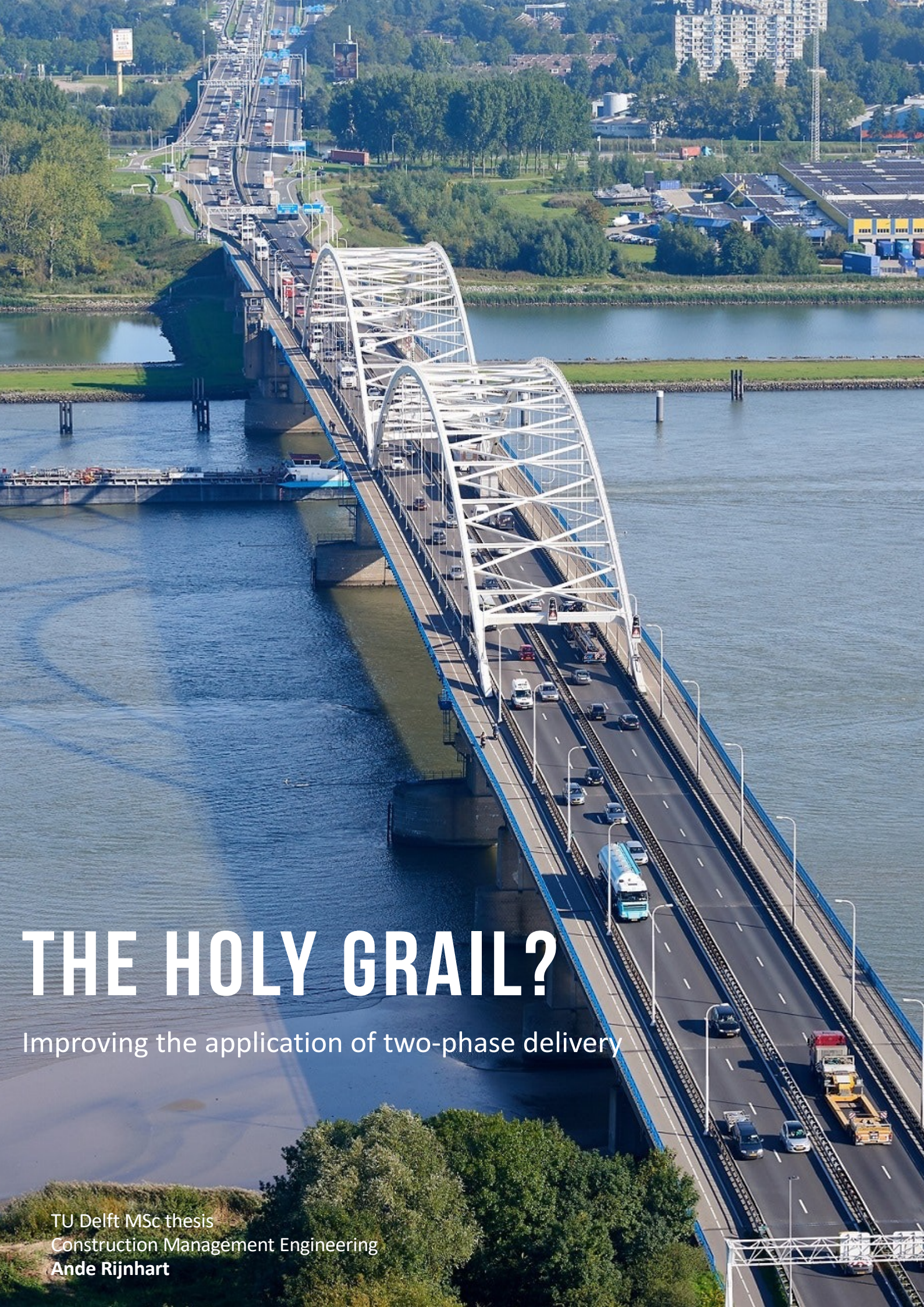

THE HOLY GRAIL?

Improving the application of two-phase delivery

TU Delft MSc thesis
Construction Management Engineering
Ande Rijnhart

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Faculty of Geoscience and Civil Engineering

Delft University of Technology

Graduation Thesis

Improving the application of two-phase delivery: The Holy Grail?

- in collaboration with Rijkswaterstaat -

by

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Preface

As I present this thesis, I conclude my Master's journey in Construction Management & Engineering at the Technical University Delft. This journey has been filled with challenges and rewards that have significantly shaped my academic and personal growth. During my time at the university, the interplay between my master's program and my work at Rijkswaterstaat has been incredibly fruitful. Each venture benefited from insights gained from the other. This research study signifies the conclusion of that symbiotic relationship. I hope readers perceive this work as a comprehensive introduction to the workings of the two-phase delivery method, serving as a stepping stone for its application within a commissioning authority.

In the course of the past 18 months, while concurrently initiating my professional journey as a contract manager at Rijkswaterstaat, I've persevered through the demanding process of completing this graduation project. Despite the challenges of balancing professional commitments with academic pursuits, my journey was often rewarding and spurred by my intrinsic interest in contract management. Yet, it was also occasionally overwhelming. The credit for this research reaching fruition goes to a group of exceptional individuals.

Navigating me through the academic world was my chair, Marian Bosch-Rekveldt. Her unwavering trust and support have been the compass guiding this process. Indeed, her unyielding perseverance is the primary reason I am here today. My gratitude extends to Jelle Koolwijk, whose assistance in shaping the research outline and providing the necessary tools for my study was invaluable — even if it sometimes meant evading the controllers of the study rooms at MBE. Leon Hombergen, who helped me shape the rest of my committee, has been a crucial bridge between the academic world of the TU and the practical world of Rijkswaterstaat. I am deeply appreciative of his efforts in both arenas. This thesis would not have been possible without the support of Hans Ruijter. His guidance, firsthand knowledge of events and projects spanning almost 40 years, and his introductions to colleagues both at Rijkswaterstaat and at (international) contractor companies have enriched this study immensely. His meticulous reading of my drafts, patiently pointing out the same errors until they were corrected, demonstrated his unwavering commitment to this project. I owe him and the rest of my committee a world of thanks for their support, guidance, and endless patience.

I am extraordinarily fortunate to have a phenomenal support system that propped me up on numerous occasions. I am thankful to my parents and sister, who patiently learned how to check machine-generated transcriptions alongside me. My friends have been an invaluable source of reassurance and motivation, voicing their confidence during countless coffee dates. Roos, my best friend since the second day we started our bachelor studies way back when, played an irreplaceable role in my journey. The rhythm of our work-from-home Fridays may have cost me a considerable sum but gifted me with the motivation and companionship I needed to complete this task. Your insightful observations about a field unfamiliar to you were invaluable, and your understanding of me as a person was even more so. Catharina, who will always be Catha to me, whose remarkable organisational skills and meticulous lists helped me maintain an overview of my tasks. Even amidst her busy professional life, she always found time to proofread my chapters. Lisa, your well-timed calls offering a welcome distraction from my thesis work, were always greatly appreciated. Last but not least, David, you knew exactly when to rally the troops. Your knack for knowing exactly what I need, coupled with your steadfast support during even my toughest moments, speaks volumes about the partner you are. Your patience with my never-ending streak is a true show of love. I am so lucky to share my life with you. A word of advice to all; never plan to graduate and organise a wedding within a six-week span.

To the reader, I invite you to delve into this thesis, a work born from my profound interest in the subject matter. I hope you find it as compelling as I do.

Ande Rijnhart
5 July, 2023

Summary

Rijkswaterstaat is the largest public procurement authority in the Netherlands, being the executive agency of Ministry of Infrastructure and Water Management. The organisation is at the forefront of implementing an innovative procurement practice in the construction industry. The objective of this research is to identify and propose improvements to the two-phase delivery model that can effectively tackle the prevailing challenges encountered in the procurement of construction projects. Recognised for its potential benefits over traditional models, the application of the two-phase delivery method aims to mitigate project risks by leveraging market expertise, leading to improved pricing, better project control, and enhanced predictability for both Rijkswaterstaat and construction companies. Additionally, it fosters enhanced collaboration in an increasingly complex project environment and aims to reduce transaction costs to promote a financially sound and productive sector.

Over the last two decades, large infrastructural projects predominantly utilised integrated contracts, which were introduced to reduce public client involvement and more effectively utilise the contractor's design expertise. However, there have been significant challenges with the use of this delivery model, including high transaction costs and risk allocation issues. These challenges have resulted in some companies' reluctance to participate in large infrastructural projects. Rijkswaterstaat aims to employ the two-phase delivery method to alleviate these concerns. This method selects a contractor based on certain criteria and a provisional price before collaboratively developing a design, setting the final price only after this phase.

However, this strategic implementation may face hurdles, as previous attempts at strategic shifts have encountered difficulties with employee understanding and adoption. This thesis therefore considers the potential biases, organisational and historical context, and external pressures that could affect the successful implementation of the two-phase delivery model.

This study aims to evaluate the effects of the two-phase delivery method, focusing specifically on its potential to address integrated project delivery challenges, and to propose improvements to the use of the delivery model. Using two Rijkswaterstaat-projects as a case study, the research question seeks to enhance the use of the two-phase delivery model in mitigating current procurement issues. The main question of this research is:*How can the two-phase delivery model be enhanced to address the prevalent issues in the procurement of construction projects?*

To this end, the study applies the Grounded Theory (GT) methodology. As a qualitative research methodology, GT enables the construction of theories based on empirical data through an iterative process of data collection, coding, comparison, and reflection. The research employs a holistic approach, using multiple data collection methods including a literature study, semi-structured interviews, and expert group evaluations. The study ensures validity through triangulation and trustworthiness principles.

The literature review provides valuable context on the historical evolution of the Dutch infrastructure sector, particularly the transition of Rijkswaterstaat from an engineering agency to a commissioning authority. This transition, marked by key events such as the Parliamentary Construction Fraud Inquiry and the Economic Crisis, illuminates the sector's challenges and informs our understanding of current issues. Three primary challenges

emerged in the procurement process: early price determination with unknown risks, high tender costs, and differing interpretations of collaboration. As part of the literature review, an overview of different project delivery models is provided, to contextualise the implementation of the two-phase delivery method within this spectrum. This spectrum encapsulates traditional procurement models, models that integrate design and delivery, as well as models promoting a collaborative team approach to design.

While introducing this model changes the procurement process of large, complex projects, it's vital to understand the organisational behaviour associated with this change. Within Rijkswaterstaat's vast structure, changes in procurement practices will affect individuals, groups, and the project as a whole. The literature review therefore includes an analysis of organisational behaviour and its impact on project success. Finally, the study emphasises the need for further exploration of the two-phase delivery model's influence on specific challenges, suggesting that understanding and addressing the influences of organisational behaviour can lead to risk mitigation, lower tender costs, and improved collaboration.

The case study as part of this research focused gaining insight on the two-phase approach and its ability to help overcome said challenges in construction projects. As part of the case study, two cases were investigated. Both of these cases were projects that applied a two-phase delivery method, were in the execution phase, and where the client-contractor relationship reflected that of a two-phase approach. The two projects that were examined were a riverbank lowering and the construction of a public transport terminal. Proposed changes and conditions to ensure success of the delivery model were also investigated. Two pivotal mechanisms were discovered in the case study. These mechanisms shed light on the interplay between individuals across varying levels within an organisation and the consequential influence this interaction can exert on various aspects of a project. By delving into these mechanisms, critical insights into behavioural patterns associated with the application of a two-phase procurement strategy are gained, along with valuable suggestions for its improvement.

Both mechanisms highlight crucial aspects of project interaction and risk management within the broader organisational field. Mechanism 1 stresses the importance of strategic interaction across organisational layers, emphasising the need for flexibility and effective tools for collaboration. Moreover, mechanism 2 details the influence of risk management approach - whether shared or allocated - on the project's execution. It showcases the benefit of shared management in fostering a collaborative spirit, but notes that its successful application relies on a genuine cooperative culture.

To enhance the two-phase delivery model and address prevalent issues in the procurement of construction projects, it's crucial to understand the holistic aspect of the model, which requires a thorough understanding of its elements, a readiness to adapt and innovate, an appreciation of the complexity of collaboration and the dynamics of the procurement process. In essence, the two-phase delivery model has the potential to address the challenges faced by the infra sector in the procurement of construction projects. However, it requires an active, cooperative, and adaptive approach from all parties involved. It's not merely a procurement strategy; it's a tool that, when used effectively, can inspire innovation, facilitate collaboration, and ultimately drive the successful execution of construction projects.

The research concludes with actionable recommendations for Rijkswaterstaat to optimise the implementation of the two-phase delivery method. First, assess the readiness of the project and its environment by evaluating various factors such as complexity, team capabilities, and availability of resources. Second, ensure the presence of the right tools and people in the team, investing in employees with the necessary technical knowledge and skills to foster collaboration and informed decision-making. Finally, adopt a flexible approach by revising rigid procedures and fostering a culture of adaptability that encourages teams to respond effectively to changing project circumstances.

This research has a few key limitations that might impact the interpretation and generalisation of its findings. The study relied on a limited number of cases, which, due to the inherent diversity of projects, might have constrained the scope and applicability of the insights. The unavailability of an interviewee from the constructor's side in one case could have potentially skewed its results, and the selection of non-typical cases might limit the insights to those specific cases rather than reflecting the broader characteristics of the two-phase

delivery method. Lastly, the time constraints associated with projects at Rijkswaterstaat made it challenging to evaluate the entire life cycle of the method and its long-term outcomes.

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Introduction

1

In recent years, the two-phase delivery method has garnered increased attention within the Dutch construction sector. This study explores the two-phase delivery method as an intervention into the procurement processes of Rijkswaterstaat as a commissioning authority. This thesis was conducted with the support of the Procurement department of Rijkswaterstaat.

1.1 Problem context

In 2019, Rijkswaterstaat published a report highlighting the significance of a healthy Ground-, Road-, and Waterway (GWW) construction sector and the sector's responsibilities in maintaining its health. The report anticipated annual growth of 3.4% between 2018-2023 in the sector. However, it also pointed to the escalating scale and complexity of projects, the lack of innovation in the sector, and the rising trend of collaboration legalisation, painting a somewhat troubling picture of the sector's future (Rijkswaterstaat, 2019).

Rijkswaterstaat is the largest public procurement authority in the Netherlands, procuring projects and services worth approximately 3 billion euros annually. A significant proportion of the roads, bridges, tunnels, and sluices Rijkswaterstaat maintains were built in the mid-20th century. Increased and heavier traffic has expedited the ageing of these infrastructural works, necessitating renovation or replacement. Recently, the Minister of Infrastructure and Water Management disclosed that an additional billion euros per year is required for maintaining infrastructural networks and replacing and renovating civil engineering structures (TNO, 2021; van Nieuwenhuizen Wijbenga, 2021).

Over the past twenty years, integrated contracts were the most frequently employed procurement method for large infrastructural projects. Upon its introduction, this type of contract was expected to lessen involvement from the public client and leverage the contractor's design expertise more effectively. The transition from a traditional delivery model to a Design-Build-Finance-Maintain (DBFM) contract, which assigns the design, building, financing, maintenance, and operation tasks to one contractor, was seen as a way to break away from the time-consuming practice of contracting different processes to multiple contractors. Under the integrated model, the design and delivery are undertaken by a single party in relation to the client. Projects procured with an integrated delivery model were expected to be realised on time, within budget, and with the desired quality, with the involvement of private parties leading to optimisation and innovation. The long-term focus of these contracts was anticipated to offer budgetary security and predictability and ensure a life-cycle approach through the integration of design, construction, and maintenance (Koppenjan et al., 2020).

Nonetheless, initial enthusiasm for this method has waned, and several significant issues have been identified (M. A. B. Chao-Duivis, 2019). The anticipated equal partnerships between private and public parties leading to much-needed innovation have not fully materialised (Parrado & Reynaers, 2020; Potemans, Volker, & Hermans, 2018). Research into the procurement and outcomes of DBFM projects at Rijkswaterstaat over the past fifteen years (Koppenjan et al., 2020) revealed positive results in terms of delivery on time, added project value, and improved focus on the life-cycle approach for infrastructural works. However, the strong emphasis on

timely completion of the work and the large sums of money tied to the project's availability can pose challenges for the contractor. Additionally, the high transaction costs during the procurement phase, due to the extensive work required in bid preparation, have proven problematic (van de Pol, 2018). Yet, the largest criticism pertains to the allocation of project risks. Due to the longevity of these projects, contractors are unable to adequately foresee project risks over the entire project duration. Furthermore, the definitive design is only completed after the bid award, but the contractor has to price all risks in their bidding documents. This leaves the contractor disadvantaged when unforeseen risks arise, as the resultant consequences can be significant and difficult to manage. Compounded by the size and complexity of projects, the financial implications can be substantial (Koppenjan et al., 2020; Miedema, 2022). Moreover, the competitive conditions push contractors to submit the lowest bid, which can lead to opportunistic behaviour and risk underestimation (M. A. B. Chao-Duivis, 2019). These financial implications have led to a cautious approach towards participating in large infrastructural projects. As a result, one of the largest construction companies in the Netherlands, BAM, has decided not to bid on projects over €150M anymore (Doodeman, 2021a, 2021b).

The dwindling competition in the sector serves as a warning bell for an unhealthy industry climate. In response, Rijkswaterstaat, in collaboration with McKinsey & Company, put forward a transition plan titled "On the Road to a Vital Infrastructure Sector" (Rijkswaterstaat, 2020d). One of the three key objectives of this plan was the introduction of the two-phase delivery method. Five projects were selected to test this new procurement process: Ring Utrecht Zuid, A27 Houten Hooipolder Zuid, A27 Houten Hooipolder Noord, A12 IJsselbruggen, and the A73 Roertunnel en tunnel Swalmen (Rijkswaterstaat, 2020b).

1.2 The two-phase delivery model

As the executive agency of the Ministry of Infrastructure and Water Management, Rijkswaterstaat is tasked with maintaining superior main infrastructure. This involves partly shouldering the responsibility for the vitality of the GWW-market. Given its status as one of the country's largest public commissioners, it recognises several issues with the procurement of projects through integrated models: early price determination in combination with unknown risks, high tender costs, and differing interpretations of collaboration. These issues have often led to financial losses and challenging collaborations during projects (Project DOEN, n.d.; Visser, 2020). The introduction of the two-phase delivery method aims to address these concerns.

The two-phase delivery method is an umbrella term for an array of variations of upcoming and established two-phase models in the construction industry. Countries like the United Kingdom, Australia, Hong Kong, and the Scandinavian nations have experimented with different versions of this model (Walker & Lloyd-Walker, 2015). Currently, Rijkswaterstaat is working on defining a standard for what they consider the 'two-phase delivery model' (Rijkswaterstaat, 2020a, 2022).

The key distinction between regular procurement and procurement using two-phase delivery is depicted in figure 1.1. In regular procurement, a contractor is chosen based on the best value bid and is contracted for the design and execution of work, based on the price stated in the bid. In contrast, with two-phase delivery, the contractor is chosen based on selection criteria and a provisional price, with the definitive price for the execution of work determined at the end of the first phase. The first phase involves collaboration between the client and contractor on the design. Fijneman and CROW (2020) describes this stage as *'(part of) the design for tender is not fixed and is worked out in collaboration to provide the best suitable solution for the reduction within the specified frameworks. It offers many opportunities for innovation and optimisation, and lays the foundation for good collaboration throughout the project'* (p.9).

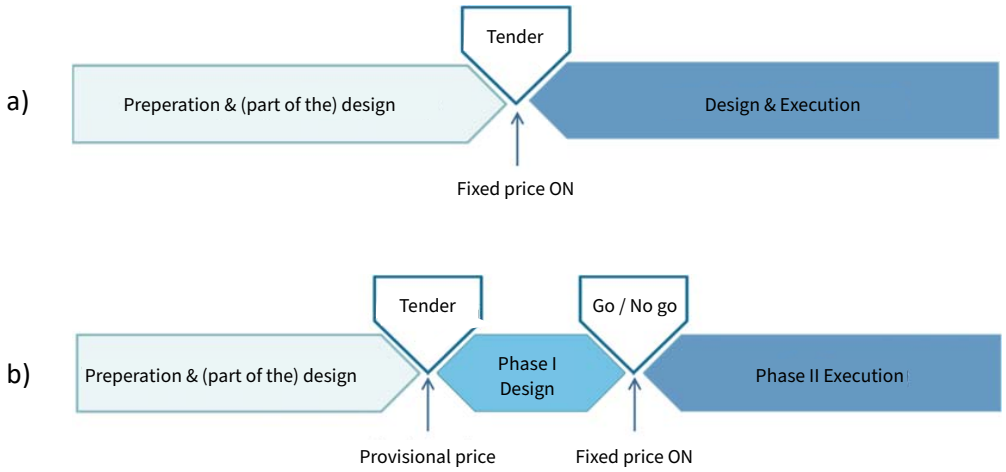

Figure 1.1: Schematic illustration of a) the regular procurement and b) the two-phase delivery method.

The definitive price is set only after the design phase. At the juncture between the first and the second phase, both parties decide whether they want to proceed with the execution of work in phase two, based on the agreed terms and price. If the contractor chooses not to continue, the client can procure the project using the regular procurement process, utilising the design realised in the first phase.

For the purposes of this research, the definition used for the two-phase delivery method is *'In the two-phase process, the price determination for the construction phase only follows the design or engineering phase. More information is well known, which leads to fewer uncertainties and financial risks, thus offering a perspective on better risk sharing'* (van Wijk-van Gilst, 2020, p. 1).

