve project results</i>	primary role of the PL, PD and / or line manager	focus on coaching of PLs that are repeatedly in trouble	- to learn from each other - evaluating projects - sharing knowledge
<i>Training</i>	- PMW - PROM - schedule	- PROME - GIGA process management - Risk management	- external training courses - "large projects café"

Table D.1: PM approaches retrieved and adapted from WitteveenBos' Project Management Handbook



WitteveenBos' guidelines for communication

The relevant contents of this documents are reported.

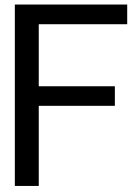
Relationship management system

WitteveenBos wants to establish new relationships and to maintain, expand and deepen existing relationships. This is primarily done by creating personal encounters. After all, contacts take place between people and not so much between organizations. Every employee has regular contact with the environment: during customer conversations, at network meetings, at trade fairs, on social networks, etc. Therefore, every employee plays an important role in the context of relationship management.

The correct attitude of employees is the basis for sustainable relationship management. A good relationship management system with an up-to-date address database of relationships supports good relationship management. WitteveenBos uses the vtiger relationship management system for this. Through this system it is possible to reach out to target groups and keep track of actions. Active use of this system is important, among other things by timely adding relationships and keeping track of changes. The relationship management system can select target groups based on the attributed attributes and is used for, among other things, sending the WitteveenBos news, the annual report, invitations to events, et cetera. Contact reports can also be added, so that colleagues are aware of a certain conversation and issued promotional gifts are kept to prevent double issuance. Employees are themselves responsible for entering relationship data in vtiger, whereby the sector secretariats can support.

Relationship management tasks and responsibilities

- The management determines the communication policy and is responsible for corporate communication.
- The sectors and PMCs are responsible for marketing communication, carried out within the guidelines for corporate communication. These include the means of communication for acquisition by the sector and / or PMC.
- Supervisors monitor the way in which employees communicate and address them where necessary.
- Every employee is responsible for his/her own communication. The employee can use his/her own style, but always takes into account the WitteveenBos interest and the desired image of the office.



WitteveenBos' step-by-step plan for customer specification

The relevant contents of this documents are reported.

Collecting customer requirements

WitteveenBos works through this plan towards a customer specification (KES; klanteisenspecificatie). "A customer requirement specification is literally the recording of requirements, wishes and preconditions per stakeholder, whereby the interests and needs of the customer are explicitly recorded". The reasons for identifying, documenting and drawing up a KES at an early stage are:

- Prevent important requirements from being forgotten in the process, which would otherwise be brought to the table at a later stage, consequently leading to the repetition of some activities;
- Clarify to stakeholders how their requirements have been weighed and which are consequences.
- An important claim is that not everyone needs to be satisfied with the result, but that a demonstrably careful process has been completed.

The aim is certainly not to pick up as many requirements as possible, but rather to pick up the core interests. For this reason, it is important to use the KES tool properly so that the effort remains in proportion to the project and the project objectives. Customer requirements can be collected from source documents that are provided by the client at the start of the project. These documents are analyzed and customer wishes are extracted from them. The goal is not to collect as many wishes as possible. Therefore, it is important to filter demand-driven requirements from documents. If it is not demand-driven, then look primarily at the most important documents (for example with project goals such as management agreement) and the most important requirements. Customer wishes can also be collected during individual discussions with stakeholders. These conversations take place under the direction of the environment manager or with the knowledge of the environment manager. In order to get clear and unambiguously formulated customer wishes, these are the steps to be followed:

- Prior to the "substantive part" of the interview, the discussion leader gives an explanation of:
 - The purpose of the interview (retrieving customer wishes, we cannot honor every wish);
 - The assignment and the role of WitteveenBos;
 - How customer wishes are collected, honored and fed back, including the role of the stakeholder in approving (after any changes) the interview report;
 - The difference between wish and requirement;
- During the conversation, the discussion leader has to recognize customer wishes. He or she:
 - Takes control of the conversation when a potential customer requirement arises;

- Explicitly informs the stakeholder that he / she raised a wish / need that may need to be formalized as a customer requirement;
 - Asks further explanation about the reason for the customer requirement and the needs of the customer;
 - Inquires about the functions that the system must be able to fulfill (functions versus solution);
 - Inquires about the manner (and the moment) in which the stakeholder ultimately wants to have demonstrated that the requirement has been met (for verification and validation purposes);
 - At the end of the conversation, summarize the retrieved wishes again;
- After the interview, the discussion leader draws up a discussion report in accordance with the customer requirements discussion form, in which the requirements are explicitly stated;
 - The discussion leader sends the report to the SE adviser;
 - The SE adviser and design manager / technical manager or environment manager / plan product manager (depending on the type of requirement) check whether the requirements drawn up by the discussion leader have been sufficiently SMART formulated and whether the reason is clear. If possible, the requirement formulations are adjusted as necessary;
 - After verification by the environment manager, the discussion leader sends the report to the stakeholder for acceptance and enters the wishes into the database;
 - Any comments from the stakeholder are processed and any changes in requirements are checked by the SE adviser;
 - The discussion leader sends the final report to the stakeholder and the SE adviser;
 - The SE adviser makes the requirements definitive in the database where a link is created between the requirement and the relevant report. The SE adviser links the customer wishes to the responsible core team member.

Finally, customer wishes can be collected from during plenary consultation and work studio with stakeholders. The method for retrieving customer wishes during plenary coordination is largely the same as the method for retrieving customer wishes during individual conversations. The most important difference is that during a plenary session there is often less opportunity to (extensively) ask about the how and why of the requirement. This is because when asking questions, the attention goes to one stakeholder and the other stakeholders can drop out of the discussion. During plenary coordination, it is therefore particularly important that the discussion leader leads the discussion well and summarizes the findings concisely, so that the minutes secretary can write these findings on the discussion form. If required, stakeholders can be offered the opportunity to submit additional wishes after the meeting via wish form.

Remuneration and validation of collected wishes

Analyzing and assessing customer requirements can be divided into two parts:

- Analysis of the "usability" of the formulated requirements;
- Assessment of customer requirements.

The process of analyzing the "usability" of customer requirements is based on the following principles:

- Whether it is clear what is meant by the requirement;
- Whether the requirement is clearly formulated.

Clear and unambiguously formulated customer requirements proceed to the next work step. In the event of unclear requirements, these must be returned immediately. If they have been collected directly, it is advisable to record the interpretation explicitly. It is recommended that important requirements are discussed directly with the client who should verify with the stakeholders whether the requirement was intended in this way. Furthermore, in case of risky requirements, the formulation for the remuneration process must be coordinated with the stakeholder. For other requirements, this can be done via the feedback.

The process of assessing customer requirements is done in consultation with the client. W + B sets the criteria for the payment. The assessment is done during work sessions in which the consultant KES, the technical manager and the environment manager assess the requirements qualitatively. In specific circumstances, the support of different specialists can be requested. The assessment is based on criteria that include:

- Not in conflict with other customer requirements;
- Technically feasible;
- Permissible;
- Meets applicable standards and guidelines;
- Falls within the primary scope of the preferred alternative and / or contributes to the project objectives;
- No significant negative effect on the planning;
- No significant negative effect on costs;

The final step in the process is validation. WitteveenBos asks the stakeholder whether the requirement has been correctly interpreted on the basis of the award decision. In order to prevent "project fatigue" among stakeholders, validation can also be carried out risk-based. This means that validation is limited to requirements that:

- have been submitted by stakeholders that pose a risk to the smooth running of the process
- or are not entirely clear or multi-interpretable.



WitteveenBos' note about teamwork

The relevant contents of this documents are reported.

Why teamwork

An important part of the success of teams is determined by the way of working together, the mutual communication. In projects and in tenders, it has been observed that well-functioning team performs better. Unfortunately, that is not self-evident. Now it is an unconscious process that we observe afterwards. By focusing on teamwork, awareness of team functioning is enhanced and can be steered at the start of a quotation process, project or in-line. That is why it is good to invest in a team functioning at the start of an offer / project and to maintain it afterwards.