1.3 Problem statement

The last decade of the previous century instructed Rijkswaterstaat to significantly deviate from its traditional practices. Starting from the 1990s, projects were to be procured with a predefined set of requirements, thus placing both the opportunity and responsibility of designing and executing the projects on the private sector (Ruijter, 2019). Consequently, Rijkswaterstaat transformed from a technical knowledge institute into a commissioning authority. The necessity for optimisation throughout the entirety of the project later ushered in a switch from traditional to integral procurement. Over time, several substantial organisational changes occurred, ranging from workforce reduction for a leaner governmental body, to a paradigm shift in asset management, where decision-making shifted from individual project levels to a more comprehensive area-level approach (Ruijter, 2019; Schraven, 2015).

The induction of change within the organisation is often based on new discoveries and practices. However, it frequently arises from the discourse of 'resolving issues encountered in the current mode of operation', often under pressure from both internal and external stakeholders. As exemplified in the implementation of Asset Management as a new workflow, discrepancies were observed between the understanding of the newly introduced strategy by the employees and their efforts towards its execution. This problem could stem from the divergence between the top-down strategy (the ideal expectation) and the enacted reality (the practical implementation) (Schraven, 2015). Top-down imposed changes can present implementation challenges due to the employees' perspectives and practical hurdles experienced lower down the organisation (Xerri, Nelson, & Brunetto, 2014). Rijkswaterstaat employees in lower offices were found to assess a new strategy based on their personal perspectives of existing practices (Schraven, 2015). This confirmation bias can potentially hinder the efficacy of a newly proposed strategic direction (Ahiaga-Dagbui & Smith, 2014).

Implementation challenge

Since the advent of the new millennium, Rijkswaterstaat has undergone several significant changes in its perspective on optimal procurement methods for projects. In a span of two decades, the organisation transitioned from a closely knit relationship to a stringent separation from the market, a shift marked by the transition label 'Market unless..'. More recently, it has gravitated towards increasingly intensive collaboration under the 2020 initiative 'Market in Transition' (Rijkswaterstaat, 2020c). Each shift was perceived as a strategic leap towards 'the new and best way forward'.

Reflect on this statement from nearly half a century ago: *'Billions of dollars have been spent in the last two decades on management activities purportedly designed to change organisations. Virtually none of these efforts have any systematic monitoring or evaluation associated with it. This leads to an unfortunate state of affairs where the waxing and waning of organisational improvement remedies are associated with limited understanding about what works and what does not and why*' (Tichy, 1983, p. 363). Research into organisational change management seems to generate an abundance of new conceptual frameworks and constructs, but frequently lacks replicated studies to validate these findings (Barends, Janssen, ten Have, & ten Have, 2014).

Over the past decades, research has largely focused on projects from the perspective of "the lonely project", studying their individual structure and dynamics. While this approach has unearthed a wealth of insights into projects and their inner workings, it has often overlooked the historical and organisational contexts that inherently influence them. Engwall (2003) elucidates how projects are significantly shaped by their environment and highlights that their outcome is, in fact, history-dependent and organisationally-embedded. The prestige of a project, its uniqueness, and the legitimacy of the project manager's approach are three aspects that can considerably influence the outcome of a project, and undervaluing these aspects could be detrimental.

One might argue that since Rijkswaterstaat is a politically governed organisation, it often had to embrace new strategies under pressure from political stakeholders and public opinion. However, the political system and the organisation itself sometimes overlook the fact that implementing a new strategy doesn't necessarily mean all employees will immediately discard their old practices and align their views with those of the organisation's top executives. An example of how Rijkswaterstaat, as a politically governed organisation, should respond, can be drawn from the extensive reorganisation in 2003. Responding to the prevailing zeitgeist for downsizing government bureaucracy, the top management of Rijkswaterstaat executed forceful interventions in its organisation under the guidance of Mr. Keijts, the then Director-General of Rijkswaterstaat, and the minister of Finance, Mr Zalm (Metze, 2010). From this perspective, Rijkswaterstaat has shown that it can effect a decisive shift from the past, although not always preserving the positive elements of the established practices.

The implementation of the two-phase delivery method, hailed as the Holy Grail, exemplifies this. The decision to adopt this procurement method for all projects, including the largest budget project in the history of Rijkswaterstaat (*A27: Widening of the route Houten - Hooipolder*), was a top-down decision made with little consideration of potential implementation challenges or the method's suitability for the project's characteristics. A common bias known as selection bias, frequently observed in organisations undergoing significant changes, tends to interpret information in a manner that aligns with one's beliefs while disregarding contradicting signs (Moorhead & Griffin, 2011). Signs of this bias are evident in the justification of the successful project outcome of the renovation Nijkerker-bridge, where the predecessor of the two-phase delivery method was selected as the procurement method (Project DOEN, n.d.). Several employees believe the outcome to be more attributable to the project team than the procurement method, yet it is presented as a triumphant case of collaborative procurement. Another justification for the two-phase delivery often cited is the success of Early Contractor Involvement (ECI) in the United Kingdom. However, the discrepancy between the recommended project characteristics for ECI and the characteristics of projects to which Rijkswaterstaat applies the two-phase delivery is often disregarded (Cabinet Office UK, 2014; Rijkswaterstaat, 2020b).

This research will blend interviews and case studies, following Charmaz's grounded theory approach, to conduct an evaluative investigation into procurement methods. The study aims to assess the impact of the recently

introduced two-phase delivery method and explore factors and activities that support this intervention. This thesis will attempt to provide a substantiated answer to the question of whether the two-phase delivery model serves as a resolution for concerns in the Dutch construction sector.

1.4 Structure of the report

This thesis follows a defined structure for optimal clarity and coherence. The introduction, as seen in this chapter, sets the stage for our discussion by outlining the context of the current procurement issues prevalent in the Dutch infrastructural sector. Chapter 2 details the research objectives, scope, questions, and methodology. This is followed by an exhaustive literature review in chapter 3, which extensively covers topics of historical context, project delivery methods, the two-phase delivery model, and organisational change.

Chapter 4 serves as the foundation for the case studies and provides a comprehensive description of the projects that have been examined in the study. The findings from these case studies are presented in chapter 5. Preliminary findings from the case studies will be presented to an expert group, as explained in chapter 6. Chapter 7 contains a rigorous discussion of the research, along with a thorough evaluation of its limitations. Finally, chapter 8 delivers the answers to the research question and provides a conclusion along with relevant recommendations.

Research design

2

This study relies on a qualitative method to meet its research goal. This evaluation research into the effect of two-phase delivery model is executed using a literature study, a number of interviews and an expert-group evaluation. This chapter describes the research design of this study, which consists of the research objective, questions, structure and methodology.

2.1 Research objective & scope

The aim of this study is to evaluate the impact of the introduction of two-phase delivery on the problems encountered through the use of integrated project delivery. Evaluation research (ER) seeks to to evaluate the impact of an intervention in a particular setting. An intervention here is defined as 'an action taken within a social context for the purpose of producing some intended result'. ER is the process of determining whether an intervention had produced the intended result and/or unintended results. This research seeks to improve, rather than prove (Koolwijk, 2022). This study will seek to gain insight about two-phase delivery as a procurement practice, to assess the effects on the procurement challenges as specified in section 1.3, and to improve its practice to enhance its success.

The scope of this study is defined to the Dutch infrastructure sector and Rijkswaterstaat as the commission authority in this sector. Two-phase delivery has been named (one of the) the solution(s) for 'a financially healthy, competitive and innovative GWW-sector' through 'risk reduction, better pricing and better collaboration in projects' (Rijkswaterstaat, 2019, p. 7). Research into the emergence of the current (procurement) issues within the sector and the intervention in the form of two-phase delivery, will determine if this procurement method results in the intended outcome of better value for money for both parties in construction projects.

2.2 Research questions

The main research question, based upon the research objective, is shown in the text box below.

Main research question

How can the two-phase delivery model be enhanced to address the prevalent issues in the procurement of construction projects?

This main research question translates into the five following sub-questions:

1. *What are the current challenges a commissioning authority encounters with the procurement of projects?*
2. *What are the different project delivery models for procurement of projects?*
3. *To what extent are the procurement challenges overcome by the introduction of two-phase delivery in projects?*
4. *What are proposed changes to the use of two-phase delivery in projects?*
5. *What conditions could ensure the success of two-phase delivery?*

2.3 Research structure & deliverables

The research is structured into four phases. All research phases, including sub-questions, methods, and deliverables, are shown in the research flow diagram.

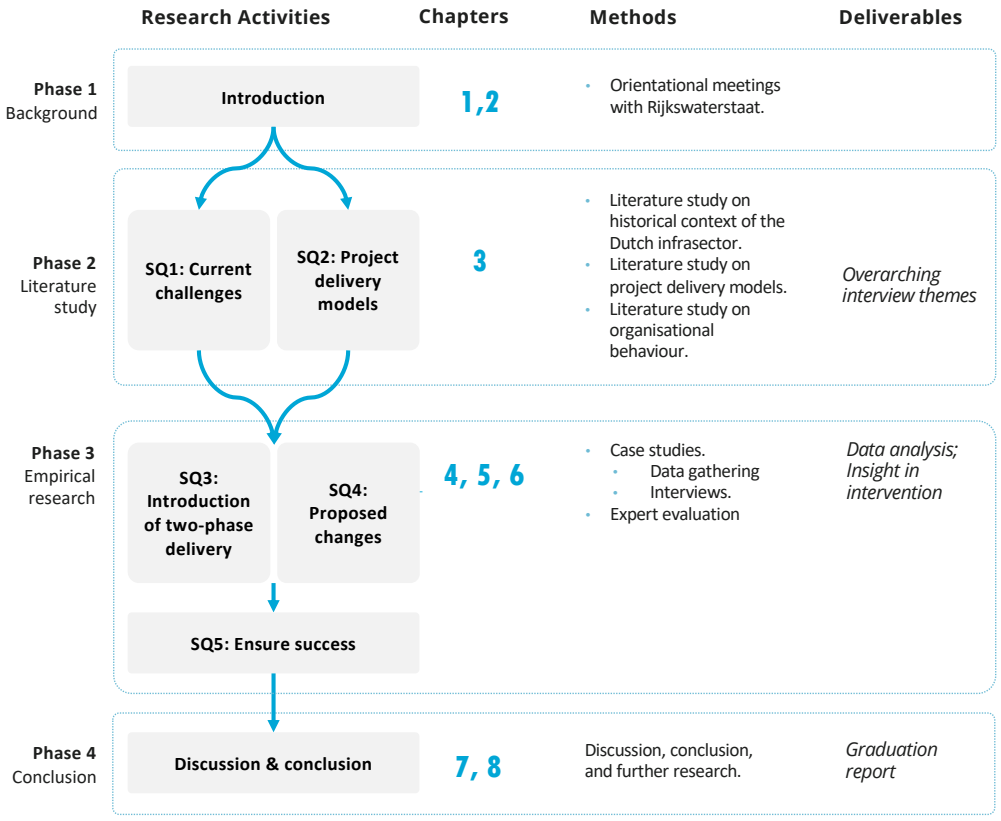

Figure 2.1: Research approach and sub-questions

Phase 1: Background

The goal of the background research phase is to find the research gap and define challenging research questions.

Phase 2: Literature study

Phase two focuses on the three pillars of the literature research: historical context of procurement, the project delivery models and organisational change. In this phase, sub-question 1 and 2 will be answered. This phase results in a selection of concepts related to the introduction of two-phase delivery at Rijkswaterstaat.

Phase 3: Empirical study

The empirical research focuses on case studies and interviews to study the effect of the introduction of two-phase delivery in projects. An expert evaluation will be held to corroborate any findings. The methods used during this phase are desk study, in-depth interviews, interview analysis by coding through Atlas TI, and expert evaluation (Yin, 1994; Bowen, 2006; Verschuren & Doorewaard, 2010).

Phase 4: Conclusion

The conclusion section has a straightforward goal: answering the main research question. Furthermore, the discussion of the results and propositions for further research will take place in this phase of the study.

2.4 Methodology

Grounded Theory (GT) is a qualitative research methodology that was first developed by sociologists Barney Glaser and Anselm Strauss in the 1960s. GT is a systematic approach to developing theories based on empirical data. The methodology is particularly well-suited for research questions that seek to explore social processes and interactions, and that aim to generate new theories or refine existing ones. A distinctive characteristic of GT is the need for an open mind, and the element of recurring reflection of ones own rationale on the study and its outcome.(Corbin & Strauss, 1990; Charmaz, 2014).

GT involves a flexible and iterative process of data collection and analysis. Researchers start by collecting data through various methods such as interviews, observations, or documents. They then engage in a process of "coding" the data, which involves systematically identifying and categorising patterns in the data. Through a process of constant comparison and reflection, these initial codes are refined and combined into more abstract and interpretive codes, which ultimately form the basis of a theoretical framework. One of the key features of GT is its emphasis on developing theories that are grounded in the data. Rather than starting with preconceived theories or hypotheses, researchers allow the data to drive the development of the theory (Holton, 2008).

2.4.1 Characteristics of Grounded Theory

Grounded Theory is an approach aimed at theory development based on recovered data (in which theory is 'grounded'). One of the main characteristics is that it focuses on the views underlying the similarities and differences within the research objects. Furthermore, it is important that a researcher follows the set of procedures and techniques related to data collection- and analysis careful and consistent. Data collection goes through various methods such as interviews, observations, or documents. The data should be rich and diverse enough to capture the complexity of the phenomenon being studied. The latter analysis relates to the use of coding: open coding, axial coding and selective coding. Coding is a method for labelling segments of data to depict what each segment is about. During the analysis, the researcher distils and sorts data, which provides a handle for the comparison of segments (Charmaz, 2008). A brief overview of each coding stage of GT(Holton, 2012):

1. Open coding: In this stage, the researcher examines the data and identifies concepts, categories, and themes that are relevant to the research question. This involves a process of breaking down the data into smaller pieces and labelling them with codes. The codes are often descriptive and capture the essence of the data. The goal of open coding is to generate a comprehensive list of codes that are grounded in the data.
2. Axial coding: In this stage, the researcher takes the codes generated in the open coding stage and begins to organise them into categories and subcategories. This involves exploring how the different codes relate to one another and identifying the relationships between them. The researcher may use a diagram or a matrix to visually represent the relationships between the codes. The goal of axial coding is to develop a conceptual framework that explains the relationships between the categories and subcategories.
3. Selective coding: In this stage, the researcher selects one or more core categories from the conceptual framework developed in the axial coding stage and begins to integrate them into a theoretical model. This involves identifying the key themes and concepts that are central to the research question and using them to develop a comprehensive explanation of the phenomena under investigation. The goal of selective coding is to develop a theory that is grounded in the data and explains the relationships between the categories and subcategories.

This process of data analysis repeats until data saturation and the conclusion of the findings (Verschuren & Doorewaard, 2010). Overall, the process of GT is iterative and reflexive, with the researcher constantly moving back and forth between the different stages as they refine their understanding of the data and develop their theory. Iterative coding ensures that ideas generated from one interview resurface to the next. Throughout the process of GT, the researcher engages in a process of constant comparison, reflection, and memo writing, in order to refine and develop the theory in response to the data. The three stages of GT provide a flexible framework that allows the researcher to stay grounded in the data while developing a comprehensive understanding of the phenomena under investigation (Bowen, 2006; Bryant & Charmaz, 2007).

2.4.2 Different versions of Grounded Theory

There are different versions of Grounded Theory, with the three distinct variants being Classical GT according to Glaser, Straussian GT (SGT) from Strauss and Corbin's perspective and Constructivist GT by Charmaz. They differ in their epistemological stance, data analysis process, and overall approach to theory development. The key differences between the three approaches are (O' Connor, Carpenter, & Coughlan, 2018; Taghipour, 2014; Coskun, 2020):

- *Epistemological stance:* Classical GT takes a more objective stance, emphasising the discovery of empirical patterns and the development of theory grounded in the data. SGT also takes an objective stance, but places greater emphasis on the role of the researcher in shaping the interpretation of the data. Constructivist GT takes a more constructivist stance, emphasising the role of interpretation and meaning-making in the research process.
- *Data analysis process:* Classical GT emphasises the use of "open coding," "axial coding," and "selective coding" to develop a theory grounded in the data. SGT underlines the use of "open coding" and "selective coding" to develop categories and the overall theory. Constructivist GT focuses on the use of "initial coding" and "focused coding" to develop more abstract and interpretive codes that capture the meaning and interpretation of the data.
- *Role of the researcher:* Classical GT places less emphasis on the role of the researcher and more on the data itself. SGT places greater emphasis on the role of the researcher in shaping the interpretation of the data. Constructivist GT places emphasis on the researcher's reflexivity and the use of memo writing to develop insights and interpretations of the data.
- *Overall approach to theory development:* All variants of GT aim to develop a grounded theory that is grounded in the data, but they have different approaches to doing so. Classical GT aims to develop a theory that is grounded in the data, but also has abstract and interpretive codes that capture the meaning and interpretation of the data which will result to a theory that is abstract and generalise. SGT aims to develop a theory that is grounded in the data and also reflects the researcher's interpretation of the data so it is concrete and context-specific. Constructivist GT emphasises the importance of generating theory that is interpretive and subjective, reflecting the multiple perspectives of the participants.

As aforementioned, all variants of GT have the goal to construct a new data grounded theory. Classical GT might be more appropriate for contexts where the research aims to develop a theory that is situated within a broader theoretical framework, is abstract and can be generalised across different contexts. Straussian GT is suited for research that is focused on understanding a particular social phenomenon within a specific context. It focuses on the importance of understanding the meanings and perspectives of the participants in a particular social setting, and developing theory that is grounded in that context. Constructivist GT might be suited for a study focused on exploring multiple perspectives and interpretations of a social phenomenon. It emphasises the importance of recognising the subjective and interpretive nature of social reality, and developing theory that reflects the diversity of perspectives and experiences of the participants. Another factor where Constructivist GT could be of better use is when the research question requires a more flexible and iterative approach to data collection and analysis, such as when the data is complex or difficult to categorise (Charmaz, 2014; Fourie, 2015; Evans, 2013)

2.4.3 Grounded Theory in this research

In this research, the GT approach of Charmaz, Constructivist GT, will be followed. The room for personal reflection on the subject, in relation with multiple perspectives on the subject to be studied can be of great benefit to this study. Personal reflection is a critical aspect of the Constructivist GT. In Constructivist GT researchers are encouraged to reflect on their own perspectives and assumptions, and to consider how these may shape their interpretation of the data. This reflexivity is seen as essential to developing a more nuanced and complex understanding of the social phenomenon under investigation, and to recognising the subjective and interpretive nature of social reality (Charmaz, 2014).

Constructivist GT stresses the importance of recognising the diversity of perspectives and experiences of the participants, and of acknowledging the researcher's own personal perception in relation to the data. By engaging in personal reflection and reflexivity, researchers can become more aware of their own biases and assumptions. Charmaz (2014) summarises how "researchers are a part of what they study, not separate from it. The grounded theory *analysis* shapes the conceptual content and direction of the study" (p. 320, 2014).

2.5 Research validity

Demonstrating scientific validity of qualitative research calls for principles that uphold both the credibility and trustworthiness of the study. Triangulation is a method used in qualitative research to improve the validity and reliability of findings. It involves using multiple sources of data to ensure the accuracy, reliability, and relevance of the data collected. In this research, literature study can be used to compare findings with established literature, case studies can identify common patterns or themes, and interviews can identify individual differences. By using multiple sources of data, researchers can improve the validity and reliability of their findings. Triangulation can help to ensure that the data collected is accurate, reliable, and relevant to the research question. It can also help to identify areas where further research is needed. (Meijer, Verloop, & Beijaard, 2002; Guion, Diehl, & McDonald, 2011; Golafshani, 2003).

Trustworthiness is a principle introduced by Lincoln and Guba (1986) which refers to the extent the research findings are credible, transferable, dependable, and confirmable, and are therefore qualitative and rigorous findings. Credibility aligns the research findings with reality, transferability reflects the extent in which the research results can be applied or generalised to diverse contexts. Dependability ensures consistency and stability in the research process, and confirmability refers to the objectivity and neutrality of the research findings, as well as their potential for being confirmed by others (Lincoln & Guba, 1986).

This study focuses on the evaluation of an intervention, the introduction of two-phase delivery method at Rijkswaterstaat. With the use of GT as a qualitative research method, a systematic process of collecting, analysing, and interpreting data is undertaken to generate a theory grounded in the data itself. To increase the validity of qualitative research when using grounded theory, both principles of triangulation and trustworthiness will be used synergistically to ensure comprehensive validity.

As aforementioned, triangulation involves using multiple sources of data to ensure the accuracy and reliability of the findings. In grounded theory research, triangulation can involve using different methods of data collection, such as interviews, observation, and documents. Secondly, member checking is a process which involves returning to the participants to check the accuracy of the data and the emerging theory. This process helps to ensure that the participants' perspectives are accurately represented in the theory. Lastly, an expert review will be set up to to review the preliminary results of the study to provide feedback on the validity of the theory. This process helps to ensure that the theory is grounded in the data and is relevant to the research question (Seeger, 2018; Flynn & Korcuska, 2018). To enhance trustworthiness, researchers can undertake several steps, according to Shenton (2004). To reinforce credibility, multiple data sources such as interviews, observations, and documents can be used. Incorporating member checking can also be valuable to ensure accurate interpretation of the data. Enhancement of transferability can be facilitated by providing a comprehensive description of the research context and participants. To further dependability, the maintaining

of an audit trail which documents the research process and decisions can be incorporated. Debriefing with peers or thesis committee members of feedback on research design and analysis the will help to enhance dependability. Finally, practising reflexivity to acknowledge personal biases and assumptions can strengthen confirmability of the research (Shenton, 2004). Reflexivity through the writing of memo's is also an important part of grounded theory. Through the use of these combined steps the triangulation and trustworthines are ensured and thereby the validity of this research.