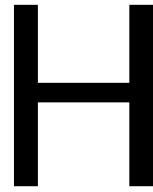
Team functioning

- Clarity and consistency of project objectives during the project, team reactions to objective changes;
- Arrangements about 'hard' PM aspects, such as planning, organization, responsibilities and authorities;
- Considerations about the "soft" aspects (in accordance with Lencioni's work)
- Individual knowledge and skills, suitability for the team;
- Leadership that coordinates and directs team functioning, the leader is present, visible, accepted;
- The context (environment) that influences the project team.

Teamwork focus on the "soft" aspects of team functioning. Managing the other aspects is part of project management.

Improve team functioning

The proper functioning of teams starts with knowledge of yourself, knowledge of the other and knowledge of the interaction. A common language is required for this and it has to be easily accessible because communicating about the "soft" aspects is not always easy. WitteveenBos has chosen Insights Discovery which displays behavioral preferences with a visual language of colors red, yellow, green and blue. This tool gives a basic guideline because an individual cannot be captured in few categories. Nevertheless, actions can be developed beforehand to compensate for weaknesses when the mapping of the strengths and possible vulnerabilities of a team is available. One should not immediately think to replace team members to create the right balance but appeal to each other, help or look for other measures. It is good to use teamwork on internal team but it is also very good with the client. By knowing each other from the profiles / preferences, attitude and behavior become negotiable, misunderstandings and possible irritations can be avoided which contributes to a better relationship with the client.



WitteveenBos' note about collaboration in the Afsluitdijk project

The relevant contents of this documents are reported.

"We are looking for a team and not a collection of good individual players, but a real team that achieves a joint performance", was one requirement of Rijkswaterstaat.

Effective cooperation

Cooperation between Rijkswaterstaat and WitteveenBos is important because:

- The tasks and work packages are divided between Rijkswaterstaat and WitteveenBos and it is crucial to properly manage the interfaces;
- Rijkswaterstaat has substantive knowledge about the project history and the environment that are essential for WitteveenBos's work and the success of the project;
- These two organizations have to cooperate for four years to bring the project to a successful conclusion;

An effective collaborative team is a team that:

- Puts the project goals at the center;
- Communicates openly and transparently with each other;
- Deals constructively with different interests and qualities in the team, especially when they are at odds with each other.

Team composition

The project team meets Rijkswaterstaat's requirements in terms of content and experience. Team members:

- know each other and complement each other (both in terms of content and personality);
- know how to find each other quickly;
- have short alignment lines (including working at 1 location);
- are familiar with WitteveenBos's quality system and work processes;
- have previously worked for Rijkswaterstaat and the Ministry.

The choice of the project team was also made considering the adaptability of WitteveenBos's people to Rijkswaterstaat's IPM team. The team was assessed to check whether they could connect well and cooperate with their partners in the IPM team. Furthermore, WitteveenBos benefits from the supports of few partners.

Collaboration between WitteveenBos and Rijkswaterstaat team members

Cooperation is more than the sum of the individuals. It's about the interaction and dynamics between all team members within WitteveenBos and with the Rijkswaterstaat team members. Collaboration is something that must be developed as a team. The collaboration with Rijkswaterstaat is enhanced by:

- the deployment of a Motion Consult team coach;
- performance-oriented collaboration with clear tasks and responsibilities.

Team Coach deployment

A team develops through a number of phases according to the Bruce Tuckman model. Therefore, it is important to pay proper attention to the cooperation in the various phase in order to help the joint Rijkswaterstaat and WitteveenBos team to go effectively through this development together. This is achieved by engaging an independent team coach that was already deployed in the quotation phase. Motion Consult helps teams of collaborating clients (including Rijkswaterstaat) and contractors (including WitteveenBos) to become aware of their cooperation patterns and to actively work on this. WitteveenBos believes that they can help Rijkswaterstaat and WitteveenBos to optimize team performance. In practice, this means:

- the organization and management of the PSU;
- the organization and management of Project Follow-Ups (PFUs) on phase transitions;
- support / supervision during phase 3.