Literature Study

3

In this chapter several subjects will be reviewed. In section 3.1 the historical overview of the last decades will be given, to give context to the procurement issues that have arisen. In this section, sub-question one, *What are the current challenges an commission authority encounters with the procurement of projects?* will be answered. Section 3.2 will provide an review of the different project delivery methods that projects can choose from when procuring a work or delivery, with section 3.2.5 elaborating on the two-phase delivery model. Here, an answer to the second sub-question, *What are the different project delivery models for procurement of projects?*, will be provided. In section 3.3 the different layers of organisational change will be explored. Finally, section 3.4 will provide a summary of all the concepts that this chapter has touched upon and how this lays the foundation for the rest of this study.

3.1 Historical context

In this section, an overview of the last 35 years (1985 - 2020) of the Dutch infrasector will be given. The arrangement of historical section is according to Ruijter(2019), which includes a focus on the transition that Rijkswaterstaat has undergone to being the countries larges commissioning authority. This historical context is provided to answer the question of how the problems in this sector came to be. What is the two-phase delivery method supposed to solve? What are the underlying triggers of these problems? In four parts, the history of Rijkswaterstaat and its collaboration with the private construction sector is portrayed. In doing so, this section answers the first sub-question, which is presented below.

Sub-question 1

What are the current challenges a commissioning authority encounters with the procurement of projects?

3.1.1 From engineering to defining contract requirements (circa 1985-1990)

In 1986, the Oosterscheldekering (the Eastern Scheldt storm-surge barrier) was completed as the first part of the world-famous Delta works. The circumstances under which the project was executed called for new and innovative solutions. The barrier provided a breeding ground for innovations in both the technical and organisational plane (Ruijter, 2019; Hertogh & Westerveld, 2010).

Before the Oosterscheldekering, Rijkswaterstaat had a very traditional way of commissioning public works. The civil servants of Rijkswaterstaat would engineer and design the project, after which the commissioned contractor would carry out the work. In this relation, Rijkswaterstaat would be responsible for the plan put to market, and the contractor for the execution hereof. This left no room for any innovations from the market side of the sector. The Oosteschelde was a disruption of these normal procedures. Since the context of the innovative project demanded more expertise than Rijkswaterstaat alone could offer, the winning private civil engineering companies were invited to think along, based on a cost-plus contract. The consortium was

known as the 'DOSbouw' and consisted of three construction directorates and six large Dutch civil engineering companies and is regarded as instrumental in the successful completion of the barrier (Bijker & Aibar Puentes, 1993; Sovacool & Linnér, 2016). The involvement of engineering constructors as with the Oosterscheldekering could be considered a gradual turn towards a new way of thinking about procurement.

After the completion of the Oosterscheldekering, the final part of the Delta Works needed to be completed. An independent committee, appointed by then Minister of Transport, Public Works and Water Management Neelie Smit-Kroes, announced a competition for the design of the storm surge barrier now known as the Maeslantkering (Ruijter, 2019; Ministerie van Infrastructuur en Waterstaat, 1997). This was the first time Rijkswaterstaat was asked to take a backseat in the design process of a large infrastructural work: their role was reduced to procurement, contract management and the supervision of the work (Sovacool & Linnér, 2016). This was in line with the prevailing spirit of neoliberal thinking, which, under the name of *New Public Management* (NPM), had been imported from an Anglo-American perspective and had gained influence among the ruling political parties. Under the influence of NPM, the government sought to downsize Rijkswaterstaat as a civil service apparatus and shift the focus from traditional arrangements to collaboration with the market (Pollitt, van Thiel, & Homburg, 2007). Where the Oosterscheldekering was designed by Rijkswaterstaat, with input from and executed by the DOSbouw under a cost-plus basis, the Maeslandkering was a turning point in procurement history by putting out the tender under a design and construct contract, with a maintenance period of five years (Bouwdienst Rijkswaterstaat, 1998). This method of procurement meant that the engineers of Rijkswaterstaat had to shift their mindset from designing the project themselves to thinking about contract requirements and how to assess these. Within the organisation, there were two sides to this new approach: those who felt their legitimacy as civil engineers slipping away and those who saw the future as a challenge and set out to embrace the new possibilities for innovation throughout the supply chain.

With the completion of the Measlantkering under a Design&Construct contract, within a reasonable budgetary and schedule range, the Minister and her committee argued that the private sector was capable of executing the design as well as the construction of a complex project of this scale. From this point on, the position of Rijkswaterstaat as an engineering agency shifted towards an commissioning agency.

3.1.2 The parliamentary construction fraud inquiry (circa 2000-2005)

Rijkswaterstaat's new project commissioning approach instigated a shift in responsibilities and risk from Rijkswaterstaat to the private sector. This necessitated Rijkswaterstaat employees to transition from technical specialists to proficient contract creators based on functional requirements, and outsource the technical knowledge previously within their purview. This change was congruent with the societal call for a leaner civil service. The new model capitalised on the private sector's knowledge, fostering innovation, and thereby enabling a higher project turnover. In response, Parliament mandated Rijkswaterstaat to integrate innovative commissioning for the majority of their projects. The *Professioneel Opdrachtgeverschap 21e eeuw* action plan [Professional Commissioning for the 21st Century] ushered in a clear departure from traditional project commissioning, replacing it with an innovative approach. This new approach was centred on cultivating businesslike relationships with the private sector, focusing more on contract management rather than designing the works, and standardising projects where feasible (Ministerie van Verkeer en Waterstaat, 2002). This concept was received with mixed feelings both at Rijkswaterstaat and in the private sector. Where Rijkswaterstaat employees felt left out of an important part of the process and did not feel that the private sector was ready for this change, nor was it up to the challenge. On the other hand, the private sector felt that under the traditional system their directions were very clear, whereas now they had to take a lot of risk in tendering for projects and attract a new type of employee to ascertain the technical knowledge expected of them (Ruijter, 2019).

On November 9th, 2001, the journalistic television program Zembla broke the news of suspected fraudulent activities in the construction sector. The story suggested a cartel of several construction companies which had scammed Rijkswaterstaat and other public agents out of hundreds of million gilders. The companies would make illegal price agreements and allegedly bribed Rijkswaterstaat employees at top positions. This systematic fraudulent behaviour would have resulted in overcharging of ten to fifteen per cent of total costs which

landed in shadow accounting (Zembla BNNVARA, n.d.). In 2002, the parliamentary inquiry into construction fraud was held, the findings of which were presented in 2003. The *Bouwfraude enquete* [Commission Fraud Inquiry] identified three primary activities related to the fraud. The first activity involved informal preliminary consultations between constructor companies before the official commencement of any procurement. During these consultations, the constructors would decide which company would undertake certain projects and agree on the prices. This kind of preliminary consultation was permitted until 1992 and 1995 when the European Commission and the European Court of Justice respectively declared cartel formation illegal. Information provided by Zembla suggested that such activities may have continued even after this declaration. The second fraudulent activity involved the collection of counterfeit invoices to inflate profit margins. The third and final activity pertained to information gathering by private companies, achieved through bribing municipal public servants. These bribes could range from outright payments to providing paid vacations or complimentary cars. Armed with this acquired information, the construction consortium could then base their bid prices on the maximum budget amount. This strategy would not only minimize their bid risks but also significantly enhance their profit margins. However, no concrete evidence was ever presented to substantiate the allegations of bribery involving public servants (Enquêtecommissie Bouwnijverheid, 2003; Graafland & Blok, 2014; Verlaan & Staps, 2002).

In the aftermath of the parliamentary inquiry, there was a lack of trust between parties in the private sector and between employees of Rijkswaterstaat and the private sector as a whole. This breach in collaboration resulted in an even more businesslike approach towards contractors, sometimes even avoiding mutual dialogue during a procurement phase altogether (Ruijter, 2019). Rijkswaterstaat itself concluded that there were a number of reasons to move from the traditional method of procurement to a more integrated project delivery method, i.e.: the recommendations from the parliamentary inquiry, the implementation of EU-procurement laws, the demand from the private sector to involve them more and at an earlier stage and, the political and public request for a smaller public sector (Rijkswaterstaat, 2019; M. A. B. Chao-Duivis, 2019). The parliamentary inquiry and the actions taken in response, can be considered the first step towards further legalisation and formalisation of collaboration in the infrasector.

3.1.3 The economic crisis in the Dutch construction sector (circa 2010-2015)

Following the turmoil in the sector, a plan was formed to restore trust between all parties by demanding more transparency and accountability. With the use of business plans to select projects, the approach would be public-oriented, with more standardisation, and less bureaucracy. By implementing innovative commissioning for 80% of all activities, greater societal value was to be acquired, with a professional commissioning authority at the head of it all. One of the premises of this position was a very distant relationship between both public and private parties. The second business plan devised, was to establish Rijkswaterstaat as a more professionalised, leading commissioning authority. The second business plan was aimed at positioning Rijkswaterstaat as a more professional and leading commissioning authority. The application of multiyear procurement programming and consistent market policy were key strategies to standardise contracts. The ultimate objective of this standardisation was to achieve high efficiency, however, it left minimal scope for project-specific interpretation. The established dialogue encompassed a uniform, process-like form of market scans, consultations, competitive dialogue during procurement, and reflections, all of which were distinctly business-oriented. The technical expertise was expected to be provided by the private sector. Nevertheless, companies within the sector found it challenging to adapt to their new roles. They struggled to accurately estimate risks and uncertainties as projects escalated in scope, time, and budget. This transformation of the construction sector came with its fair share of difficulties, requiring industry players to adjust and develop new capabilities.

Rijkswaterstaat had decided that a 10% profit margin was good to ensure a healthy market. Due to the inexperience of market parties to estimate risks and translate this into a bidding price, margins stuck at 2%. Expectations from both Rijkswaterstaat as procurement authority and the private sector on the pace of these implemented changes were badly managed. Rijkswaterstaat expected the private sector to come up with innovative technical solutions for their problems and to translate these into a sound bid, where the private

sector felt overwhelmed by their new responsibilities and that Rijkswaterstaat now lacked the expertise to fair asses the technical solutions proposed. The chosen contract-oriented approach of collaboration felt for some 'as if the accountant was in charge of a complex technical project' (Ruijter, 2019).

Despite a change in the approach to the execution of infrastructural projects, a lot of politicians wondered why there were so many projects with large cost overruns. They demanded more predictability and more transparency during the realisation of these projects. Integrated contracts or DBFM(O) contracts [Design, Build, Finance, Maintain (Operate)] were appointed to be the vehicles through which cost reduction and project security was to be obtained (Pianoo, 2021; Tweede Kamer der Staten-Generaal, 2009). Integrated contracts placed more risks towards the private sector because they were responsible for all integrated aspects of project execution and therefore believed to be in a better position to estimate and mitigate risks (Rijkswaterstaat, 2011) When the financial crisis hit, a lot of companies struggled to survive (Leoné, 2009). They had to cope with the hardship of getting to know the new form of procurement by Rijkswaterstaat, as well as the fierce competition in light of the crisis. These aspects were reasons several companies were either not able to estimate project risks accurately, or were too keen on winning bids that they purposely under priced their bids to win. Both driving forces resulted in contractors obtaining projects which were not profitable (Nagelkerke & van Valkenburg, 2016).

Due to the imposed choice for integrated contracts, the speed with which this change was enforced and the lack of project-specific possibilities, the expectations of the innovative integrated delivery model fell short of its results (Nagelkerke & van Valkenburg, 2016).

3.1.4 Outlook to the future (from circa 2019)

In response to the troubles in the private sector following the economic crisis, Rijkswaterstaat felt the responsibility to move the sector towards a more collaborative, profitable sector, able to successfully execute the projects for years to come (Rijkswaterstaat, 2020c).

In rapid succession, new plans and visions were presented to the Ministry of Infrastructure. Under the latest market vision of Rijkswaterstaat, *On the road to a vital infrasector [Op weg naar een vitale infrasector]*, twenty-three points of action were formulated. One of the overarching focus points is the implementation of new procurement delivery methods: the two-phase delivery method (Rijkswaterstaat, 2020d).

3.1.5 The challenges of project procurement

Following the developments in the infrastructure sector, several key problems stand out. Due to the extensive use of integrated contracts and the lack of project-specified exceptions both the private and the public sectors are dissatisfied with the current status. The problems needing to be overcome with any new form of procurement are the following:

- the price to be given in combination with the unknowns
- the large tender costs for bidding contractors
- the scope and demarcation of project activities
- division of tasks and interrelation between client and contractor
- sequentially of activities

The primary concern at present revolves around the necessity to set a price during the procurement period, a decision based solely on the information currently available. The challenge lies in accurately estimating the project's risks within the short time frame of the tender period, based on its scope. This process carries the potential to be detrimental if not managed effectively.(Rijkswaterstaat, 2020c; M. A. B. Chao-Duivis, 2019).

The second point pertains to high tender costs, which largely stem from the extensive time and effort invested in crafting a detailed bid. Contractors may spend up to eight months pursuing a tender, a process that may

ultimately prove unsuccessful. This failure results in a significant accumulation of man-hours and internal costs, which translate to substantial business loss when a tender bid is lost.

The remaining points collectively pertain to the concept of 'interpretation of collaboration'. This covers areas of concern, such as the scope of the project, the activities involved, and the division of tasks and responsibilities between client and contractor - issues highlighted by actors in both the private and public sectors. In sum, these three elements – the early price determination compounded by unknown risks, high tender costs, and difference of interpretations of collaboration – constitute the three key challenges in the infrastructure sector's procurement process. These core points answer the first sub-question: *What are the current challenges a commissioning authority encounters in the procurement of projects?*

3.2 Project Delivery Models

The term 'project delivery model' (PDM) refers to the assignment of roles and responsibilities to all parties involved in a project, to establish a framework of the design, procurement and construction process (Oyetunji, Asce, Anderson, & Asce, 2006). Despite many efforts, no clear consensus on the definition of PDM has been reached (Azari, Kim, Ballard, & Cho, 2014). Under the current practice of project delivery, the procurement of just the construction of a project is hardly conventional. To include the current practice of project delivery and provide a thorough definition, Miller et al. (2000) defined PDM as 'a system for organising and financing design, construction, operations and maintenance activities that facilitate the delivery of a good or service' (Miller et al., 2000).

The current guiding principle by the Dutch council for construction, adopts the definition of PDM or '*bouworganisatievorm*' as "the way in which the tasks to be carried out in a building process are divided among the different sections of the building process" (p. 403, Jansen, 2009). The variants of PDMs most common in the Netherlands are the traditional model, the integrated model and the alliance model. The two-phase model is a delivery model that cannot be simply assigned to one of these variants. It bears a resemblance to some, with characteristics of others (Miedema, 2022). A broader view on this subject is provided by Walker and Lloyd-Walker (2015). They conducted extensive research into different procurement arrangements and PDMs. They distinguish broadly three different approaches to project procurement: A traditional approach, a focus on integrating design and delivery process and a focus on integrating project design and delivery teams. This distinction corresponds with the listing of Jansen but adopts a slightly different angle on the subject. The two-phase delivery model bears different features from different categories, but because there are multiple ways to introduce the two-phase model, a simple assignment to one of the given categories is not possible. In an effort to categorise and introduce the different project delivery models, the second research question is answered, which is presented below.

Sub-question 2

What are the different project delivery models for procurement of projects?

3.2.1 Project delivery models and contract models

The distinction between project delivery models and contract models is sometimes hard to explain as both are often used interchangeably, as described by Miedema (2022). However, a contract model is a supporting means for the successful implementation of a project delivery model. Pishdad-Bozorgi (2012) defines contracting strategy as where "the roles and responsibilities of the contracting parties [are described]; it determines the risk allocation strategies, methods of payment, basis for reimbursement, and incentive strategies for encouraging enhanced contribution." (Pishdad-Bozorgi, 2012, p. 31). Jansen (2009) defines the contract model as a "legal record of the contractual arrangements made between the participants in the construction process" (p. 404). Often these contractual arrangements are standardised for regularly used PDMs, hence the overlay in use of terms in practice (Miedema, 2022).

3.2.2 Traditional project delivery method

Traditional PDM focuses on the segregation between the design and the delivery of projects. The two most common traditional PDMs are (Design) Bid Build (DBB) and Cost reimbursement variants hereof. With this PDM the employer or client is responsible for the design and the contractor for the execution of the project. Under the standard conditions of DBB, roles and responsibilities for all involved parties are clearly outlined (Miedema, 2022). The high-level completion of the design is a key feature of this type of procurement. The contract terms are rigid and the tender bids are usually focused on a fixed price and fixed time, with certain milestones of project delivery. During construction, all tasks in each stage need to be finalised before moving on to the next. However, due to inevitable changes during the project's construction time, the project result will differ from the tendered specification (Walker & Lloyd-Walker, 2015). Most construction projects nowadays are multi-million and multi-year mega projects. While the overall purpose of the project rarely changes, small issues and new insights will cause a lot of required smaller changes to the scope and design of a project (Hertogh, Baker, Staal-Ong, & Westerveld, 2008). Due to the rigid form of collaboration under DBB, this can lead to a lot of time-consuming negotiations. Settling contract deviations can take up a lot of energy and resources (Walker & Lloyd-Walker, 2015). The advantages of DBB are the standard contract forms, which prescribe unambiguous roles and responsibilities of parties involved and the embedded checking possibilities throughout the project. Disadvantages are the sequential manner of the project stages and the strict separation of design and construction, leading to a slowdown effect on the building process. Further, since the contractor is only involved during the construction phase, his expertise can not be fully utilised during the project as a whole. As aforementioned, the high level of claims due to additional work can delay the project and drive up the costs. Under this PDM, collaboration is low and restricted to the moments as specified in the contract (De Ridder, 2009; Miedema, 2022). An additional concern from the perspective of the procuring party is that projects under DBB are often tendered via an open-tender system. This system lacks a selection phase to weed out under performers based on their past performance or qualifications. Research suggests that estimators often believe that the winning bid is the one that has overlooked or omitted the most elements. Even when a selection phase with pre-qualifying requirements is implemented, it is common to receive ten or more bids. This situation can result in high tendering costs for unsuccessful bidders, who must then recoup these costs in the profit margins of their successful bids. This could potentially result in either higher bids or lower quality of work in subsequent projects (Walker & Lloyd-Walker, 2015).

3.2.3 Integrated project delivery, integrating design & delivery

There are several forms of integrated project delivery (IPD) where, several building processes are integrated into one product delivery, either contractually or physically integrated, that focus on integration through planning and control systems. The key belief behind these delivery methods is that projects are logically driven by planning and control, more than people management or collaboration. These delivery forms include design and construct (D&C), Build-own-operate-transfer (BOOT), public-private partnerships (PPP) and the most integrated form of IPD: design, build, finance, maintain and operate (DBFMO). With D&C, the design and delivery of the project are the responsibility of one entity. This might be the main contractor or the contractor with a design sub-contractor, but from the position of the client, it is outsourced to a single party (Walker & Lloyd-Walker, 2012). Unlike the traditional model, no detailed design is provided by the client, but rather a set of certain outputs, based on functional requirements (De Ridder, 2009). The perceived outcome of IPD is closer collaboration between design and delivery teams, therefore reducing transnational costs between parties. When a single entity also bears the contractual responsibility for the financing, maintaining and operating of the project in relation towards the procuring client, the DBFMO form of IPD is chosen.

DBFM

The integrated delivery method in the form of a DBFM model may use some extra explanation. After discarding the traditional model, the most used form of project delivery in large Dutch construction projects was the DBFM model. Globally, the integration of the "O" for operate can be seen in project procurement practices, whereas

in the Netherlands, construction projects almost never include an *operate* element in the tendering process. The reasons Rijkswaterstaat and other procuring offices were keen to use this form were the shortening of completion time, the extent to which the contractor's knowledge was put to use, the option for the client to be either more or less involved in the realisation phase, the fact that both sides could be positively influenced by each others expertise which could help to anticipate problems in later phases of the project, the duration of the realisation phase could be shortened and the contractors would have more opportunities to influence their chances of winning tenders (M. A. B. Chao-Duivis, 2019).

While the introduction of the integrated model was received with enthusiasm from both the client and contractor side, even from the beginning there was apprehension on one particular aspect that in hindsight proved to be the downfall of this form of PDM: the pricing of unknown risks. Construction projects are known to exceed their initial tender amount and original planning. According to Rijkswaterstaat "There is an inherent uncertainty about the risks at the time of determining the bid prince and planning for the bid." (Rijkswaterstaat, 2019, p. 25). This is one of the key problems, two-phase delivery will try to solve. According to M. A. B. Chao-Duivis, this problem has two aspects: the unknowns, through the information sharing problem and the inherently more complex projects in complex surroundings, and the pricing system where parties are to price the project in their bid when most of the risks are unknown. The other core challenges to overcome with regards to DMFM are the scope and demarcation of the project, the division of tasks and interrelationships, and the sequentially of activities and the time pressure this perceived advantage proposes (M. A. B. Chao-Duivis, 2019). These problems and the solution two-phase delivery proposes will be discussed in chapter 5.