Performance-based collaboration and collaboration protocol

WitteveenBos strives for a performance and result-oriented collaboration with Rijkswaterstaat, in which both improve every day. In practice, this means:

- A clear effective and efficient division of tasks and responsibilities;
- Mutual performance measurement;
- A clear separation of content and business interest.

Interface Rijkswaterstaat with WitteveenBos It is of great importance to recognize and control the interfaces between Rijkswaterstaat and WitteveenBos. These interfaces require good agreements. WitteveenBos have recognized certain interfaces and indicated who does what.

Example:

Interface	WitteveenBos	Rijkswaterstaat
KES	<ul style="list-style-type: none"> - collects requirements and wishes from stakeholders (KES); - prepares decision - making on requirements and wishes. 	<ul style="list-style-type: none"> - takes a decision within a previously agreed and reasonable period of time on honoring the requirements and wishes of stakeholders or prepare decision for steering committee.

WitteveenBos's expectations about Rijkswaterstaat

WitteveenBos made clear what they expect from Rijkswaterstaat.

Example:

Theme	Expectation
supply data and information	<ul style="list-style-type: none"> - supplying and sharing knowledge and experience already gained in general and specifically about pumps collected from suppliers; - thinking along and providing knowledge where possible about fish-friendliness; - thinking along and providing knowledge where possible about sustainability for the Afsluitdijk; - supplying information that is required for WitteveenBos to perform its work within a previously agreed and reasonable period of time. The work package descriptions indicate per theme which information is required as input and which documents / data must be supplied by Rijkswaterstaat, including deadlines; - informing WitteveenBos of all developments that become known to Rijkswaterstaat during the project, which may influence the work and results of WitteveenBos (including changes to guidelines and frameworks); - keeping WitteveenBos informed of the progress of the DBFM contract and developments that may influence the work of WitteveenBos; - keeping WitteveenBos up to date on the Rijkswaterstaat discussion agenda for discussions with internal and external stakeholders in relation to the Afsluitdijk project and enabling WitteveenBos to participate in consultations that may be relevant to its work ; - the preparation of interview reports of all discussions with internal and external stakeholders that Rijkswaterstaat is conducting in relation to the Afsluitdijk project and making these reports available to WitteveenBos in a timely manner.

Collaboration protocol

During the PSU the following cooperation agreements were made for the team Afsluitdijk:

- I stick to my agreements;
- I do not surprise the other;
- I report deviations immediately;
- I am open about my uncertainties / what I do not know;
- I address the other person about attitude and behavior;
- I escalate when necessary;
- I call back within 1 working day;
- I ask specific questions;
- I record appointments;
- I am a member of a joint project team.

A first PFU was also organized at the end of phase 0. The outcomes of this PFU were summarized as follows:

- In mutual conversations, we retrieve points and complete them;
- We separate facts from interpretations;
- In the event of discrepancies, we also provide the other person with insight into the context;
- We establish a strategic IPM team meeting;
- We keep the final goal in sight and we keep a close eye on whether the work is being carried out according to it;
- We use issue management to jointly elaborate and manage important risks.

A second PFU took place following the completion of phase 1. It was concluded that phase 2 really needs to be improved and that there are certain patterns that make it difficult to comply with the cooperation agreements. This involved in particular:

- Dealing well with decision points, substantive process and contract;
- We think we are clear at the front;
- Sharpness in the moment.

Consultation structure

Regular consultation is necessary to be able to work well together, discuss principles and outcomes and make decisions. In addition to the formal contact moments, informal contact between the two project teams is important. To facilitate this, Rijkswaterstaat's core team works at WitteveenBos's project location one day per week.

Performance measurement

For the Afsluitdijk project, performance measurement takes place every quarter with the following participants:

- Rijkswaterstaat:
 - Client (twice a year, discussion of results);
 - Project manager;
 - Project supervisor;
- WitteveenBos:
 - Project manager;
 - Contract manager (twice a year, discussion of results);

Rijkswaterstaat's Construction and Maintenance Work Guide

The relevant contents of this documents are reported.