3.2.4 Integrated project delivery, integrating design & delivery teams

The last division of PDM concerns those that focus on integration by design and collaboration of teams. These models include partnering or alliances, early contractor involvement and the Dutch Bouwteam model. Partnering and alliance suggest two different approaches to project delivery when in fact, both forms possess the same characteristics and pursue the same objective. Partnering focuses more on collaboration where the alliance model and the distribution of risks and gains are emphasised (De Ridder, 2009). For this purpose, partnering and the alliance model will be discussed as one PDM. Alliances integrate the development and execution of a work, while the client, designer and contractor form an integrated organisation. They all pursue a common goal while sharing risks and resources, as well as possible profits. The division of these risks, roles and rewards is established in an agreement before the commencement of the project. Distinctive of this PDM is the use of the 'open book' determination of costs where the client gains insight into the build-up of prices of the contractor. This transparency is installed to ensure the contractor's use of realistic pricing, as well as the guarantee that he will receive the pay he's due. Advantages to this PDM are the decrease of conflicts and costs of resolving these, as well as the improvement of atmosphere in the project team now that there is a lesser feeling of opposite sides' than under traditional models. However, this does not result automatically in better collaboration. According to Suprapto, Bakker, Mooi, and Hertogh (2016), partnering or alliance contracts and incentive contracts do not necessarily result directly in better project performance, but through relational attitudes and how they play out into actual team working behaviour. Their study indicates that projects with a partnering or an alliance contract are likely to perform better than those with lump-sum and reimbursable contracts, and projects with incentive contracts are likely to perform better than those without incentives through better relational attitudes and team working quality. However, they conclude that much time has to be invested beforehand into the involvement of project members to achieve said client-contractor collaboration. This PDM is often used for long-term projects, resulting in the need for regular consultations between group members to ensure smooth engagement between all parties. Also, the extent of price detailing in the open book procedure might be against the contractor's wishes (Clemens, 2021; De Ridder, 2009). This can be even more so when the contractor is involved in one project under an alliance model which calls for open book pricing but involved in another project with a different delivery model. Even though both projects and PDMs are different, comparisons between the open and closed pricing might be attempted by the client.

Early Contractor Involvement

Early Contractor Involvement (ECI) is a procurement method used in construction projects where a contractor is involved early in the project, either during the design phase, before execution, or from the project's outset. Under this procurement method, a contractor is selected based on their expertise, experience, and other qualifications, and is engaged to provide input and advice on the project design, planning, cost, and feasibility (van Wijck, 2018).

ECI is a collaborative approach that allows the contractor to work closely with the project owner, designers, and other stakeholders from the early stages of the project. The contractor is involved in the project planning and design stages, and provides input on constructability, cost, and other factors that can impact the project outcome. One of the primary benefits of ECI is that it allows the project owner to benefit from the contractor's expertise and experience, which can lead to better project outcomes in terms of cost, schedule, and quality. Additionally, ECI can lead to more efficient construction processes, reduced risk, and better project team integration (De Ridder, 2009). Research by van Wijck (2018) has shown that ECI brings numerous advantages to project delivery, including quicker project delivery, cost reduction, higher certainty in costs and planning, improved quality of design and project, and improved informativeness. ECI is widely used in Australia, New Zealand, and the United Kingdom, where this type of procurement method is used with the purpose of reducing tender costs. ECI is mostly utilised for simple projects with a clear scope, no uncertainty about the end product, very little need for innovation or uncertainty about the project area(De Ridder, 2009). However, these methods have a significantly different rationale for the early engagement of the contractor. In these cases, the added value is derived from the experience that the contractor can contribute when the project scope is still indistinct or when there is uncertainty surrounding the project area, thereby introducing risks. The following subsection elaborates on the Bouwteam approach as a procurement method.

Bouwteam

Bouwteam is a Dutch procurement method that is similar to Early Contractor Involvement (ECI). In Bouwteam, the contractor is involved in the project from the earliest stages and works collaboratively with the client and other stakeholders to optimise the project's design, cost, and feasibility (M. A. B. Chao-Duivis, Bruggeman, Koning, & Ubink, 2018; Chao et al., 2022).

The Bouwteam approach is designed to facilitate effective communication and collaboration between the contractor and the client. The client provides the initial project requirements, and the contractor provides input and advice on the project's feasibility, cost, and constructability. The contractor's input is used to inform the project's design and delivery (M. Chao-Duivis, 2012).

One of the primary benefits of the Bouwteam approach is that it allows for early collaboration and input from the contractor, which can lead to more efficient construction processes, reduced risk, and better project outcomes in terms of cost, schedule, and quality. Additionally, the Bouwteam approach can lead to improved communication and collaboration between the client and contractor, which can help to minimise conflicts and disputes during the construction process. The Bouwteam approach is widely used in the Netherlands for public and private construction projects. It is considered a more collaborative approach to procurement, and it is intended to promote effective communication and collaboration between the client and contractor throughout the project life cycle.

The largest differences between Bouwteam and ECI are the formality of the agreement and the reason for the early involvement of the contractor. Bouwteam is a more formal procurement method that is governed by a formal agreement with contractual arrangements between the client and the contractor. Currently, the Bouwteam agreement is being revised *(Duurzaam gebouwd 2020 model or Model Bouwteamovereenkomst by Bouwend Nederland)*, where the UAV or UAV-GC should be applicable as general conditions for the execution phase (M. Chao-Duivis, 2012). As aforementioned, under ECI the contractor is involved early to reduce tender costs for simple projects with a clear scope, where Bouwteam is used to reduce uncertainty in the project.

While the terms 'Bouwteam' and 'two-phase model' are often used interchangeably in the infrastructure industry, they indeed denote distinct concepts. Although a Bouwteam contract technically comprises two phases—design and execution—with the realisation price being determined post-design phase, it markedly differs from the two-phase model. According to Duurzaam Gebouwd (2020), a Bouwteam agreement is designated for the execution of a specific project. Conversely, the two-phase delivery model can be deployed for a collection of projects, and is also referred to as framework agreements, portfolio contracts, or collaboration contracts. Another significant difference resides in the allotment of roles and responsibilities. The Bouwteam model features a somewhat standardised role distribution, while the two-phase model lacks predefined roles, thereby granting clients the flexibility to designate responsibilities as they deem appropriate. For instance, the client could confer upon the contractor a coordinating role and take on a larger share of the design responsibility. Thus, the two-phase delivery model represents a broader term that encompasses Bouwteams, which a more standardised form of a PDM compared to the two-phase delivery model (Miedema, 2022).

3.2.5 Two-phase delivery model

The goal of the two-phase delivery method is twofold: on the one hand, it tries to reduce risks and uncertainties in projects, so contractors and clients can more accurately price the project bids. On the other hand, it tries to lower the transaction costs during the overall project phases, from design to execution. With the pursuit of these objectives, the conditions for a clear scope, a robust design, solid planning and a fixed price should be able to be fulfilled.

The outline of a two-phase delivery model, as depicted in figure 3.1, is that after the preparation and procurement phase, the contract will be executed over two phases. The first phase commences after the award of the tender. In this phase, the design of the project will be developed collaboratively with both parties. During this design process, more insight into the risks and uncertainties and the possible reduction hereof will be gained. The goal of this shared design and risk management process is to effectively and fairly allocate risks, improve the feasibility within the allotted time frame and reach a fair project price. The definitive price determination of the work is based upon an open book procedure of the contractors' financial books and the pricing of the high-risk or high-uncertain project elements. One of the goals Rijkswaterstaat is trying to achieve with the use of the two-phase delivery method is 'honest pay for honest work' (Rijkswaterstaat, 2020d, 2022).

Between the first and second phases, a go/no-go moment has been implemented. The results of the first phase, foremost the design and the established price, will have to comply with pre-set conditions to enter the second phase, just as both parties have to be willing to move forward together. This is an opt-out moment for the client as well as the contractor. The intention of both parties, however, has to be to execute phase two and only opt out in exceptional circumstances. The schematic representation of a regular procurement and procurement using a two-phase delivery system is shown in fig. 3.1.

Phase two is subject to a positive go/no-go decision and will proceed unless certain predefined conditions are not met. Should this be the case, the process will either linger in phase one, or the client will utilise the design for a conventional procurement procedure. Key conditions for proceeding to the contract's phase II include reaching a consensus on the (final) design, project timeline, the contractor's fixed price, and the risk distribution between the client and the contractor, along with a project deadline. Consequently, the objective for both parties during phase one should be to reach an agreement on these conditions. They should use the time allocated in the first phase to select an appropriate collaboration mode and strive for a design and approach that aligns with the constraints imposed in terms of time, cost, and quality (Rijkswaterstaat, 2022; van Wijk-van Gilst, 2020).

In phase two, the execution of the contract shall be carried out in a manner corresponding to the execution of regular projects. It may be expected that the collaboration established in phase one will continue to work positively in phase two and will have a positive impact on collaboration in phase two. However, no definitive answer on the influence of a more collaborative approach to designing and risk management and its workings on the execution phase of the project is available. This study might provide some insight. This introduction of

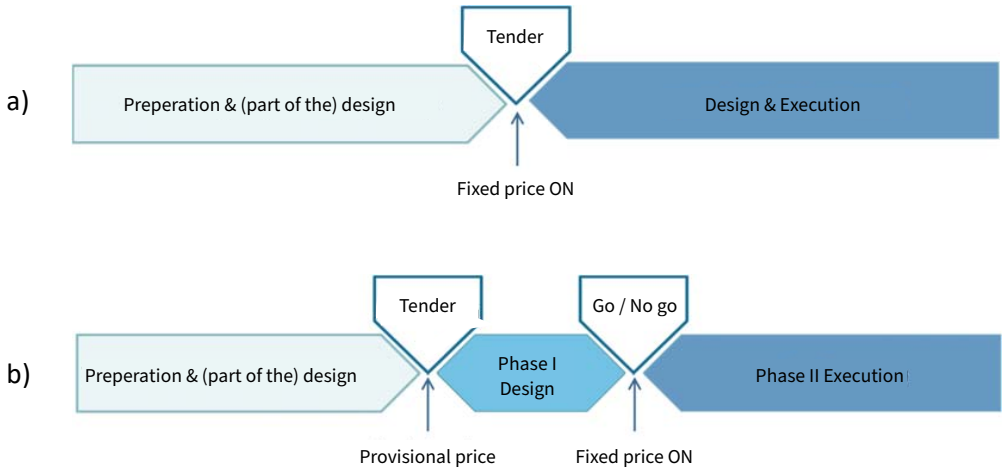

Figure 3.1: Schematic illustration of a) the regular procurement and b) the two-phase delivery method.

the two-phase delivery model concludes the overview of project delivery models projects can use to procure construction works. This overview provides an answer to the sub-question: *What are the different project delivery models for procurement of projects?*

3.3 Organisational behaviour

The use of two-phase delivery as a method for procurement is a change in the regular way of undertaking large and complex projects. It is an intervention in the structure of a procurement process, but it does not spell out what people should do (activities), how the project organisation is managed, or how people should behave (culture). When change occurs in an organisation, there are different levels where this change is implemented but also different ways of how people react to this change. This chapter goes deeper into what happens when change is applied to an organisation.

Rijkswaterstaat itself is a large organisation, with more than 9000 employees over thirteen different divisions, six on a national and seven on a regional level. Within these divisions, there is a multitude of different sections and departments, all with different roles, responsibilities and expertise. However, like Rijkswaterstaat itself, projects could be seen as (temporary) organisations too. Reich et al. (2013) reported on this change in philosophy on project management, to include this view into theory. As construction projects are becoming larger over the years, the organisation of these projects is becoming increasingly complex. Where under traditional projects maybe two parties were working together, the organisation of megaprojects can look like Rijkswaterstaat itself. To implement a change like two-phase delivery, one has to look into organisational behaviour to see how changes like this are received and implemented. Li, Lu, Cui, and Han (2019) address this gap by implementing organisational behaviour into the context of megaprojects. They define organisational behaviour as *a subject that studies how humans behave in an organisational environment, which includes being influenced by individuals, groups, and structures*, with an ultimate goal to use this knowledge to improve efficiency.

Human behaviour, in highly complex settings of megaprojects, is never set in stone: Situational or contextual perspective is highly influential on the situations during projects and its outcome. Context can be defined as *"as situational opportunities and constraints that affect the occurrence and meaning of organisational behaviour as well as functional relationships between variables"* (Johns, 2001, p. 386). Furthermore, Johns proposed two dimensions of context: omnibus (relating to occupation, location, time, and rational aspects) and discrete (referring to task, social, and physical aspects). Li et al. (2019) further argues that context, being subjective for all involved on different levels, has a substantial influence on the performance outcome of relations-related and task-oriented processes. To further research organisational behaviour in megaprojects, they propose to pronounce three

different aspects of the organisational context (p. 3):

- *Macrocontext* (external): political and institutional contexts, culture and cross-cultural, economic, legal, industry context, conventions, and globalization;
- *Mesocontext* (interface between external and internal): financing methods, project governance, project strategy, external interest groups and other related organizations, stakeholders, project type, project delivery method, and project target challenge; and
- *Microcontext* (internal): organisational size and complexity, organisational structure, direct/main stakeholders, organisational culture, values, organisational capabilities, leadership, pressure, commitment, and management strategies and tools.

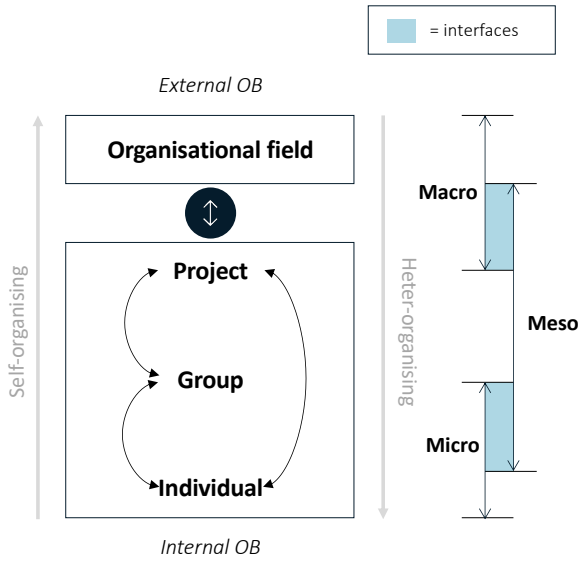

Figure 3.2: Schematic multilevel framework of organisational behaviour in mega-projects. Reprinted from (Li et al., 2019)

During a project, human behaviour manifests differently on certain levels. Within the project, there is individual behaviour, group behaviour and project behaviour. Lastly, there is the interaction between the project as an entity with and within its organisations. To ensure successful change, it has to manifest in all different levels of an organisation. But how do all these different forms of behaviour comply within the complex surroundings of a megaproject? In figure 3.2 a schematic overview of these levels and context planes is depicted. On an individual level, psychology has been used to explain triggers such as motivation, emotion, effectiveness or leadership skills. Individual decision-making is another key aspect of organisational behaviour that influences the success or failure of megaprojects. On a group level, it can be said that groups, or teams, form, build and grow during the temporary stage of the project. Successful delivery is highly dependable on high-performance teams. The need for effective and efficient collaboration rises under the complex environment these groups find themselves. Investing in this collaboration is a must. As a collective, the decision-making of all subsystems can influence the overall project delivery. Behaviour at the group level can distinguish itself inter and intra-groups. Relationship management can need more attention at this level. At the project level, project organisations are constantly adapting to the ever-changing environment and uncertainties of their external environment. These project organisations can include a multitude of companies and agencies and can take a multitude of different forms, depending on the specific phase and needs of the project. Because of this, the corresponding governing structures also need to evolve to adapt to ensure overall project performance and success. Separate from the internal organisation of a project, but not isolated from, lies the organisational field where a project operates. Behaviour at this level will highly influence the project's management and successful project delivery. This is also the level where power and politics come into play. On all these different levels, organisational behaviour plays a great part in the overall project success or the successful implementation of change. The individual, group, and project behaviour or activities can influence each other, just as any activity in the organisational field

can influence the project as a whole. Bottom-up (self-organising) or top-down (heter-organising) behaviour can both be present (Li et al., 2019). How these different levels and planes of context react to these two types of behaviour is relative to each project and its context is depicted in fig. 3.2.

In terms of implementing the two-phase delivery as a procurement method for complex projects, it's important to examine the crucial behaviours that contribute to a successful project outcome under this PDM.

3.4 Conclusion literature study; overview issues and solutions

In light of the evolving perspectives on the relationship between public clients and private constructors, as detailed in the historical overview, different PDMs have gained favour under varying market conditions. As the era of total market reliance wanes, a shift towards a more balanced collaboration has begun. This chapter delves into the driving forces behind this shift, elucidating why two-phase delivery might be regarded as a viable instrument for facilitating this transition.

3.4.1 Issues with the integrated model

Division of risks: dealing with unknowns

Over the recent years, with the use of integrated delivery models, the allocation of risks has been largely put on the contractors side. Under this responsibility, risks are not allocated to the party that has the most insight into or is best managed by said party. This can lead to poor risk control, with numerous consequences for the overall project outcome. Furthermore, due to the procurement set-up with the work procured for a pre-determined bid and scope, any problems that arise as a result of unforeseen risks will trigger a response where both parties will retreat to their contractual positions, creating confrontational interactions (Clemens, 2021).

One of the reasons that contracting parties are unable to manage risk properly, is the information problem. Contractors have a lack of knowledge at the early start of the contract when they are expected to price all risks into their bid. However, they enter a legal agreement from the moment they submit their bid. All unknown risks to arise during the project, are legally their responsibility. van den Berg, Jansen, and de Boer (1996) view that leaving contractors to deal with the risk management of large complex projects poses a certain danger. They argue that "since it is the client who 'undertakes' the work, it is only appropriate to assign the client the risks that go beyond the entrepreneurial risks or those that are not attributed to the contractor [at the time of the bid]" (p. 83, M. A. B. Chao-Duivis, 2019).

The client may be argued to be in a better position to assess risks since they have access to all information surrounding the project, either physical on-site or intangible knowledge within the organisation. Transparency and collaboration are drivers to identify unknown unknowns and the measures to properly mitigate them. This transforms unknown unknowns into known unknowns or risks. True unknown unknowns pose real uncertainties. The contract specifies who is responsible for these uncertain risks. Under the integrated model, there is often an allocation of an excessive risk to the contractor, including risks that clients could or should bear being in a better position to mitigate, or the allocation of external risks to the contractor. This could lead to defensive behaviour by lowering the quality of work or excessive claiming of change orders. Concerning collaboration during the project, it is important to focus on reasonable risk allocation, which leads to the fairness of the perception of contractors and collaborative behaviour from both parties (Clemens, 2021).

Pricing the bid

The procurement process for integrated delivery models dictates contenders price their bid before the start of the contractual agreement. There are two main reasons this poses to be difficult for contractors: unknown unknowns and unfair risk allocation (the financial consequences thereof hard to properly translate into the bid) as stated before, and the extent to which the design of the work is finished in the provided tender documents. The different options for paying the priced bid all pose their issues. Two extremities in form of payment are

'lump-sum' or 'reimbursable'. To enter a contract based on a lump-sum reimbursement, combined with the lengthy and complex traits of construction projects, could result in an uncontrolled design and execution phase, which leads to excessive cost overruns by the contractor. To use a reimbursable form of payment, however, will temper with the budgetary certainty of the commissioning authority (van den Berg et al., 1996).

In 1994, de Ridder studied three projects using D&C as a PDM and found several shortcomings to the procurement method as control mechanism. He stated that "the goal of D&C is the search for an effective solution to a problem, which can be - and will be - implemented efficiently. The goal at the start of D&C, however, can hardly be defined as the perceived problem is different from the actual problem and the solution to the problem is, at best, known in a rough conceptual form" (de Ridder (1994), p. vii). If the client starts a project with a badly defined scope, an underestimation of efforts and a rigid type of contract as D&C, the contractor is found to have a control problem. Instead of constructing and executing a concept, he first has to find an effective solution for the problem the client really seems to have. Since the contractor often already has started with the execution of several components of the project, the window of possible solutions becomes smaller, enhancing project costs. De Ridder states: "Although these additional costs originate from the previous project phases combined with the wrong perception of what D&C is and not from the disappointing performance of D&C itself, these costs will not be compensated automatically. Since the cost overruns will normally be claimed, the Client is confronted with the risk of a - possibly large - price overrun and a solution offering more possibilities than was originally called for" (de Ridder (1994), p. viii).

The price mechanism in D&C contracts fails to address the fact that a lot of price-driving components are determined in a phase where the contractor is not involved. The contractor is expected to realise a project based on a set of functional requirements. However, by defining a number of (design) requirements, their solution space is severely limited. This could sevearly hinder the contractors ability to set a fair price for the project bid. The lack of insight into the impact of the set design requirements on the client's side could lead to a contract estimate that is too low. M. A. B. Chao-Duivis (2019) puts the conclusion forward like this: "It does not seem impossible to me that, in a system of deferred pricing for the execution of a project, clients will be well aware that the price is partly influenced by the design activities. Would it then not be logical for them to become more involved? From this point of view, a dynamic price calculation can bring about more than just a change in the price system" (M. A. B. Chao-Duivis (2019), p. 86".

Scope and collaboration

In terms of scope delineation, scope creep, and post-bid activity pricing (which is typically high, resulting in budget overruns due to Rijkswaterstaat's tendency to pay), this new approach may seem to require the winning bidder to always prioritise the client's interests. However, this is not necessarily the case. Evidence from research clearly shows that the contractor can make significant contributions to the project. Under this system, both parties are encouraged to collaborate to identify solutions that ensure a reasonable scope and price.

3.4.2 Two-phase delivery and organisational behaviour

As discussed in section 3.1.5, the first sub-question - *What are the current challenges a commissioning authority encounters with the procurement of projects?* - was answered with three key challenges: *early price determination paired with unknown risks, high tender costs, and varying interpretations of collaboration*. These elements could potentially lead to diverse organisational behaviours under different project delivery models. When regarding figure 3.2, illustrating the framework of organisational behaviour on different levels in mega-projects, the three key factors can be placed in this framework. These elements and the organisational behaviour they might instil could contribute to varying degrees to the desired effect of the intervention of two-phase delivery.