Integrated Project Management

Rijkswaterstaat carries out projects with Integrated Project Management (IPM). Integral project management aims to realize projects as well and efficiently as possible. It is a working method based on the idea that the project team integrally weighs the interests and structurally manages the risks. The project members are aware of the interests of each role holder and the possible tensions between them and strive to make them explicit as early as possible. The team then makes joint assessments to achieve the project result as optimally as possible. IPM was introduced as a standard by Rijkswaterstaat in 2008 with the ambition of achieving optimal internal and external cooperation, with a clear division of roles and tasks. Many other (government) clients in the construction and infrastructure sectors have now also introduced IPM. The structure of the IPM model (figure I.1) has a strong focus on risk management. The interests of 5 focus areas Project Management, Project Control, Contract Management, Technical Management and Environmental Management are constantly and fully considered. In addition, the model is a cooperation model that strives for good mutual coordination between these disciplines.

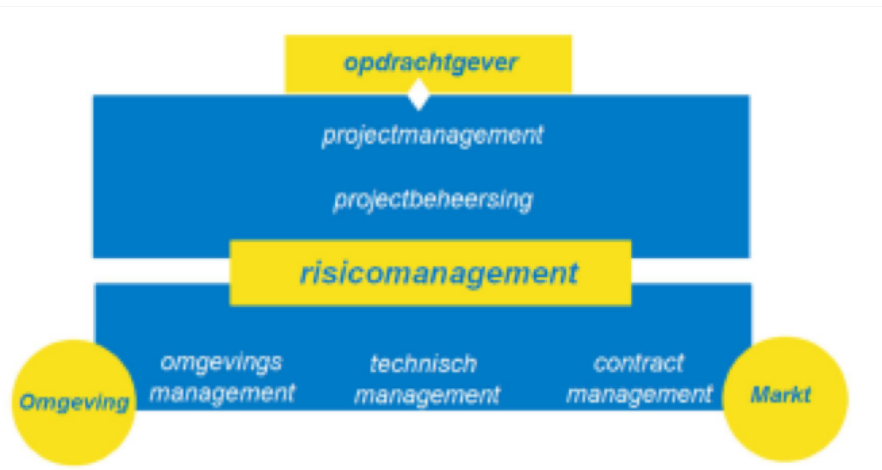


Figure I.1: IPM model

Each area of attention is represented in the IPM team and by an IPM role holder:

- Project manager
- Project control manager

- Contract manager
- Technical manager
- Environment manager

Responsibilities of IPM roles

The following is an outline of the responsibilities of the IPM role holders:

- The Project Manager is responsible for the realization of the project assignment within the set conditions. The project manager manages the project team, manages the mutual interfaces and ensures the cohesive leadership.
- The Project Control Manager takes care of project-wide control of the project on the aspects: scope, time, money, risk, information, documentation and reporting. The coordination and planning of advice and testing moments related to quality assurance is the responsibility of the Project Control manager. This person is responsible for ensuring that the assessment process within the project is optimized and that the form and weight of the assessment match the project risks.
- The Environment Manager is responsible for the administrative and social embedding of the project. The environment manager functions as intermediary between the (project) organization and the stakeholders in the project environment.
- The Technical Manager is responsible for content quality and safety. The technical manager takes care of the specifications (requirements and design), the research into the effects, and the realization of the objects to be built and transferred to management and associated (ICT) systems.
- The Contract Manager is responsible for contacts with market parties, for both products and services, for both building contractors and for engineering services. The contract manager ensures the entire process of preparation, purchasing and contract management in the project.

Project start-up and Project follow-up

The project manager (PM) and the client make agreements about, among other things, the products to be delivered, the preconditions and the way of communication. Furthermore, there is an interface with the Project Control sub-process, because the periodic progress reports and risk management take place within this.

For a good start or phase transition, a Project start-up (PSU) or a Project Follow-up (PFU) can be deployed. In a PSU and PFU, the focus is on internalizing the project assignment and / or project and sub-project plans, but they are also regularly deployed at the start of contracts with market parties. The PSU is the moment that all parties involved in the project can make their professional, substantive and personal contribution. The moment that the desired results can be shared with each other, so that the expectations are the same. In summary, this is the moment when cooperation is discussed, expectations about results, quality and personal contribution are shared with each other and converted into agreements.

Quality assurance with market parties

As a project progresses, the market input increases. Implementing tasks in the field of construction and maintenance are performed by the market as much as possible. Rijkswaterstaat remains responsible for the project result. The quality delivered by the market must be guaranteed. This so-called external quality assurance takes place with three instruments: selection of certified contractors, SCB (system-oriented contract management) and performance measurement.

- Selection of quality certified contractors. Before a contract can be awarded to a market party, the contractor must demonstrate at the start of the tender that he is certified for internal quality assurance. Then, Rijkswaterstaat has the option of executing the award on the basis of EMVI (MEAT - most economically advantageous tender). This method of balancing is not in itself quality assurance, but it does offer the possibility of not only looking at the price criterion, but also translating qualitative criteria into the price of the offer.
- System-oriented contract management (SCB). Rijkswaterstaat is ultimately responsible for the project result. The contractor himself is responsible for the quality of the work that he has accepted and for securing it. Rijkswaterstaat requires the contractor to demonstrate during and after the execution of

the work that it guarantees quality and that processes and products meet the quality requirements. Project teams no longer perform direct control tasks, but use the quality system of the contractor. The contractor must prove, in advance and afterwards, that he delivers the promised quality. He carries out the checks for this in-house. With SCB, Rijkswaterstaat tests remotely and risk-based whether the contractor meets the contractual obligations. Rijkswaterstaat uses the data from the (ISO) certified quality management system of the contractor for this.

- Performance measures. Performance measurement focuses on the quality of the collaboration process. This is done by measuring the attitude and behavior of both the client and the contractor. Performance measurement is specifically aimed at strengthening quality assurance. A fixed questionnaire is used for this.

Knowledge, knowledge management and the relationship with the Construction & Maintenance Process

Knowledge is crucial for the proper implementation of projects, but, what is the exact meaning of "knowledge"? Knowledge is the product of the information (I), experience (E), skills (V) and attitude (A) that someone has. In other words: $K = I * EVA$. (Knowledge is Information * Experience Skills Attitude). Therefore, knowledge is not only what has been recorded, but also the knowledge that is in people's minds. Knowledge management is managing the knowledge production factor (by developing, sharing and securing knowledge) in such a way that the knowledge that RIJKSWATERSTAAT needs to perform its tasks is available in any moment. Knowledge management is consciously aimed at closing the PDCA (Plan - Do - Check - Act) cycle. Within the Construction & Maintenance Process, effective knowledge management ensures that the knowledge that projects need, from inside or outside Rijkswaterstaat, is available on time and of good quality. Knowledge management also ensures that every project can benefit from the latest learning experiences of colleagues. This ensures that projects do not have to reinvent the wheel unnecessarily and thus prevents delays and / or unexpected expenditure in projects due to lack of knowledge. That is why projects within the Construction & Maintenance Process are encouraged to share relevant knowledge. Projects and programs that require knowledge can find answers in different ways, namely:

- Contacting similar projects. At every stage of the project it is advisable to actively look for similar projects / programs. Creating a "map" in advance with similar projects or other initiatives that have been implemented allow to quickly identify contacts that may have relevant experiences to share.
- Contact the main knowledge field leader and / or knowledge field leaders of a main knowledge field. These are Rijkswaterstaat employees who manage specific parts of the Rijkswaterstaat knowledge tree. This knowledge tree shows all the knowledge that Rijkswaterstaat needs to perform its tasks, linked to the primary processes. The knowledge is ordered by main knowledge fields. For knowledge questions, the main knowledge field leader can provide answers, furthermore, this person has an overview of knowledge relationships, both within and outside Rijkswaterstaat (national and international).
- Search for digital information (such as best practices). Knowledge in the form of frameworks, guidelines and best practices can be found in the Construction & Maintenance Work Guide. In addition, there are many knowledge documents on the intranet, SharePoint and other websites.