The two-phase delivery model itself could be placed under the mesocontext of a project: The procurement strategy plays an important role in the project strategy and influences behaviour between the project's internal and external context. The macrocontext where a two-phase (pilot) project exists, is influenced by the

political and institutional context. There is a lot of political interest in the two-phase delivery method and one could argue that this can lead to different behaviour: Does the fact that the ministry closely follows events, lead to other behaviour within a project, group or on an individual level? Within the internal context of a project, the microcontext, aspects like organisational complexity, organisational pressure, commitment and management tools influence behaviour within the project. Two-phase delivery is essentially a top-down intervention. This fact could have an influence on behaviour on a group or individual level. The organisational pressure or commitment present in the project context could have an impact on the behaviour and outcome of a project.

Organisational behaviour within a project also influences how projects will deal with the three issues identified. The question remains if two-phase delivery can influence certain aspects of behaviour leading to these identified issues, or if there are other factors which have nothing to do with two-phase delivery, that contribute to the outcome of these aspects in two-phase delivery projects.

Opting for a two-phase delivery method in a project introduces some unique collaboration dynamics, distinct from those under an integrated project delivery method. As elaborated in section 3.2.5, the shared design and risk management process's mutual aim is to 'effectively and fairly allocate risks, enhance the feasibility within the specified time frame, and agree on a reasonable project price.' The interplay between organisational behaviour in two-phase delivery projects and these defined elements could facilitate the desired outcomes. Through the case studies outlined in chapter 4, this research aims to explore whether two-phase delivery truly aids in identifying and mitigating risks, lowering tender costs, and whether improved collaboration ultimately results in superior project outcomes.

Case study design

4

In section 3.1.5 of the literature study, the answer to the first sub-question *What are the current challenges a commissioning authority encounters with the procurement of projects?* was found to be 'early price determination in combination with unknown risks, high tender costs and difference of interpretation of collaboration'. In combination with how organisational behaviour manifests itself on different levels of a project, the question arises in what way certain interactions between these factors and organisational behaviour contribute to the desired effect of the intervention 'implementation of two-phase delivery'. It is on this plane of interaction and on these three themes, the current challenges in the infrasector, organisational behaviour and two-phase delivery in projects, that the case study is focused on.

This chapter explains the selection of case study projects, as well as the data-gathering method within the case studies. Subsequently, the analysis of gathered data will be elaborated on. Lastly, a description of the studied projects will be given.

4.1 Case selection

The case selection was driven by the need to understand the added value of the two-phase delivery method and to explore the interaction between organisational behaviour and current procurement challenges. Several projects that employed two-phase delivery as part of their delivery method were identified. However, many were in their early stages and had not yet been put out to tender, or had been put on hold due to issues related to nitrogen and building permits, known as the '*stikstofprobleem*'. To provide insight into the added value of two-phase delivery and the aforementioned interaction between organisational behaviour and the current challenges in procurement, enough time had to have passed to properly evaluate the delivery method. Therefore, only those projects that were in the execution phase were selected. This approach facilitated the comparison of how the two-phase delivery model is implemented, how team members perceive this model, and its implications compared to other procurement methods. Consequently, two projects were chosen for the case study, based on the following criteria:

- The project implemented a two-phase delivery method as delivery method for either a significant part of the full scope of the project;
- The project is in the execution, or second phase of the two-phase process;
- The relation between the client and contractor is a client-contractor relationship and has entered a collaboration according to the setup of two-phase delivery as described in chapter 3;

4.2 Data gathering

In qualitative research, data gathering typically involves the use of multiple methods to gain a comprehensive understanding of the phenomenon being studied. Two common methods that will be used in this study are document study and interview sessions. Document study involves examining written or recorded materials

related to the research topic, which in this case will consist of project plans, procurement strategies and other informative project documents. This method can provide rich contextual information and can be used to triangulate or validate data gathered through other methods. Interview sessions, on the other hand, involve one-on-one conversations between the researcher and interviewed project members. This method can provide detailed insights into participants' experiences, beliefs, attitudes, and behaviours related to the research topic. The combination of these two methods can provide a more complete understanding of the research topic by allowing the researcher to gather both contextual and personal perspectives. Furthermore, the data gathered through these methods can be analysed and compared to identify patterns, themes, and variations in participants' experiences and attitudes, which for this study will be done with Atlas.TI. Therefore, the use of document study and interview sessions in qualitative research can contribute to the collection of rich and comprehensive data that can provide valuable insights into the phenomenon being studied (Verschuren & Doorewaard, 2010).

In an attempt to provide an answer to the third and fourth sub-questions of this study, the focus of the data gathering will lie on the interaction between two-phase delivery in projects and organisational behaviour throughout the project. The document study will provide context for the projects, where the interviews will lay the foundation for more depth and the possibilities to investigate and deepen possible themes and questions.

4.2.1 Document study

As aforementioned, a document study is performed to gather background and context about the research topic. In this study, the document study was carried out by studying project documents such as the project plan, procurement strategy, tender guidelines and other relevant project documents. These documents could be found on the internal document system of Rijkswaterstaat, were shared by project members, or could be found on public sites such as TenderNed. By conducting this document study, contextual information about the projects could be extracted from the documents. This information could also provide a basis for the interviews. Based on the literature study, the themes to focus on during the review of the documents are:

- Procurement strategy
- Forms of collaboration
  - Project organisation and management team
  - Task and role division
- Contractual reinforcements
  - Risk division
  - Price determination
  - Incentives
- Culture, attitude and behaviour

4.2.2 Interview sessions

Several interview sessions were planned with project members of the selected projects. These members were selected on the basis of their function in the projects. Members of the project's management team were found to have an overarching view of the project context as well as the operational side of the project. To gather experiences from both sides of the collaboration, members from the client, as well as the contractor, were interviewed. The client can provide insights into their needs, expectations, and goals for the project. For example, they could describe the criteria they used to select the contractor, their priorities for the project, and any challenges they encountered during the project. They can also provide feedback on the contractor's performance, and how the issues experienced under integrated project deliveries are viewed now. The contractor can provide insights into their approach to the project, including how they managed resources, communicated with the client, and addressed challenges that arose during the project. They can also describe their experience working with the client, including any issues that arose and how they were resolved. An overview of the interviewees is provided in the table below.

Interviewee	ID	Years of experience in role	Project involvement
Case A: Riverbank lowering			
Client Contractmanager 1	A1.Cl	20	2017 - jan 2022
Client Contractmanager 2	A2.Cl	> 20	jan 2022 - jan 2023
Client Contractmanager 3	A3.Cl	10	jan 2023 - current
Client Contractadvisor	A4.Cl	15	2018 - current
Client Projectmanager	A5.Cl	> 20	2017 - current
Case B: Public transport terminal			
Client Contractmanager B1	B1.Cl	10	2018 - current*
Client Contractmanager B2	B2.Cl	> 20	2019 - current
Contractor Contractmanager	B3.Con	15	2021 - current

* Client contractmanager B1 was involved in the preceding project collaboration, prior to the disbandment of the initial contract.

Table 4.1: Interviewee information

The interview setup has been structured according to in-depth interviews. Interviews with an in-depth technique are described as '[a] conversation with a purpose' (Webb & Webb, 1932). It is a qualitative research method that involves conducting a one-on-one conversation with a participant to gather detailed information about their experiences, beliefs, attitudes, and behaviours. This method is often used to explore complex or sensitive topics that cannot be adequately captured by surveys or other quantitative methods. Techniques used in this research method include building report, asking open-ended questions, active listening, probing for more information, avoiding leading questions and maintaining neutrality. The use of in-depth interviews can be a powerful tool for gaining insights into the experiences and perspectives of participants. In-depth interviews can be either unstructured or semi-structured, the latter form will be used in this study. The topic of the interview is fixed. The question formulation, question sequence and interviewer behaviour can be free or fixed. In this case, a number of themes will be prepared. These themes will rely on a frame, but have no fixed sequence to them. In order to guide the interviewee through the list of themes, several topic bridges will be prepared, but a natural flow of the interview is preferred. The topic bridges will be used only when certain pressing themes have not come up yet naturally. The themes will be prepared and pre-formulated according to the closed coded themes, but there will be space to deviate from these(Moerman, 2015). As stated at the beginning of this chapter, the themes derived from the literature study are the current challenges in the infrasector, organisational behaviour and two-phase delivery in projects. Any new themes that arise during the interviews will be added to the codebook. The interview questions can be found in appendix A.

4.3 Data analysis

The data collected by methods as described in the previous section, will be analysed by the methodology of grounded theory (GT). GT involves identifying key concepts and themes in the data, by the use of coding and categorisation. An analysis is performed with the use of Atlas.TI, by creating codes to label and categorise different parts of the data. These codes can be organised into a hierarchical structure to reflect the relationships between them. This allows for the identification of patterns and relationships in the data and the development of new concepts and theories based on these patterns (Niedbalski & Ślęzak, 2017).

Data analysis in this study involved a comprehensive approach that employed various methods to gather and interpret information. The initial data collection process encompassed both document study and interviews, which served as the foundation for the subsequent analysis. To facilitate comparison and identification of patterns, the transcriptions were coded using codes derived from the theoretical framework, as detailed in chapter 2. The coding process encompassed closed coding, where predetermined codes were applied, and open coding, which involved the extraction of emergent codes from the interview data. The outcome of this coding process, referred to as the *codebook*, has been included in appendix B. Particularly intriguing were the repetitive codes, which signify recurring themes or phenomena within the data. Investigating the influence

of these codes on the project's outcome is an essential aspect to explore. Furthermore, the different levels of codes and themes identified throughout the analysis are interconnected with distinct levels of organisational behaviour, highlighting their relevance and impact in understanding the effect of the introduction of the two-phase delivery methods at Rijkswaterstaat.

4.4 Case description

In this section, the two studied cases will be presented. For each case, the project scope and organisation, project phasing and technical complexities are described.

4.4.1 Case A: Riverbank lowering

The project in Case A aims to lower groynes and riverbanks to reduce water levels by 5 cm during high water, providing better flood protection for residents in the river area. The project has developed a preferred alternative and is entering the planning phase. The project team has set ambitious goals, including retaining knowledge from planning in the implementation phase, managing the risks associated with incomplete or inaccurate data, and minimising the impact on the environment and human activities. To achieve these goals, the procurement strategy emphasises early market involvement, integrating planning and implementation into a single contract, and incorporating a risk budget to cover costs related to soil and land data risks.

The internal project organisation consists of a management team of Rijkswaterstaat members, with a project manager, contract manager, manager project control, technical manager and stakeholder manager. To assist the contract manager, a contract advisor is also connected to the project. For the contractor, the management team consist of the same roles. There are regular meetings with the project managers and contract managers to discuss the status of the project. The project is currently in the execution phase. The overview of the project and its phases is depicted in fig. 4.1 below.

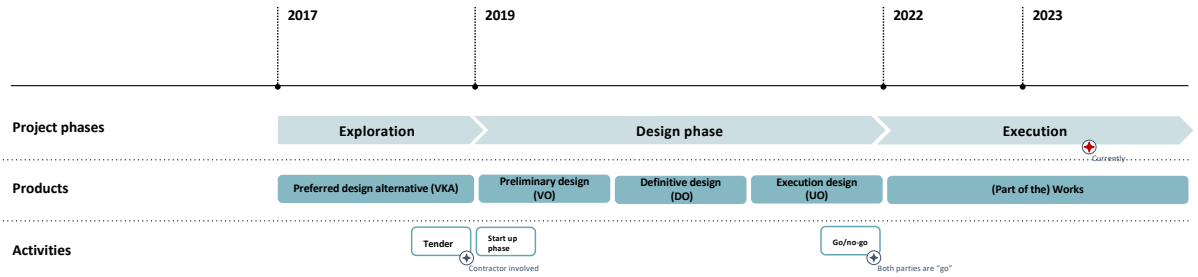

Figure 4.1: Case A. Timeline and project phases

4.4.2 Case B: Public transport terminal

Case B is a project under a multi-stakeholder program aiming to bolster the growth of a large city in the Randstad and the metropolitan region's north wing through enhanced road and public transport accessibility. The program's primary objectives include improving metropolitan accessibility, fostering the large city's international status, establishing a high-quality public transport hub, and integrating sustainable infrastructure. The implementation of the program has gained urgency due to escalating passenger numbers and safety concerns. The scope of Case B is split into two sub-projects.

- Sub project B1: Realisation of the (new) Passage A and flipping metro platforms and ascent points in Passage B.
- Sub project B2: Widen and renew the (existing) Passage B and widen existing train platforms.

The project's critical considerations revolve around ensuring development at each stage, prioritising safety, and maintaining the project site's accessibility and livability during execution.

A joint organisation, featuring members from the federal government, the municipality and traffic management board of the large city, the province manages the program. This team operates as a singular client, necessitated by limited physical space, intertwined activities, and the continuous growth imperative during construction. The project is also set to closely collaborate with various external developments that could influence the project's scope and execution possibilities. Procurement targets the commencement of B1 in 2022, leading to the inauguration of Passage A in 2025. A consortium of engineering companies is responsible for preparing the project's integral preliminary design and part of the detailed design, ensuring a level playing field in choosing the contract form and tender design.

Currently, sub-project B1 is in the execution phase, with sub-project B2 in the design phase, before the go/no-go moment in September 2023. An overview of the project and its phases is detailed in fig. 4.2 below.

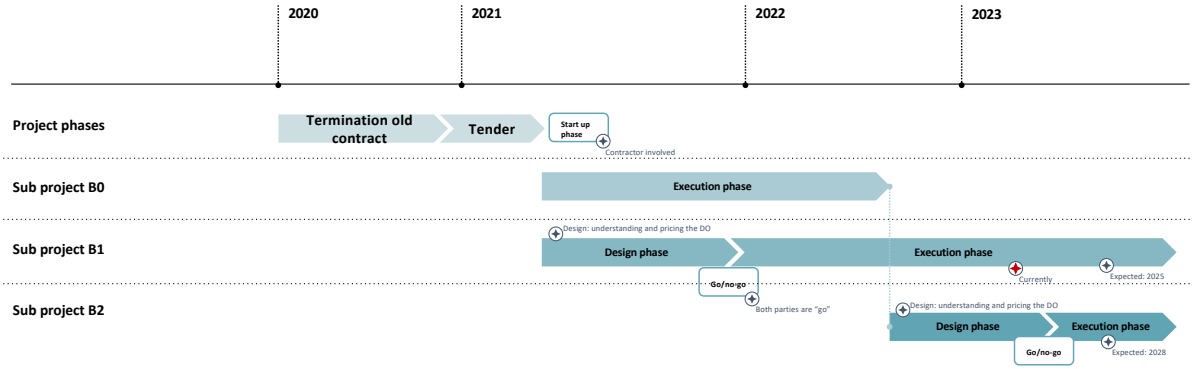

Figure 4.2: Case B. Timeline and project phases

Case study results

5

This chapter presents the results of the case study where the findings of the document study and interviews are reviewed. The findings per case will be presented per the outline of themes as discussed in section 4.2.1. In section 5.3 a cross-case analysis has been performed to analyse these findings. The overarching mechanisms as found in this case study will be elaborated on in section 5.4 and section 5.5. With this, this chapter hopes to provide an answer to the third and fourth sub questions as depicted below.

Sub-question 3

To what extent are the procurement challenges overcome by the introduction of two-phase delivery in projects?

Sub-question 4

What are proposed changes to the use of two-phase delivery in projects?

5.1 Case A: Riverbank lowering

In case A the tender documents as found on TenderNed, the project management plan and procurement plan were studied. Afterwards six project members were interviewed, as introduced in section 4.2.2.

5.1.1 Organisation of Case A

This subsection describes how different project elements are organised in case A. These elements, as found in the literature study, include the procurement strategy, the form of collaboration initially planned during contract preparation, compared to the actual collaborative practices currently embedded in the project, contractual elements such as risk allocation, pricing unknown unknowns, and incentives that mayhaps have been included in the contract.

Project objectives

The project objectives for case A are described in the tender documents. There are four objectives to be achieved:

1. The main objective of the project aims to realise a 5 cm reduction in water levels on the Upper Rhine during high water conditions.
2. Preserving knowledge from the detailed design phase during the construction phase and utilising implementation knowledge during the detailed design phase.
3. Making the risk of missing or inaccurate area and soil data more manageable.
4. Designing and constructing with the lowest possible impact on human beings and nature.

Procurement strategy

In the procurement plan, several of the project team motives for two-phase delivery method were outlined. The contract strategy for the project involved dividing tasks and responsibilities into three packages: client tasks, contractor tasks, and joint tasks. The aim was to leverage the expertise of both parties and ensure effective risk management. The procurement strategy promoted a competitive dialogue approach that allowed for discussions on contract elements, considering the project's unique aspects and involving the market in the decision-making process. Collaboration with the market was crucial due to a high level of uncertainty surrounding the state of the project location, and the selection criteria for awarding the contract primarily focused on how well the contractor integrated planning and implementation and utilised the risk budget. *By involving the contractor early in the soil investigations, they can assume ownership of the process and make more accurate risk assessments. This early involvement equips the contractor with the necessary understanding to take responsibility for these specific aspects*, according to A1.Cl. Overall, the project sought to optimise the organisation and execution of similar projects, aligning the interests of the client and contractor and emphasising substantive criteria for the contract award.

When considering the right procurement strategy, the project team aimed to pursue project ambitions through early market engagement. In September 2017, the high-level procurement strategy was determined, which involved integrating the planning and realisation phases as much as possible. This approach was preferred by the project team after comparison to a traditional model and a model that intertwined planning with the tendering of execution. The procurement strategy was to yield immediate benefits, such as incentivising contractors to conduct thorough research in the planning phase and reducing knowledge loss and inefficiency during the transition between planning and execution.

The two-phase delivery method was the very early stages at Rijkswaterstaat, at the moment case A formed their procurement strategy. A1.Cl emphasised how it was the project teams' idea to implement a collaborative design phase and described how they held three market consultations to coordinate with the construction market on how they would align the delivery method: *"We were truly pioneering, working collaboratively with the market to find a solution for this specific problem, both for the project and its setup."*. A4.Cl outlined how there was a split in the procurement of the project: *"The two-phase approach is exclusively employed for the uncertain aspects of the project. Meanwhile, the more straightforward parts of the project were awarded a fixed price contract."*

Forms of collaboration

After awarding the bid to the contractor, it became evident on several occasions that the contractor was relatively new in their role as the head of the contracting combination. A1.Cl: *"The contractor had never before led a project as the main contractor. They came from the water management sector, a completely different world, so they had no experience with a two-phase contract. Therefore, those within the contractor's company had never, for instance, dealt with detailed planning or a major tendering process. This contractor, undertaking their first project as a main contractor for the governmental water management entity, with a new type of contract, also holds the responsibility of managing all subcontractors. All these parties need to adjust to each other, and each of them has a different corporate culture."* Over the course of case A, the forms of collaboration and organisation needed to mutually adjust. A large part of the clients' team originated from the 'Room for the River' program and had to adjust how different the context and organisation of this project was. The contractor had also worked for this program, as a subcontractor. So both parties required to to adapt their working methods. A5.Cl added *For instance, during an initial assessment within the context of the MIRT-3 framework, it can become quite tense as to whether the evaluation will pass. In such situations, experience with such assessments is important, and it becomes apparent whether we can eventually solve the emerging problems. We have noticed that the contractor has relatively little experience with Rijkswaterstaat and with these types of evaluations. They lack experience working with project phases, for instance, and had therefore hired an engineering firm for this task, heavily relying on their expertise. This approach was fine, but you could notice that it led to a period of mutual exploration and adjustment.*

Contractual reinforcements

During the tender, the contractor had to calculate a price for different aspects of the project. The tender guide states that prices had to be established during the contract phase for work falling under the Collaboration Budget and Risk Budget and the final price for implementation. These prices are therefore established outside of competition. For this pricing, a number of principles applied, based in part on experience gained from the project Nijkerkerbrug and the ideology '*Doen*' (Project DOEN, n.d.). The submitted reference estimate (based on the most important cost drivers, such as applying breakwater stone, applying geotextile) for implementation work served as the basis for the implementation price. The principles for pricing included a real price for the work, full transparency regarding pricing, an ON procurement process that ensured competition, and the use of established surcharges for general costs, implementation costs, profit, and risk. Reference prices would be used as a basis for pricing during the contract phase. The reference prices should be based on reference quantities for characteristic components, and the bidder would bid on a reference design that could be used later for the settlement of quantities.

The tender guide specified the Go/No go moment between the plan development and implementation phases. It mentioned how this moment would only occur when the necessary permits have been obtained, the project has been approved for execution (*tracébesluit*), and a reasonable implementation price has been established. If these conditions are not met, the project would not proceed, and the project team would work with the contractor to develop an E&C contract that can be put out to bid.

The risk management strategy, as outlined in the tender documents, emphasised intricate discussions about risk identification, categorisation, and allocation during the bidding phase. The strategy aimed to delegate each potential risk to the party most capable of managing it, thus promoting the project's overall efficiency and success. The project team had prioritised risk management by recognising and addressing potential threats, incorporating these considerations into the selection and bidding process to foster a collaborative and competitive bidding environment. To accommodate the identified risks, the contract was structured to include a risk budget and a ceiling budget. The risk budget allocates funds for unexpected complications, while the ceiling budget establishes the maximum overall expenditure, including risk management. By implementing these measures, the project team tried to ensure efficient financial management, allowing room for unforeseen occurrences while controlling total project costs, ultimately forming a comprehensive approach to effective risk control, management, and mitigation.

5.1.2 Experiences with the two-phase model

In this subsection, the experiences of the interviewees with the two-phase model are outlined. Attention is directed towards the results of phase one, but also on the dynamics within the current project team and the possible occurrence of organisational behaviour in the project. The results of the collaboration in phase one and their influence on the second execution phase of the project are discussed.