Sharing knowledge or securing it yields a lot, but it also takes time. That is why it is good to consider in advance what knowledge to share or safeguard. This depends on the supply and the demand. The supply considers what knowledge gained in the project is unique (for Rijkswaterstaat, for the sector, etc.) and what are the most striking learning experiences. On the other hand, the demand side examines what knowledge Rijkswaterstaat needs and wants to perform their tasks. By comparing supply and demand it becomes clear for which subjects it is crucial to share or secure knowledge. In addition to various consultants, knowledge management serves the purpose of finding a good method for sharing and / or securing knowledge and defining the right group receivers, for example by facilitating a special session in which supply and demand are brought together. Sharing knowledge can be done by giving presentations or lunch lectures, for example. The knowledge circles are a platform within Rijkswaterstaat that is ideally suited for sharing knowledge. Rijkswaterstaat has partnerships with external organizations, like Neerlands diep within which knowledge is shared.

J

Rijkswaterstaat's Interface Management guideline

The relevant contents of this documents are reported.

Definitions

Interface regards functional and physical properties that must exist for the correct functioning of system parts on a common boundary. Therefore, relationships between the project organization and stakeholders are not considered an interface. As a result of uncertainties about the relationship between system parts (objects), interfaces between these parts often go wrong. In order to prevent problems at the interface, there must be clearer and more complete communication about the interface between the persons or parties involved.

Procedure / Rules

Interface management is both a solution for communication problems and issues caused by the lack of knowledge of other professional disciplines. That is why a means of communication is desirable in which the various designers, other project employees and involved external parties (stakeholders) can share information. Tools for interface management are the so-called Raakvlak Beheers Documents (RBD). In document all relevant information regarding interface are explicitly recorded and kept up-to-date. In this way, everyone can see at any time the (last) design solutions and agreements with regard to an interface. This also prevents that parts or (design) aspects are not checked against the requirements, because the interface was not recognized. An important aspect is that clear and practical working agreements must be made about the accessibility and use of the RBDs and coordination obligations of the parties and persons involved.

ISO Risk Management Guidelines

The relevant contents of this documents are reported.

Principles

The principles presented in figure K.1 illustrate the features of effective and efficient risk management, and clarify its intention and purpose.



Figure K.1: Principles for risk management, retrieved from ISO Risk Management Guidelines

Organizations' risk management framework and processes should be based on these principles.

- **Integrated.** Risk management is an essential component of all organizational activities;
- **Structured and comprehensive.** A well-defined and thorough approach to risk management contributes to solid results;
- **Customized.** The risk management approach is tailored to the organizational context and objectives;
- **Inclusive.** The risk management approach engages and enables stakeholders to contribute with their knowledge and perceptions.
- **Dynamic.** Risk management adapts to changing and/or unforeseen circumstances.

- Best available information. Risk management is based on historical data and forecasts and is aware of any limitations and uncertainties associated with it. It is important that information are clear and accessible to relevant stakeholders.
- Human and cultural factors. Human behavior and culture significantly influence all aspects of risk management at each level and stage.
- Continual improvement. Risk management is constantly improved through learning and experience.

Framework

The purpose of the risk management framework (figure K.2) is to support the integration of risk management into relevant activities. The degree of integration into the governance structure determines the effectiveness of risk management and needs to be supported by stakeholders, particularly top management.

The framework helps organizations to fill the gaps of existing risk management practices and processes but should to be adapted to the specific circumstances.

Top management is responsible for the integration of risk management into all organizational activities. Managers should lead a comprehensive framework implementation, raise awareness about the risk management approach, allocate sufficient resources to risk management and assign roles and responsibilities within the organization.



Figure K.2: Framework for risk management, retrieved from ISO Risk Management Guidelines

- Integration. Integrating risk management requires a profound knowledge of organizational structures and context. Risk management should be included in any aspect of the organization through a dynamic and iterative process.
- Design. The risk management framework should be designed taking into account the organization external and internal context. Part of the design is to make explicit the risk management commitment to the organization and the (relevant) stakeholders. It is also really important to clearly identify and communicate who is accountable and has the authority to manage risk. Capabilities and limitations of the existing resources should be considered in order to ensure a sufficient resources allocation. A communication and consultation approach is needed to support the implementation of risk management.
- Implementation. Successful implementation of the framework requires the engagement and awareness of stakeholders. In this way, organizations can explicitly address uncertainty during decision-making.
- Evaluation. The effectiveness of the risk management framework has to be regularly tested by comparing expectations and actual performance.