Results of phase one

There were challenges encountered in adopting a two-phase delivery method and collaboration with the internal cost pool at Rijkswaterstaat. During the project's initial phase, the cost pool needed to approve the final execution price, an obligation that was found problematic due to unfamiliarity with two-phase contracts. In the course of the price formation process, it was noted that the cost pool kept to its guidelines built for a more traditional form of contracting, neglecting earlier discussions and assessing the project on individual prices. The price forming process was very complex, making it difficult to establish a good estimate in a one-on-one setting. The project and the contractor felt intimidated by the stance of the cost pool, which was seen as uncooperative and rigid. This situation resulted in a deadlock, with the cost pool unable to offer a suitable evaluation. Being unable to pursue the project, the upper management of Rijkswaterstaat had to decide what to do with this negative evaluation. The issue escalated up to the CPO, who signed off on the project. However, this had resulted in a six-month standstill of the project. The contractor, unable to comprehend how

the same organisation had worked so counter-productively from within, lost faith in the further progress of the project.

Culture, attitude and behaviour

Since the two-phase delivery model was new at Rijkswaterstaat, the client was inexperienced as a main contractor, the clients' team consisted of members mostly from a D&C oriented context at the Room of the River program, it was clear that the project needed to adhere a strong focus on collaboration to overcome cultural differences. A1.Cl *"Adapting to a new method, new people, and a new environment requires a period of adjustment. It is essential to support one another and progress collectively; otherwise, succeeding together becomes a difficult task"*.

Over the course of the project, the political climate shifted, which also altered the direction given by upper management. Initially, strict control was maintained over time and budget. Later on, due to factors such as the nitrogen problem, the focus shifted more towards quality, under the assumption that 'we knew how the project was structured' and therefore could relax control. This assumption turned out to be incorrect, and the contractor found this shift challenging to deal with. Active coaching on culture and mutual understanding of each other's interests helps to ground the project during shifts in direction.

5.2 Case B: Public transport terminal

In case B the program and project management plan, the procurement plan and the tender documents as found on TenderNed were studied. Subsequently, three project members were interviewed as introduced in section 4.4.2.

5.2.1 Organisation of Case B

This subsection provides a comprehensive overview of case B, outlining the organisation of various project elements including procurement strategy, anticipated and current collaboration forms, contractual aspects such as risk allocation, pricing for unforeseen variables, and potential contract incentives.

Project objectives

The project objectives for case B are outlined in the tender documents. There is one overarching goal, derived from the program objectives. Subsequently, there are five objectives specified to case B.

1. The realisation of the program creates a high-quality public transportation hub of international allure that provides an optimally functioning high-quality traffic and transportation system.
   (a) Sub project B1: Realisation of the (new) Passage A and flipping metro platforms and ascent points in Passage B.
   (b) Sub project B2: Widen and renew the (existing) Passage B and widen existing train platforms.
2. Satisfied Users: Aiming to minimise disruption, the goal is to deliver predictable interference within the defined parameters and improve the current situation as swiftly as possible.
3. Satisfied Environment: The anticipated disruptions should be trustworthy, transparent, and realistic, communicated to the surrounding environment in a timely manner regarding their timing and nature.
4. Satisfied Managers: A well-managed transfer process is key, along with controlled interface management and maintenance, to ensure smooth operations.
5. Satisfied Client: The project prioritises proactive safety culture, collaboration within the supply chain, maintaining project scope (quality, budget, and timelines), transparency towards the market, and personnel stability. All these factors ensure the project meets safety ambitions, allows efficient and pleasant communication, utilises market knowledge, and maintains a steady workforce for successful project outcomes.

6. Satisfied Market: Early discussions about risks, information needs, and dilemmas are essential, along with collaborative efforts based on equality and complementary. The financial establishment and settlement of the project should be efficient, profitable, and fundable for all parties, with a balanced risk distribution in the contract, assigning risks to the party best suited to manage and influence them.

Procurement strategy

The chosen contract form for the project utilises the Integrated Contracts based on the UAV-GC 2005, with the definitive design and corresponding construction phasing, including necessary train and metro track outages, pre-established by the project before the start of the tender. Given the highly detailed level of design and construction phasing, a traditional or integrated contract would be fitting. The difference lies in who is responsible for the final execution design - the client in the case of UAV 2012, or the contractor for UAV-GC 2005. Following market consultation, the decision was made to utilise an implementation contract based on the UAV-GC 2005, as most market parties indicated their preference to develop the execution design themselves.

Usually, bidders must understand a client's final design during the tender and offer a fixed price for its development into an implementation design and realisation at the time of bidding. However, in this case, account must be taken of the prior knowledge of the former consortium parties. In order to be able to request a fixed price, other parties should have the same knowledge as the former consortium parties. To create that level playing field, a lot of time would have to be allocated in the tender. Based on considerations regarding project timelines, knowledge disparity amongst potential bidders, and the desire for rapid continuation of the project, a method was chosen to quickly determine a winning party without requiring bidders to fully immerse themselves in the definitive design and construction phasing for their bid. After awarding, the contractor will start their work regarding the understanding and pricing of the various sub projects (referred to as B1 and B2), which are divided into five partial orders. The agreement for these tasks will be built in stages with a fixed-price E&C contract based on the UAV-GC applied for each stage. The pricing for further development of the definitive design and execution is made outside of competition, which may be a potential disadvantage, but the project organisation considered this risk sufficiently manageable due to a transparent approach with fixed prices. In this project, the design phase of the two-phase delivery focuses more on the understanding and pricing of the the provided design, then on designing the project in collaboration with the client.

Forms of collaboration

The project organisation of case B is different than most projects at Rijkswaterstaat. It is modelled to projects at the rail infrastructure management agency, ProRail, whose members make up a high number of the project team. Due to the close proximity of the rail infrastructure in both location and scope, this team consists of both members of Rijkswaterstaat and ProRail. Due to this organisational mode, the team has a strong focus on the technical aspect, where the adage 'technology before contract' applies. When the team was in the contract preparation phase, the coronavirus outbreak occurred. Due to remote work, the interfaces between all disciplines in the contract were translated as *"sufficient, but not at its best"* (B1.Cl). The start with the new contractor was perceived positively. The collaboration in phase one had a focus on the understanding of the design and contract, to be able to allocate risks and to come up with a definitive price. *The focus phase one of sub-project B1 was: can it be made and is it feasible in time, can it be done with the number of out-of-service periods, and can you do it with the number of closures of the highway? Can you then carry out the tasks that we have thought up? Or do you want a different phasing or do you say "it is not possible at all". Some changes did occur during this phase, but they were limited. The first phase of sub-project B2 is improving in this regard.* (B1.Cl). In case B, the design phase could be considered more on an exploration phase [*Ned: doorgrondingsfase*].

Contractual reinforcements

During the tender, the contractor had to provide a hypothetical price the costs associated with the tasks under phase one of sub-project B1 and B2. The payment for these tasks would be based on actual hours worked by

the contractor, using the bidder's provided hourly rates, up to a maximum price. A fixed price was requested for project out-of-service execution during summer 2022, with the same unit prices applied to comparable tasks in B1 and B2. The project's detailed design work for summer 2022 would be charged based on a cost-plus basis. Bidders would also have to provide a hypothetical price for B1 and B2 based on a tender schedule prepared by the client, derived from the contractor's estimate, which consists of fixed quantities and fixed items where bidders must fill in fixed unit prices and fixed percentages. The principle was that a thorough understanding of the scope of B1 and B2 was not required for the proposal of unit prices and percentages. With these fixed prices and percentages, the implementation design and risks would be definitively priced in the first phase.

This tender schedule and provided works would later become a sore point. Due to scope creep, the out-of-service execution in 2023 would exceed the original estimated time by 140%. This would lead to a lot of discussions on design responsibility, responsibility for the acceptance of the work during the first phase and the division of reimbursement of costs during the settlement of claims.

The objective of the tender was to create an arrangement that encouraged collaboration and shared responsibility between the parties involved. With the two-phase delivery method, the project team of case B tried to foster a collaborative atmosphere where the parties work together to mitigate and manage project risks, rather than simply assigning them to different parties. The aim is to create a payment mechanism that encourages mutual interest, for instance, through a 'pain/gain' model. This model means that all parties would share the benefits (gain) if the project performs better than expected, and the burdens (pain) if the project performance falls short. The other objective of this contract was to motivate the involved parties to establish a strong partnership. This implied working closely together, maintaining open and frequent communication, aligning goals, sharing knowledge and expertise, and cooperatively managing the project to ensure its successful completion. This approach was to trust, promote synergy, and enable both client and contractor to jointly navigate project challenges, to overall enhance project performance and results. With regard to the feasibility and the price of the project, B2.Cl stated how you can not work in a project focused on collaboration without trust: *The purpose of the first phase was exploration. Our thought was, we have a design and a solid estimate, and all the contractor needs to do is to review whether our plan is feasible, if it can be implemented, what cannot be done and where changes are needed. The focus was not so much on the design, but on the feasibility and viability, and the mutual understanding of the price structure. We may not have always nailed that, so it's about identifying the upsides and downsides, and discussing those together. We wanted to understand why you might be correct at that moment - in my opinion, that's transparency. If you're honest and you trust the market, realistically there is only one market party that can determine the price, and that is the party that has to execute the project. So we've said, "you can't carry out a project like case B without trust."*

5.2.2 Experiences with the two-phase model

This subsection details the interviewees' experiences with the two-phase model, concentrating on the initial stage outcomes, the current project team dynamics, and potential organisational behaviour, as well as discussing the effects of initial collaboration on the project's second execution stage.

Results of phase one

The tender and awarding of the bid for sub-project B1 was relatively quickly done. The first phase lasted from September 2021 until April 2022, with a focus on understanding the projects design, allocating possible risks and the establishment of a price. Risks that were identified were allocated to the party best equipped to manage the risk, and unresolved discussions about risks were labeled as working hypotheses. An example was the quantity of reinforcement steel in the concrete. A risk distribution was agreed upon up to a certain quantity, and beyond that, settlement was based on a per kilogram basis. B3.Con explained: *So, in essence, what we're doing is setting aside, or 'parking', that risk, which initially lies with us. The problem was that this approach shifted the debate. For instance, if the client had calculated that something was 150 kilotons of steel, and my engineer came to 250 kiloton using the same standard, we then had to investigate the discrepancy. The cost for the steel was included in the working hypothesis, but the cost of my designer was simply drawn from the fixed price for the design. This remains a difficult aspect because perhaps I saved 1000 Euros on reinforcement, but I lost 2500 Euros in engineer costs.*

Both parties highlighted that they believed that the tender procedure and the first phase of the project brought the contractor to a healthy starting position and capable to oversee the project. However, both B1.Cl and B3.Con expressed their doubts on how the execution of the project would progress after the go/no go towards phase two. B1.Cl *Even before we began, I was convinced that the starting position for the contractor at the end of the tendering process and at the end of the first phase would be healthier, with more knowledge, more clarity about the risks and the project scope, as well as the client's expectations. I firmly believe that the initial conditions are much better. However, I don't know if it's ultimately sustainable, in the sense that you do need competition to maintain that pressure. The paradox you mentioned—if it's meant to take two months, then we'll ensure it gets done in that time frame—could become more fluid if you think, "Well, I have no competition." This might be a negative perspective, but I think it could happen. So I'm unsure whether it remains affordable to operate this way.*

Culture, attitude and behaviour

Over the course of the project, from the moment of terminating the old contract, through the tendering process, and phase one of the new contract, there was a strong focus on collaboration. The program that case B was part of set a goal around "collaboration" in its sub-projects. The procurement plan in case B describes how it aims for a satisfied market; engaging in early discussions about risks, information needs, and dilemmas. Collaborating in the chain based on equality and complementarity, with each party having its own role and responsibility, and where the task is paramount. The financial realisation and settlement of the task is efficient, profitable, and financial manageable for all involved. A balanced risk distribution in the contract. Risks are assigned to the party that can control and influence them the best.

B2.Cl explains how there is a focus at the management level to explore with the directors of the contractor's consortium what collaboration means for everyone and how they want to fill it in. B1.Cl and B3.Con report that they find their collaboration pleasant, but a lot of their time is still spent in *"tug-of-war over liability and tossing responsibilities over the fence regarding claims"*. At the same time, the fact that the first phase of sub-project B2 runs parallel provides an ideal opportunity to incorporate lessons learned from B1 and to properly manage the conditions and provisions from B1 that need to be adjusted now for B2.

5.3 Case comparison

In this section, an overview of different elements present and characteristics of the cases is presented. The goal of this section is to discover which overarching concepts emerge from the cases.

5.3.1 Case A: Summary

Case A was characterised by its turbulence, as numerous external influences continually disrupted the collaboration and subsequently impacted the progression into the second phase. This disruption was enhanced by significant mistrust from the contractor, stemming from negative experiences with the cost pool assessment. Complicating matters further was the clients' unpreparedness regarding the framework for approving of project pricing.

The project was also marked by a high degree of internal change within the clients' team, which could have significantly influenced the course of the project. Moreover, the go/no-go decision presented a significant challenge. The parties involved found themselves unable to sever ties when necessary, which further added to the difficulties faced.

The project environment also proved pivotal during the second phase. The complex management lines that ran through the organisation were difficult for the contractor to comprehend, which led to a state of unrest. This complexity and the simultaneous application of multiple new elements were persistently underestimated by the client organisation according to A1.Cl, further demonstrating the challenges encountered in case A. Through this, three contract managers on the client's side have passed the project, even now expressing their

sympathy for the ill-fortune this project has had in terms of organisational readiness, but emphasising how the collaboration with the contractor was always a dynamic, growing factor.

5.3.2 Case B: Summary

Case B was marked by a smoother progression, with all participants deeming the collaboration as good, with notably amicable individuals involved. However, there were still traces of "old behaviour" manifesting during the realisation phase, suggesting some patterns of traditional project management remained in play.

Interestingly, the decision to adopt the two-phase approach was primarily influenced by the former contractors' combination and the pursuit of a level playing field. It's worth noting that, given different circumstances, an alternative procurement strategy might have been the preferred choice.

Despite the exploratory phase that preceded the second phase, both the client and the contractor reported the same kind of discussions recurring in the second phase. This suggests that the initial exploration period might not have had a significant influence on the nature of the dialogues between the parties. In the exploratory phase of sub-project B2, this is a focus point.

5.3.3 Comparison summary

In this section, the findings in both cases were compared on underlying causes, reasons for differences between behaviour and outcome as presented in interviews. The recurring themes are listed in table 5.1.

The main difference is rooted in the initial setup and approach of case A and case B in terms of collaboration between client and contractor. In case A, the foundation is built on collaboration, with a joint effort to manage risks. The mindset is relational, influenced by alliance contracts and the principles outlined in Project DOEN (n.d.). Collaboration in case A is seen as a goal in itself, with relational contracts and alliance-like structures forming the basis of its operations.

On the other hand, case B represents a more traditional approach. It did incorporate elements of the two-phase approach to address a problem during the tender phase: maintaining a level playing field between all parties in procurement). However, it doesn't function as a relational model and lacks the broader context present in case A. In other words, while it includes certain ingredients from the two-phase approach, it doesn't fully adopt the method, thus not yielding the same results as seen in case A.

In essence, although both cases aim to enhance client-contractor collaboration, they employ distinctive strategies and are underpinned by fundamentally different principles, leading to varying outcomes. An overview of the case characteristics is provided in table 5.1. The most pronounced differences between the cases are their procurement and collaboration objectives. For case A, the procurement period aimed to identify a contractor committed to collaboration and expertise sharing, which would in turn reduce uncertainty surrounding the project area in the final design. On the other hand, case B faced a knowledge gap between the involved tender parties due to a previously cancelled contract. During the procurement phase, the primary goal was to bridge this gap. It was a necessity to choose this solution, rather than a free choice for the two-phase approach. As a result, the main emphasis of the first phase was a collective exploration of the design, planning, and contract.

	Case A	**Case B**
Culture	Focus on creating a shared culture	Focus on working with each other
Structure	Project struggles with parent organisation	Project falls under parent program
Risk management approach	Joint risk management	Risk allocation
Procurement objective	Collaboration	Maintaining level playing field
First phase	Design phase	Exploration phase
Collaboration objective	Uncertain project environment	Project execution

Table 5.1: Case analysis

Upon comparative analysis, two prevailing themes emerge: the organisational structure of the project and the genesis of the two-phase approach, and the varied methods of risk allocation. These two mechanisms will be further explored and elaborated in the ensuing sections.

5.4 Mechanism 1: Organisational interplay and its impact on projects

In case A, the team was highly motivated, feeling as though they had almost conceptualised the two-phase approach themselves, inspired by the collaborative focused project Nijkerkerbrug (Project DOEN, n.d.). This instilled a strong sense of purpose within the team, bolstering their efforts. The project started the procurement strategy with the acknowledgement of the need to collaborate with the market, to accomplish the project objective of the river lowering. The procurement strategy of the project was initiated with the understanding that collaboration with the market was essential to achieve the primary goal of lowering the river. Given the complex project environment, the contractor's expertise was deemed necessary, not just in the execution phase, but also in the design and planning study phases. Thus, the need for collaboration was deeply felt by the client's project team members. This collaborative objective, coupled with shared responsibility and joint ownership, was underscored in the contract documents.

Nevertheless, the team encountered a major setback with the cost-pool test. Despite implementing initial mitigation measures to involve someone from the cost-pool in the project to counter potential organisational rigidity, they failed to secure approval on the project estimate. The issue escalated to the CPO, who eventually signed off by dismissing the advice. This led to a six-month hiatus, and relations between the client and the contractor plummeted (quotes A5.Cl, A2.Cl, A1.Cl). To summarise, while there was a collective willingness to proceed at the group level, the broader organisational context (macro context) negatively affected the project (micro context).

In case B, the two-phase approach was more of a top-down introduction. The rationale behind adopting the two-phase delivery method was to remedy an issue arising from the termination of a contract with the previous contractor, who could still partake in the new tender of project B. To counter the imbalance in knowledge, a two-phase approach was considered optimal. In absence of this issue, case B would have been brought to market with a D&C, especially considering they already had an almost definitive design (quote B1.Cl). Following the award of the bid, senior management invested significant effort into fostering collaboration between the two parties. They involved a coach to facilitate the process surrounding the setting of the price, as well as some sessions on understanding of each other's attitudes and behaviours, promote genuine collaboration, and navigate the nuances of the two-phase approach (quote B2.Cl). Yet, this concerted effort was not reflected at a more operational level. At this level, both the client's contract manager and the contractor perceived a persistence of "old strategic behaviour" particularly in areas like claims. Both felt that the discussions in phase two were essentially reiterations of issues from phase one, indicating that the exploratory period in phase one did not yield the anticipated success (quote B1.Cl, B3.Con). Hence, while collaboration to prepare for the two-phase approach exists at the organisational level (macro), but this does not fully permeate to the project level (micro context). These aspects of case A and B are represented in mechanism 1, as depicted in fig. 5.1.

Another interesting comparison between case A and B is the cost pool assessment. The mechanism revolves around the interaction between the project and the parent organisation (the organisational field), examining how it can and is willing to adapt within the collaboration. In case B, this was mitigated at the front end by the overarching program. Case B had a quality framework written based on the frameworks and guidelines of Rijkswaterstaat, detailing motivating reasons when and why deviations occur. This was approved by the Director-General, granting the authority to deviate. The program organisation ensured that a different procedure could be followed. The "inter-organisational field" (the program), as defined in fig. 7.1, anticipated that the instrumentation of the "parent organisational field" (Rijkswaterstaat) could become a problem (specifically the cost pool), and mitigated this. This allowed for the incorporation of flexibility. As a result, unlike case A, case B didn't experience issues due to the inflexibility of the parent organisation. The interaction between

different organisational fields and the project context will be further elaborated on in section 7.2.

Figure 5.1: Schematic representation of Mechanism 1: Organisational interplay and its impact on projects

Conclusion mechanism 1: The interaction between the project and the (inter) organisation field is of great importance for the project. This interaction encompasses motive for the procurement strategy, instrumentation from the organisational field to the project and other aspects or the flexibility to support the collaboration between client and contractor within the project.

5.5 Mechanism 2: Risk management dynamics: shared vs. allocated

One of the possibilities for risk allocation is the use of working hypotheses. In case A, procedural agreements were made to manage the risk of high or low water levels. A weekly risk board convenes to evaluate the implications for the project based on water level predictions, and any resulting costs are then balanced. The significant advantage is the precise understanding of which water levels allow for certain work activities. There have been two instances of low water and three of high water, but these pauses - the quiet moments - have all been resolved. If you were to settle these within a regular contract based on multi-year predictions, as was done with the Room for the River projects, it would mostly occur at the end. By then, many details would no longer be reproducible, leading to a loss of information and an increase in disputes. In case A that issue has been overcome with the use of working hypotheses, especially regarding high water. With traditional contracts, you buy off a risk, which then removes the incentive to collaboratively determine when to restart work or what can truly be done together to mitigate that risk. What is happening here is a more explicit handling of risks. Simply paying to remove a risk doesn't resolve it, because at some point, a contractor could charge a certain amount for it. If the risk exceeds the amount charged, it could still come into play, leading to a discussion nonetheless. (quote A5.CI)

In case B, the use of working hypotheses has been used on several aspects like the expected weight of steel in reinforcing concrete. Here, they are less positive about this mechanism, describing it as deferred disappointments (quote B2.CI). Even though there is a strong focus on collaboration, discussions about the division of working hypotheses focus on that; the division of pain and gain. At a management level, extensive discussions have been held regarding the purpose of working hypotheses. The perspective of B2.CI suggests that the focus often leans excessively towards saving as much money as possible, which should not be the primary aim. Instead, the objective should revolve around efficient work, wherein discussions about money could be a part, but it should not be the end goal. The focus should be on fostering a cooperative relationship on both sides. In discussing the claims that subsequently arise within the project, the culture is identified: The deeper one looks into the culture of both companies, down to the organisational layer, the clearer it becomes. At a high level, everyone agrees on the principle of collaboration, but in a project context, the focus is on achieving targets. This focus can often reduce the perceived space for collaboration.

The mechanism highlighted in these cases centres on the philosophy of risk management and is depicted in fig. 5.2. Each case presents a distinct perspective on risk management: is it a matter of shared risk management, or is risk allocation the focus? The organisational fields in both cases can significantly impact how the projects perceive and implement their risk management strategies. This difference in philosophy not only affects the practical handling of risks but also the level of collaboration and mutual understanding between stakeholders. Hence, it is essential to delve into the underlying beliefs and practices surrounding risk management to comprehend the collaborative dynamics in these projects.

Figure 5.2: Schematic representation of Mechanism 2: Risk management dynamics

When it comes to risk allocation, discussions naturally arise regarding which party is optimally positioned to control the cause or effect of a particular risk and what appropriate compensation should be returned. On the other hand, in a collaborative environment, the focus shifts towards identifying the problems and deriving holistic benefits for the project. Shared management, a different premise altogether, allows a project to allocate easily definable risks, while adopting working hypotheses or scenarios for others. The question then arises: 'What actions should the project undertake when this scenario transpires?'

At the outset, it is understood that certain risks are inherently unsuitable for allocation. Therefore, processes are developed to collectively handle these situations. It is essential to remember that no project team, particularly those with a focus on collaboration, consciously opts for a "risk allocation only" approach. There are also cultural factors at work here: the organisational fields of all involved parties (Rijkswaterstaat and the contractor as a company) significantly shape the project's risk management vision. In case A, the project's strategy was fundamentally about integrating the market/contractor into the project, with collaboration being an explicit goal. In the 'Room for the River' program, risks were assigned according to the D&C guidelines. The project team from case A took lessons from this approach, putting emphasis on managing risks collectively. Conversely, the first phase in case B wasn't so much a design phase but rather an exploratory phase. The focus lay on "feasibility, viability," risk allocation, and price formation instead of a collective design process and direct exposure to risks. Drawing lessons from case A, sub-project B2 could underline the importance of a transition from managing risks allocated to one party, to collectively managing risks. This collective approach acknowledges the intricate dynamics of responsibility, risk-bearing capacity, and foresight, aiming to mitigate any impact irrespective of its origin. Collaboration goes beyond binary outcomes of success or failure; the responsibility is shared among all project stakeholders in all scenarios.

However, it is vital not to oversimplify the relationship between risk sharing and collaboration. While the two often go hand-in-hand, collaboration is not solely contingent on risk sharing. For example, if one party feels that the risk budget has been unduly drained due to the other's mistakes, it can lead to friction. At its core, collaboration hinges on a shared sense of responsibility for risk resolution and determining who is best equipped to handle each risk. From this perspective, risk allocation can actually foster collaboration, offering more clarity and transparency, which in turn can be beneficial for the project. This notion of shared success and

shared adversity signifies a balanced approach to risk management, blending the principles of risk sharing and risk allocation.

Conclusion mechanism 2: The manner in which risk management is approached - whether through sharing or allocation - could have implications on project collaboration and overall execution. The cultural inclinations of the involved parties, their underlying philosophies and the organisational fields, greatly shape this approach. The distinction between shared management and risk allocation has been highlighted in both cases, with shared management fostering a more collaborative spirit that positively impacts the project's execution and outcomes. Moreover, the use of working hypotheses presents a viable mechanism for addressing those risks that cannot easily be allocated, allowing for joint decision-making and problem-solving. However, it is also clear that the successful application of shared management and working hypotheses relies heavily on a genuine cooperative culture and a commitment to collective success, as opposed to merely meeting individual targets. It necessitates a paradigm shift in traditional risk management, focusing not just on who controls the risks but how they can be jointly managed for the project's overall benefit.

5.6 Conclusion

This section will conclude the chapter on the case study results. The answer to sub question 3: *To what extent are the procurement challenges overcome by the introduction of two-phase delivery in projects?* and sub question 4: *What are proposed changes to the use of two-phase delivery in projects?* will be provided.

The prevalent challenges in the infrasector, as identified in section 3.1.5 are the early price determination in combination with unknown risks, high tender costs and difference of interpretation of collaboration. As found in this chapter, several key insights emerge.

Firstly, it's clear that the success of a project is significantly influenced by the attitudes and behaviours of those involved. This points towards a critical learning opportunity for the Rijkswaterstaat; it underscores the necessity of paying due attention to these aspects when selecting project participants, rather than basing decisions solely on availability criteria. This human factor can often be the determining element in the project's trajectory, especially in a two-phase delivery setting.

Secondly, while the concept of later pricing is generally seen as a positive aspect of the two-phase approach, it does bring about its own set of complexities. Rijkswaterstaat currently lacks the necessary tools to effectively navigate this process. This highlights the need for innovative thinking and flexibility in managing the intricacies of this procurement method.

Lastly, it appears that risk management may be positively influenced by the two-phase approach. This method prompts all parties involved to collectively contemplate potential risks and appropriate mitigation measures. This, in turn, initiates discussions about which party is best equipped to handle specific risks. It's crucial to remember that neither risk distribution nor allocation inherently has a negative impact. The key caveat here is that a non-optimal distribution of risks can encourage strategic behaviour, which could potentially undermine the benefits of a collaborative approach. Therefore, it isn't the act of risk distribution or allocation itself that's problematic. In fact, some risks may be more suitably managed by one party, while others may benefit from a more collaborative approach. Additionally, it's essential to understand that enhanced risk management does not automatically promise a seamless second phase. As such, caution must be exercised in associating enhanced risk management with overall project success.

In this chapter, two pivotal mechanisms were introduced as discovered in the case study. These mechanisms shed light on the interplay between individuals across varying levels within an organisation and the consequential influence this interaction can exert on various aspects of a project. By delving into these mechanisms, critical insights into behavioural patterns associated with the application of a two-phase procurement strategy are gained, along with valuable suggestions for its improvement.

Both mechanisms highlight crucial aspects of project interaction and risk management within the broader

organisational field. Mechanism 1 stresses the importance of strategic interaction across organisational layers, emphasising the need for flexibility and effective tools for collaboration. Conversely, mechanism 2 illuminates the significant influence of risk management approach - whether shared or allocated - on the project's execution. It showcases the benefit of shared management in fostering a collaborative spirit, but notes that its successful application relies on a genuine cooperative culture.

In over to overcome the challenges in the infrasector, several changes to the use to two-phase delivery can be made. By incorporating these changes into the two-phase delivery model, it may be possible to address the prevalent issues in the procurement of construction projects and enhance project outcomes.

- Emphasise the interaction between the project and its organisational field: Given the significant impact of the interplay between the project and the (inter)organisation field on the procurement strategy and overall project execution, it is crucial to encourage more proactive and meaningful interactions. This could involve fostering a greater understanding of the broader organisational context at the project level and ensuring that the project's objectives and needs are well-understood and supported at the organisational level. Additionally, incorporating more flexibility in project management processes could aid in adapting to unforeseen circumstances and better supporting collaboration between the client and contractor.
- Embrace a collective approach to risk management: Drawing from the findings of mechanism 2, it seems that a pivot towards a shared risk management strategy could boost collaboration and positively affect the project's execution and results. To achieve this, projects should strive to cultivate a setting that fosters joint decision-making and collaboration. This necessitates a shift in perspective from the conventional risk management practices, which concentrate on individual control over risks, towards a more communal and inclusive approach.
- Use of working hypotheses for complex risks: For those risks that cannot easily be allocated, the use of working hypotheses could provide a framework for joint decision-making and problem-solving. This could also necessitate a change in the cultural inclinations of the parties involved, fostering a commitment to collective success rather than merely meeting individual targets.
- Promote a cooperative culture: In order to support shared risk management and the effective use of working hypotheses, it is essential to foster a genuine cooperative culture. This should permeate all levels of the project, from senior management to operational staff, and be reflected in practices, attitudes, and behaviours. This would entail moving away from a focus on individual targets and towards a shared commitment to the project's overall success.
- Selection based on suitable project characteristics: It's essential to consider the nature of the project when choosing a procurement method. Particularly for projects characterised by high uncertainty, a two-phase delivery model can be beneficial. The flexibility of this model allows for adaptive responses to changing circumstances and better management of unexpected risks. Consequently, a more strategic selection of projects for the two-phase model could enhance its effectiveness and contribute to successful project outcomes (quote A5.CI, B1.CI).
- Encouragement of cross-project learning: While it might seem like a commonplace suggestion, cross-project learning is not yet adequately capitalised upon in many project environments. By sharing experiences, successes, and challenges across different projects, teams can learn from each other's experiences, fostering an environment of continuous improvement. This practice could also provide valuable insights into the nuances of implementing the two-phase model in varied project contexts, leading to refined practices and strategies (quote A1.CL, A2.CI).
- Investment in innovation within project contracts: A critical aspect of enhancing the two-phase delivery model is providing room for innovation within project contracts. This can be achieved by crafting contract terms that not only accommodate but encourage innovative solutions. By doing so, this allows for adaptive strategies and novel solutions to complex project challenges. Such an approach could foster a culture of creativity and problem-solving that contributes to both project-specific and broader industry advancements.

Expert evaluation

6

This chapter will examine the design and results of the expert evaluation. The set-up of this expert evaluation is described in section 6.1. The evaluation will be executed by a group of industry experts in order to offer their perspective on the results and this research in general. To do so, the results from chapter 5 have been summarised into a set of statements. These statements and their origin are described in section 6.2. The results of the expert meeting and their perspective on the statements are described in section 6.3. With these results the last sub-question, which is presented below, is answered in section 6.4.

Sub-question 5

What conditions could ensure the success of two-phase delivery?

6.1 Expert evaluation design

The expert evaluation was designed to assess the recognition and agreement of industry experts regarding the results obtained from the case studies on the two-phase delivery method at Rijkswaterstaat. The evaluation consisted of two separate meetings, each involving three experts, one with construction industry participants and the other with Rijkswaterstaat participants. The selection of these experts was based on their extensive experience and expertise in project procurement methods, in some cases with a particular focus on the two-phase delivery method. Shown below is table 6.1 with an overview of the attendees of the expert evaluations.

The evaluation sessions followed a structured format to ensure consistency and comparability. The first part of each meeting involved a short presentation of the key findings and results from the case studies. This presentation provided a comprehensive overview of the research, including the methodology employed and the specific outcomes obtained.

Following the presentation, a series of five statements related to the case study results were provided to stimulate discussion and elicit expert opinions. These statements were carefully formulated to cover various aspects of the two-phase delivery method and its implications on project outcomes. The experts were encouraged to express their perspectives on each statement, considering their own experiences, industry knowledge, and any potential disagreements with the presented findings.

To ensure fairness and objectivity, the experts were given equal opportunity to voice their opinions and provide feedback. Their responses were recorded, and additional probing questions were posed to delve deeper into their perspectives. This approach aimed to uncover any areas of disagreement or alignment between the experts and the research results.

The expert evaluation aimed to create a constructive and insightful discussion, allowing the experts to offer their unique insights, critiques, and alternative viewpoints. By providing a platform for in-depth dialogue, the evaluation sought to explore potential reasons behind any disagreement with the research results, enabling a

comprehensive analysis of varying perspectives on the two-phase delivery method and its implications in the construction industry.

	ID	Organisation	Function and experience
		Session 1	
Expert 1	E1.Con	Heijmans	Director; 16 years of experience in business development within the construction industry, particularly in the infrastructure sector.
Expert 2	E2.Con	TBI Infra	Director (CEO); >25 years of experience with managing mega projects, director of large infrastructural projects, chairman of the board of one of the largest construction companies in the Netherlands
Expert 3	E3.Con	AT Osborne	Senior project manager; >10 years experience with a focus on project management, contract management and strategic procurement.
		Session 2	
Expert 4	E1.Cl	Rijkswaterstaat	Program director '*Market in transition*'; >10 years of experience as project manager. As director responsible for improving collaboration with market parties.
Expert 5	E2.Cl	Rijkswaterstaat	Coordinator '*Two phase delivery method*'; >30 years experience as (senior) expert on strategic procurement.
Expert 6	E3.Cl	Rijkswaterstaat	Senior Advisor ICG; > 20 years of experience as a senior contract manager for large projects. Responsible for ethical market policy and improving specialised issues related to market policy and conflicts of interest.

Table 6.1: Experts' information

Overall, the expert evaluation was designed as an important component of the research methodology, seeking to enhance the validity and trustworthiness of the study findings by integrating expert opinions and insights. The structured format and selected statements aimed to promote meaningful discussions and provide valuable insights into the experts' recognition or disagreement with the research results obtained from the case studies on the two-phase delivery method.

6.2 Statements

The statements as listed below are derived from the results of the case study. As explained in sections 5.4 and 5.5 there were two overarching mechanisms found in this study. Mechanism 1 examines the dynamic interplay between a project's micro-context and the broader organisational macro-context that surrounds it. Mechanism 2 explores the influence of shared versus allocated risk management strategies on project collaboration and overall success. The statements are constructed to summarise the lessons learned from interviews and literature study and to spark discussion amongst the experts. The following table 6.2 indicates which statements have been adopted by the experts and which have not.

Statement	Market expert group	Rijkswaterstaat expert group
Statement 1	+	+/-
Statement 2	-	-
Statement 3	-	-
Statement 4	+/-	+
Statement 5	-	-
Statement 6	+	+/-
Statement 7	-	-

Table 6.2: Experts' judgement on statements

1. *Rijkswaterstaat, as a mother organisation, is not yet capable of facilitating projects with the two-phase method.*

In both cases, the importance of the alignment between the project and its surroundings is mentioned. The project environment can consist of the programmatic context it forms part of or the organisational context. When projects start with a new strategic course as the two-phase delivery method is, many difficulties and obstacles can occur. Even though the two-phase method is set out to be a 'learn as we go' method, according to the report *Toekomstige Opgave* (Rijkswaterstaat, 2019), the process projects have to follow, with all different desks throughout an organisation, have to transform to be able to accommodate both the objective process as well as the philosophy of the two-phase method in projects. This means that both processes may have to be adapted, as well as a cultural shift to be undertaken in a mother organisation.

2. *A top-down choice for the two-phase method is disastrous for the project progress.*

As found in mechanism 1, the motive with which a project team can choose the strategic outset for a project can influence the outcome of the project results. In the case of projects with a two-phase approach, it could be that the degree of autonomy for the procurement strategy can have an impact on the organisational behaviour as an individual or as a team and therefore impact the degree of collaboration throughout phase one and phase two.

3. *The two-phase approach leads to outdated (negative) strategic behaviour.*

The two-phase approach was described by multiple interviewees as a method with the potential to eliminate negative strategic behaviour on both sides of a project. However, there were still instances of such behaviour. For instance, in Case B, it became evident that despite the considerable time the project team had spent on fully understanding the design and appropriately allocating risks, the contractors' team attempted to disregard any responsibility for any changes during the second phase of sub-project B1, largely ignoring any potential shared culpability. In response, the client's contractor team made significant efforts to counter these claims. This reaction may be viewed as an instance of persistent strategic behaviour, which can re-emerge under stressful circumstances.

4. *The two-phase approach allows for innovation and collaboration.*

During the initial phase of the project, the teams of both the client and the contractor must establish mutual understanding, assimilate cultural variations, comprehend the project's scope and content, and plan an approach for the design phase. It is within this phase that opportunities for project optimisation, whether technical or organisational, can emerge. Consideration can be given to varying methodologies and technical solutions. Unlike a D&C or DBFM project strategy, the requirements for a two-phase project are not fully determined from the outset, allowing for innovation. The foundation for collaboration can be set by both project teams during the project's initial phase, as opposed to merely meeting the conditions outlined in the tender. This approach has the potential to enhance collaboration throughout the project's duration.

5. *The choice of a two-phase approach for a project is primarily politically motivated.*

In the literature review presented in chapter 3, it was discussed how the political environment in the Nether-

lands can significantly impact Rijkswaterstaat as an executive agency. Several interviewees brought up the increased scrutiny Rijkswaterstaat and its projects face in terms of results and accountability. It could be posited that the two-phase delivery method emerged in response to political pressure aimed at addressing underlying issues within the Dutch construction sector. The question now is whether the two-phase approach is capable of addressing these challenges effectively.

6. *The use of working hypotheses in the allocation of risks leads to improved collaboration in phase two.*

The case study's second mechanism reveals that working hypotheses can enhance both collaboration and project outcomes. Case A demonstrated that at the onset of phase two, the contractor would attempt to recover all expenses for any machinery rendered inactive due to high or low tide. However, upon assessment from the client's contract manager, it was found that fewer machines were idle than claimed, as some were redeployed to other projects. When working hypotheses were established—distributing the impact of high or low tide risk between both the client and the contractor—the contractor displayed a heightened eagerness to resume work as quickly as possible.

7. *The earlier statement "Two-phase allows for innovation and collaboration" was also mentioned during the introduction of D&C. Therefore, it can be concluded that the choice of contract form does not matter.*

The introduction of D&C was intended to prioritise the contractor's expertise during the design and execution stage. The client, Rijkswaterstaat, would be in charge of the project scope's functional requirements, while the contractor would handle design responsibilities. This would ideally enable the contractor to optimise the interplay between design and execution regarding the process, timing, and material usage. The anticipation was that this approach would allow for increased innovation and optimised design implementation by the contractor. Moreover, the ongoing process of submitting and approving design elements was expected to enhance the collaboration between the client and the contractor and invigorate the construction process. However, project outcomes indicate that neither optimisation nor collaboration has significantly improved following the implementation of D&C. Rijkswaterstaat sets such stringent requirements based on its own preliminary design that the contractor's room for innovative solutions becomes significantly constrained. Interviews about the newly introduced two-phase approach, with these same goals, frequently highlighted that specific individuals, with their unique attitudes and behaviours, remain crucial in driving innovation and collaboration.

6.3 Expert evaluation results

In this section, each statement as illustrated in the section 6.2, the general findings and results of the expert evaluation are described.

1. *Rijkswaterstaat, as a mother organisation, is not yet capable of facilitating projects with the two-phase method.*

Constructors: The consensus among the participants is that Rijkswaterstaat, in its current state, is not fully equipped to facilitate projects using the two-phase method. They all recognise the complexities and nuances involved in this approach, underlining that there are several interpretations and variations of the two-phase method, which in itself may pose challenges to its uniform implementation. They highlight the need for a clear, abstract definition of this approach, and suggest that the lack of a well-understood and standardised interpretation could be a significant barrier to its successful application. The recently introduced guideline *Application of 2-phase approach in Rijkswaterstaat projects* by Rijkswaterstaat (2023) could help this implementation process.

In addition, the experts emphasise the challenges associated with the cultural and operational transition necessary for Rijkswaterstaat to move from traditional procurement methods to a two-phase approach. Especially important is the two-phase method's inherent one-on-one contractor relationship which presents a new dynamic that demands greater transparency and a shift in collaboration style. They stress the importance of managing this change effectively, and of ensuring Rijkswaterstaat and the market are aligned on expec-

tations and processes. Furthermore, they advocate for a measured introduction of the two-phase method, starting with smaller projects before escalating to larger, more complex undertakings. This gradual approach, they argue, would allow for necessary learning and adjustment, helping to set the stage for successful future implementations.

Rijkswaterstaat: The participants appear to be in agreement that Rijkswaterstaat is in the development phase of managing two-phase projects. There is an acknowledgement that the organisation does not yet have a well-established and robust system in place for these projects. However, it's seen as part of a growth process, as they learn through executing these projects.

They share an optimistic perspective, indicating that progress has been made, and the organisation is not starting from scratch. The initiation of new practices, such as written guidelines for projects and communities of practice, signifies the strides taken toward facilitating two-phase projects effectively. However, the consensus is that there is still room for improvement and growth, with the participants suggesting a slow and steady approach, rather than a rushed implementation of all projects as two-phase. As expert E1.C3 concluded: *"Inherent to development is the fact that, while we at Rijkswaterstaat always want everything to go perfectly from day one, if you start developing by doing, naturally, some things will go wrong. However, making mistakes is also necessary in order to learn from them."*

General conclusion: Rijkswaterstaat is in a developing state concerning the readiness of the organisation to completely facilitate two-phase delivery method for projects. However, several processes and instruments have been set up to guide projects through the different phases of the project. Some mandatory processes and gate reviews have been adapted to support two-phase delivery. Both expert groups agree on the fact that a cultural and organisational transition is necessary, but both underline the fact that steps to ensure this have been taken. It is an ongoing process.

2. *A top-down choice for the two-phase method is disastrous for the project progress.*

Constructors: There was a general consensus among the participants that a top-down decision for the two-phase method by any means is not necessarily disastrous, as long as the team selected to implement it is competent, understands the implications, and is motivated to follow through. The participants emphasised the importance of team selection and the alignment of the team with the chosen method. There is an understanding that the selection of team members should be based on their specific competencies and fit for the role, rather than simply on availability. The participants agreed that while top-down decisions can be tricky, the success of a project significantly depends on the team's competence and ability to adapt to the chosen method.

Continuity in the project team, especially during transitions from tender to execution, was seen as an essential factor in the success of a project. The participants acknowledged the need for maintaining a degree of continuity while also understanding the specific needs and risks associated with each project phase. They stressed that managing these transitions effectively is crucial to avoid unnecessary fail costs and disruption for construction parties. On the other hand, they also noted the challenges of managing team continuity, given that not all tenders are won and not all team members can be reserved for potential projects. However, it was acknowledged that with careful management, team changes do not necessarily have to impact the project success in a negative manner.