- Improvement. The framework has to be continuously adjusted, particularly, when internal or external circumstances change or when the evaluation highlights flaws in the implementation.

Process

The risk management process is illustrated in figure K.3. It can be applied at different levels and should be embedded into all the aspects of the organization. It is an iterative process and it is influenced by human behavior and culture.

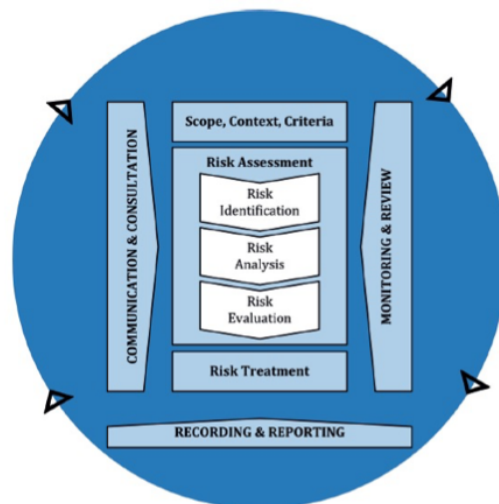


Figure K.3: Risk management process, retrieved from ISO Risk Management Guidelines

- Communication and consultation. The purpose of these activities is to raise awareness and improve risk management. These activities should be coordinated and implemented during the whole process. Communication involves sharing information with targeted audiences. Consultation is done to collect feedback and information to support decision making.
- Scope, context and criteria. Definition of establishing the scope, the context and criteria is necessary to design the most appropriate risk management process.
- Risk assessment. This process includes risk identification, risk analysis and risk evaluation. Risk assessment should be conducted systematically, iteratively and collaboratively, taking into account the knowledge and perspectives of stakeholders, supported by additional research when necessary.
 - Risk identification. Information plays a fundamental role in risk identification. The organization should identify risks regardless of whether or not their sources are within its control range.
 - Risk analysis. Risk analysis can be influenced by stakeholders and methods employed to perform the analysis. Stakeholders have different opinions and risk perceptions. Methods have limitations and are only as good as the information used as inputs. These factors have to be recognized and openly communicated to decision makers.
 - Risk evaluation. The course of actions is decided upon the comparison between the results of the risk analysis and the established risk criteria. Decision makers should consider the actual and perceived consequences to external and internal stakeholders.
- Risk treatment. Risk evaluation may highlight the necessity to implement a risk treatment strategy. Risk treatment is itself an iterative process, treatment options have to be evaluated and potentially revised. Options for treating risk may involve one or more of the following:
 - avoiding the risk by pursuing a different strategy or activity;
 - taking or increasing the risk in order to pursue an opportunity;
 - removing the risk source;
 - influencing the likelihood;

- influencing the consequences;
- sharing the risk (e.g. through contracts, buying insurance);
- deliberately accepting the risk.

The balance between benefits and costs define the suitability of risk treatment options. However, the decision should not be based only on monetary aspects but also consider organization's commitments and stakeholder positions and potential involvement. Therefore, it is important to communicate and consult with them. Furthermore, the decision made has to be in line with the organization's objectives, risk criteria and available resources. Decisions and specifications regarding risk treatments strategies should be comprehensively explained and justified in the risk treatment plan.

- **Monitoring and review.** This is part of the risk management process and it is needed to ensure and improve the quality and effectiveness of the process.
- **Recording and reporting.** This step provides the necessary information to improve the process and communicate within and outside the organization. Reporting is essential to improve the quality of dialogue with stakeholders and to check whether obligations have been fulfilled. On the other hand, reporting cannot be indiscriminate but has to be weighted on factors like information requirements and relevance, cost, frequency, etc.