Rijkswaterstaat: From the discussions, it can be observed that there is a general agreement on the fact that a top-down choice for the two-phase method might not be detrimental if the decision is made strategically. It is evident that the participants believe that a top-down decision could work if it takes into account the characteristics of the project and whether a two-phase approach is suitable. They collectively argue that the suitability of a project for this approach and the aptitude of the team members for the method are crucial considerations.

On the other hand, the participants point out flaws in the current practice. They criticise the fact that the existing model puts a team on a project first and then decides the best method of collaboration. The conversation

reveals the participants' shared belief that this order should be reversed. They argue for a model that first determines the project approach from the project requirements and then selects a team suitable for that approach. Therefore, although the participants do not out rightly reject a top-down choice for the two-phase method, they urge for more strategic decision-making that considers project specifics and team abilities.

General conclusion: Both expert parties find this statement to be untrue, but mention the specific needs for a team to cope with a top-down decision on project strategy: the fact that the choice has been made strategically, based on project characteristics and with regard for suitable team members. Both discussions brought to light the current state of the labour market, pointing out that capacity presents a significant challenge for both parties.

3. *The two-phase approach leads to outdated (negative) strategic behaviour.*

Constructors: Across the board, the participants disagree with the statement that the two-phase approach encourages outdated or negative strategic behaviour. They all view this method as an opportunity for improved collaboration, better understanding of projects, and increased precision in risk assessment and price determination. They believe that any contract can lead to negative behaviour if misused and that the two-phase approach, in fact, opens up more possibilities for positive conduct. Expert E2.Con: *"You know, it's a sunny day, and I choose to strongly disagree with this. We should aim to change the sector, and this is a fantastic tool. So, I decide to firmly disagree. And if someone is not well intentioned and thinks they benefit from exhibiting old behaviour, they can indeed do this with any contract form."*

Furthermore, participants emphasise the benefits of this approach in dealing with uncertainties and complexities within projects. The ability to freely exchange knowledge and deal with unforeseen circumstances, they argue, not only improves project management but also enhances job satisfaction. However, they recognise that certain challenges need to be addressed, such as ensuring that everyone involved understands and embraces the implications of a two-phase project. They also highlight the need to consider the readiness of organisations, especially in the context of large-scale and complex projects, before implementing the two-phase approach.

Rijkswaterstaat: There's a consensus among the discussants that the two-phase approach does not guarantee the prevention of outdated strategic behaviour. The panel recognises the usefulness of this approach, particularly its potential in managing and allocating risks more effectively, but they refute the idea of it being a panacea for all project-related issues. Expert E1.Cl stated *"So, in my opinion, the two-phase approach helps to avoid situations where you need that behaviour, but it all depends on the people in the teams, both on the client side and in the market. And it's not a magic solution that ensures that it never happens again, definitely not, no."*

Each contributor underscores the role of the teams and individuals involved in the process, asserting that the success of the two-phase approach largely depends on their actions and behaviours. They highlight the importance of choosing teams capable of effectively implementing the approach and fostering an environment conducive to learning and mutual understanding. They suggest that while the two-phase approach may not eliminate strategic behaviour, it can certainly contribute to a better comprehension of the project, promoting empathy and collaboration among team members.

General conclusion: The two-phase approach is not the holy grail which will solve all challenges associated with strategic behaviour in construction projects, does offer certain advantages. Both expert parties agree it does facilitate room for better mutual understanding, and fosters an environment to exchange knowledge and ideas. This will create an environment where the necessity for negative strategic behaviour has reduced.

4. *The two-phase approach allows for innovation and collaboration.*

Constructors: In general, there is an understanding among the participants that a two-phase approach could provide room for innovation, but this is largely contingent on how the process is managed. There is recognition that innovation becomes possible when projects have healthy earning potential, which allows room for investment in innovative practices. However, this is only achievable if the project is not completely predetermined from the onset. The initial contract must be structured in a way that it creates the right conditions for

innovation.

On the other hand, there is a shared concern about the desire for certainty, control, and accountability, which could impede innovation. In this context, the culture of an organisation, particularly Rijkswaterstaat, is seen as an important factor. If the culture isn't open to handling the uncertainty that comes with innovation, then a two-phase approach might not result in increased innovation. Additionally, there is recognition of the influence of politics and how political control could potentially stifle innovation efforts

Rijkswaterstaat: The group generally agrees that the two-phase approach allows for innovation and collaboration. However, they emphasise that innovation does not occur automatically as a result of this approach. It's the responsibility of the teams to actively drive innovation within the framework of the two-phase process.

It was further clarified that the first phase of this approach particularly facilitates innovation, as it provides a conducive environment for discussing and understanding new methodologies presented by contractors. This flexibility and openness inherent in the two-phase approach is what enables the emergence of innovation and collaboration, setting it apart from more traditional contract forms.

General conclusion: Though the two-phase delivery method doesn't automatically guarantee innovation and collaboration, both expert groups concur that it fosters an environment for innovation and collaboration to emerge. Traditional procurement methods often require contractors to define innovation aspects in their bids; sometimes leading to rigid implementation plans devised without comprehensive project understanding since the elaboration often follows post-bid. Or, the client, unable to recognise the innovation's value, may dismiss it. As E1.Cl said *With the two-phase approach, you truly get a glimpse into the other's kitchen. Otherwise, it remains 'unknown is unloved'.* The two-phase delivery method, however, enables open conversations about potential innovations, exploring their full project benefits without reservation. This doesn't guarantee automatic innovation implementation, but significantly broadens the space and potential for it. Similarly, while the two-phase approach doesn't directly lead to improved collaboration, it unquestionably provides a more conducive environment for its development.

5. *The choice of a two-phase approach for a project is primarily politically motivated.*

Constructors: The participants in the discussion did not connect the choice of a two-phase approach in project management to political motivations. Instead, they mentioned how the constructors' market was eager to move away from the traditional way of project procurement. E1.Con even stated *"The market has now reached a point where if projects continue to be tendered in a traditional manner, industry players simply won't participate anymore."*

The participants discussions highlighted the value of a phased approach for risk management and project execution. They suggested that the choice for this kind of approach is not primarily politically motivated, but rather stems from practical and strategic considerations. The goal is to foster better collaboration and manage uncertainties successfully, rather than adhering to a rigid, fixed-price model.

Rijkswaterstaat: The experts predominantly agree that the adoption of the two-phase approach was not primarily politically motivated. They point out that while political entities have come to recognise and embrace the two-phase approach as a solution for managing risks in construction projects, the initiative for its implementation largely comes from within project teams or the organisation itself.

However, it was also acknowledged that there has been a shift in political attitudes towards the two-phase approach. Once seen as merely an operational choice without any political implications, it is now understood that the broad application and development of this approach require political support. Nonetheless, the group concludes that the impetus for the two-phase approach originates more from practical necessity and organisational choices, rather than being politically driven. E3.Cl summarised: *"I believe the time was ripe for political system to embrace the approach."*

General conclusion: Both parties are aligned in their belief that the implementation of the two-phase delivery system at Rijkswaterstaat was not a result of politically driven decision-making. Despite each group attributing

the larger role in adopting the approach to their respective sides, a consensus was reached regarding the timely convergence of problem, policy, and politics. This convergence created an opportune policy window for the implementation of the two-phase approach at Rijkswaterstaat.

6. *The use of working hypotheses in the allocation of risks leads to improved collaboration in phase two.*

Constructors: In general, the participants seemed to agree that working hypotheses can be helpful in project management, but they voiced concerns about the notion of risk allocation. They expressed a preference for collaborative risk management over traditional risk allocation strategies, suggesting that this approach leads to better outcomes and improved collaboration during phase two of a project.

While working hypotheses can provide a framework for navigating uncertainties and managing risks, the conversation highlighted the perceived limitations of conventional risk allocation methods. The participants indicated that engaging in discussions and joint decision-making about risk management measures is a more effective approach. The aim is to move towards a model of shared responsibility and collaboration, which can lead to improved efficiency, cost-effectiveness, and ultimately, better project outcomes. This model challenges the traditional paradigm of risk allocation where one party would not feel responsible for the risks allocated to the other party, and indicates a shift towards a more integrative and collaborative approach in project management.

Rijkswaterstaat: In discussing the use of working hypotheses in risk allocation, the participants generally agreed that this method can enhance collaboration in phase two. The conversation emphasised that these working hypotheses allow teams to proactively address potential issues, creating an understanding of risks and how to manage them collectively. This thorough risk management in phase one reaps benefits in phase two, as it enables swift, premeditated action when risks materialise, reducing potential disputes and fostering collaboration.

However, the dialog also reflected some initial uncertainty about the role of working hypotheses in risk allocation. The conversation revealed a learning process, as the participants explored different applications of these hypotheses and found common ground. E1.Cl provided an example where she could extrapolate the projects' philosophy behind risk allocation to other, unforeseen scenarios that emerged in the execution phase of the project. With this, she stated how working hypotheses could provide not just concrete solutions, but also a framework for managing unexpected risks. This potentially enhances adaptability, a critical factor in improving collaboration in complex projects.

General conclusion: Working hypotheses could provide a framework, support a vision on how to deal with risks and even unknown unkowns. However, the expert group from the contractors side provided insight in how even the term risk *allocation* could imply a division, rather than a joint approach to managing risks.

7. *The earlier statement "Two-phase allows for innovation and collaboration" was also mentioned during the introduction of D&C. Therefore, it can be concluded that the choice of contract form does not matter.*

Constructors: In general, it can be inferred from the conversation that the choice of contract form does matter as it introduces distinct dynamics and requires different types of collaboration. The participants agreed that both NEC4 and DBFM contracts have the potential to encourage innovation and collaboration, yet they also emphasised the importance of the contract form during challenging situations, such as when deviations, changes, or unforeseen circumstances arise. The contract form can significantly influence the direction and resolution of these situations, showing its inherent importance.

Furthermore, the participants expressed the necessity for the client organisation (Rijkswaterstaat) to possess the necessary knowledge and skills to effectively implement and manage new types of contracts. Another aspect discussed was the wider political and organisational context and its influence on the choice of contract form. However, it was suggested that these factors could be secondary to the project management's motives and intentions. This highlights a potential area of focus for future research, particularly the effects of these variables on the implementation and outcomes of projects.

Rijkswaterstaat: The discussion regarding the role of contract form in fostering innovation and collaboration provided a variety of insights. Participants generally agreed that the effectiveness of collaboration and the level of innovation are not inherently determined by the contract form but by a myriad of factors, including project specifications and the teams involved. Most important was concluded to be providing the necessary conditions within the project that allow for innovation and collaboration, independent of the contract form.

However, differences were noted between the D&C and the two-phase approach, primarily in the level of control that each party has over the innovation. Under D&C, the contractor chooses the innovation at the bidding stage, while under a two-phase approach, the innovation is chosen collaboratively, providing more comfort and ensuring organisational consensus. The conversation further stressed the importance of adapting the project strategy to the people involved, the project's context, and the level of knowledge about the area in question. This adaptability could help address information gaps in the project preparation stage and create a conducive environment for effective collaboration and innovation.

General conclusion: Both parties responded with amusement to the proposition. They both pointed out that the era when D&C was introduced was characterised by different dynamics within the construction sector compared to the present. The reality is that we are now operating in a distinct time frame with a different perspective on project management and overall procedures. To summarise, E3.Cl articulated that *"In terms of collaboration, the people involved are the key factor, whereas for innovation, the leeway that your contract provides is crucial"*. Echoing a similar sentiment, E1.Con reasoned, *"A competent team can transform a subpar contract into a stellar project. Conversely, even with a stellar contract at hand, if there's inherent opposition from both parties, it will affect the project results.*

6.4 Conclusion

The aim of this chapter was to evaluate the findings from the case study and to answer sub-question 5: *What conditions could ensure the success of two-phase delivery?* In these expert evaluations seven statements have been evaluated, in order to provide an overview of the different elements contributing to a successful use of the two-phase delivery method in a project. The statements from various experts in this chapter are opinions, which were either supported or not supported by the other attendees. The conclusions drawn in this chapter are based on these opinions.

The success of two-phase project delivery depends on several key elements. First, fostering an environment of trust and transparency is seen as fundamental, as it enhances the reliability of the tender procedure inherent to this approach. Dispelling misconceptions surrounding strategic behaviours is also crucial, as the two-phase approach promotes collaboration, improves project understanding, and refines risk evaluation and price determination. Furthermore, the method's ability to spur innovation and collaboration is recognised as a major success factor. However, it's noted that this depends largely on how the approach is managed, incorporating elements like aptitude of project members, openness to innovation and organisational culture. These are the components that Rijkswaterstaat will need to commit to in the coming years to achieve a successful adaptation of the two-phase approach.

While the contract form can provide a conducive environment, the success of promoting innovation and collaboration is reliant on multiple factors such as project specifications, team composition, and adaptive strategies. The value of working hypotheses in risk allocation, promoting a shift from traditional methods to more integrative and collaborative risk management, could be perceived as a pathway to improved efficiency and better project outcomes. Contractor incentives, more focused on the optimisation of efficiency than on the technical optimisation already present on the contractor's side, require careful consideration to maintain financial and scheduling control during phase one. Lastly, the readiness of the organisation, manifested in the standardisation of the approach, effective management of transitions, and a gradual, learning-based introduction, is recognised as pivotal.

Adding to the aforementioned conditions for successful two-phase delivery, the context in which the approach

is implemented plays a vital role. Both within and outside the project, the desire to collaborate and the flexibility to provide support are fundamental. It has been observed from various case studies that conditions for success are not static but rather dynamic and continuously evolving.

Two-phase delivery consists of various elements, but having these components alone is insufficient. This can be compared to baking a cake; having all the ingredients (like apples, flour, and egg) is necessary, but it's the entire process of mixing, baking, and cooling that produces a delightful pie. If any part of the method is skipped or altered, it disruptively affects the end product. In the context of a two-phase delivery, if the parent organisation is not adequately prepared or if it responds incorrectly, the impact on the entire system can be profound. Hence, readiness at the organisational level, willingness to learn, adapt and support the project team, and an understanding that success is a result of a dynamic process - not just the presence of certain elements - are essential conditions to the successful implementation and application of the two-phase delivery method.

Discussion

7

This chapter provides a critical reflection on the methodology, results and limitations of the research presented in this study. The reflection of the research is set up according to three topics: Participants' perspective, personal perspective and an interpretation of the results. This chapter continues by outlining the limitations of this study and recommendations for further research, before presenting the academic and societal contribution of this study. Lastly, the recommendations for practice at Rijkswaterstaat are given.

7.1 Reflection

7.1.1 Participants' perspective

The main focus of this study lies in the empirical research. In this phase, relevant stakeholders were interviewed regarding their experiences and perceptions of the two-phase approach, supplemented with examples from ongoing projects they were participating in. Crucial in this analysis is a reflection on the interview methodology and the perspectives of the interviewees on the problem at hand. First, the structure of the interviews is evaluated, addressing questions related to their effectiveness, comprehensiveness, and relevance. Factors such as the suitability of the interview setup for fostering open dialogue, the depth and relevance of the subjects discussed, are vital in evaluating the robustness of the data collection strategy (Verschuren & Doorewaard, 2010). Second, the viewpoints provided by the interviewees are reflected on. Consideration is given to whether the current project contexts may have impeded their ability to provide honest insights, and whether they were able to provide a holistic analysis of the problem, including historical build-up and their own actions, or were primarily restricted to discussing the main events prompted during the interviews. Through this, the aim is to gain a comprehensive understanding of potential biases and limitations in the research process.

The interviews were conducted in an informal setting, either at the Rijkswaterstaat headquarters in Utrecht, at the project location, or online via Teams. As the author of this study is a Rijkswaterstaat employee, she introduced herself as a graduate student from the Technical University Delft during these sessions. Several interviewees being her direct colleagues facilitated an atmosphere of trust and ease, reducing the need to build rapport (Rubin & Rubin, 2005). However, this familiarity occasionally resulted in answers that assumed tacit knowledge of the subject, impacting the clarity and traceability of the results, in a sense that there would be implicit information in the transcripts of the interviews. Whenever such instances were detected, the author strove to clarify and make the responses as explicit as possible.

Two expert meetings were conducted, separating the client and contractor expert groups. This approach was taken to create an environment where all participants could freely express their thoughts without the concern of strategic behaviour during the meeting. Although participants were asked to think beyond their organisational contexts, the author recognises the inherent difficulty of completely disregarding the influence of one's organisation on their viewpoints. Nonetheless, it was observed that all participants made a concerted effort to consider diverse perspectives.

7.1.2 Personal perspective

In conducting this study, the researcher's unique perspective inherently plays a role in the analysis and interpretation of the data. As both a graduate student and an employee at Rijkswaterstaat, the client company the research focuses on, the researcher navigates a dual identity that may influence the understanding and interpretation of the two-phase delivery model. The juxtaposition of these roles may lead to an internal tug-of-war between academic rigour and professional bias.

While the researcher has strived to maintain neutrality throughout the study, the intimate knowledge of Rijkswaterstaat's workings could potentially introduce certain biases. For instance, a tendency to overlook or under emphasise challenges within the organisation due to familiarity or loyalty could subtly shape the interpretation of data. Similarly, preexisting beliefs about the effectiveness or ineffectiveness of certain processes within the organisation could unconsciously impact the analysis. One of the experts during an evaluation meeting stated *It's a pity that almost all of us come from a similar background, whether we studied law or engineering. At a certain point, we make a choice, to the left or to the right, and that choice ultimately determines how we spend the rest of our career on a particular side of the table and slowly adopt that stance on issues as the truth* (E2. Con)

Furthermore, established relationships with colleagues-turned-interviewees might have resulted in responses that assumed shared knowledge, affecting the clarity of the data. Conversely, the researcher's position within Rijkswaterstaat could also enhance the richness of the study, offering an insider perspective that external researchers may not have access to.

The Constructivist Grounded Theory approach aids in recognising and addressing these potential biases. Through continuous reflexivity, a process of self-evaluation and introspection, the researcher endeavours to manage these potential biases (Charmaz, 2014; Gibbs, 2010). While the researcher's dual role could have skewed the perception of the study, acknowledging this possibility and actively seeking to counteract it promotes a more nuanced, balanced, and ultimately, valid study.

Constructivist GT recognises the subjective nature of social reality and encourages researchers to reflect on their own perspectives and assumptions, and how they might shape their interpretation of the data. *"Researchers are part of what they study, not separate from it"* (Charmaz (2014), p.320). It is in embracing this complexity that the author hopes to contribute a valuable understanding of the two-phase delivery model in the context of Rijkswaterstaat.

Maintaining trustworthiness throughout this study was paramount to ensure the validity and rigour of the findings. This was pursued diligently by adhering to the principles of credibility, transferability, dependability, and confirmability, as proposed by Lincoln and Guba (1986).

To ensure credibility, the research drew upon multiple data sources, including interviews, observations, and documents. This approach provided a comprehensive, multi-faceted view of the two-phase delivery model and its impact on Rijkswaterstaat's projects. Furthermore, participant checking, by reviewing interpretations of the interviews and checking quotes, was employed as a valuable tool for validating the interpretation of data, further enhancing the credibility of the study. Transferability, or the applicability of the research results in diverse contexts, was reinforced through a thorough description of the research context and participants. This extensive contextualisation allows future researchers to better understand the setting and determine if findings could be transferable to their unique contexts. Dependability was fortified by maintaining an audit trail documenting the research process and decisions made along the way. Regular debriefing sessions with thesis committee members offered valuable feedback on the research design and analysis, helping to ensure a consistent, stable research process. Lastly, confirmability was enhanced through the practice of reflexivity. Regularly acknowledging and reflecting upon personal biases and assumptions helped to preserve the objectivity and neutrality of the research findings. In line with grounded theory, memos were written throughout the study to document reflections and emerging insights, further strengthening the confirmability (Shenton, 2004; Charmaz, 2014).

7.2 Interpretation of results

Mechanism 1: Organisational interplay and its impact on projects

Mechanism 1 reflected the interaction between the project and the (inter) organisation field, which can be of importance for the project. This interaction encompasses motive for the procurement strategy, instrumentation from the organisational field to the project and other aspects or flexibility to flexibility to support the collaboration between client and contractor within the project.

Reflecting upon mechanism 1 and its emphasis on strategic interaction across organisational layers, it becomes apparent that it aligns with the Inter-organisational Collaborative Capacity (ICC) model posited by Hocevar, Jansen, and Thomas (2011). Specifically, the domains of *Purpose and Strategy* and *Structure* echo the themes in mechanism 1. In cases A and B, both felt the need for collaboration (*Felt Need*) and demonstrated strategic actions through senior leadership commitment to foster collaboration (*Strategic Actions*). However, the execution varied; the motive for the application of the two-phase approach in case A was intrinsic, while in case B, it was more of a top-down decision. *Resource Investments* assesses the extent to which the organisation makes adequate investments in collaboration. In case A, the resources focusing on building collaborative capacity were sought internally, where in case B, an external coach also supported the process towards aspects of collaboration. The *Structure* domain of the ICC model also resonates with mechanism 1. The emphasis on *Structural Flexibility* and *Collaboration Structures* in the ICC model reflects the need for strategic interaction and flexibility within different organisational layers in mechanism 1. The differences in how each case navigated these elements—particularly, the ability to adapt to changes—highlight the potential impact of the structure on the collaboration's effectiveness.

Furthermore, Peterson's (2007) insights regarding the significance of motivation for project success are clearly reflected in both case studies. For instance, case A demonstrates how robust team motivation and a cultivated sense of collective responsibility can fuel superior collaboration and an eagerness to strive for project objectives. Similarly, case B also showcases a sense of collaboration and shared project goals, although during financial negotiations about contract adjustments, remnants of "old strategic behaviour" occasionally resurface at the operational level. The influence of individual preferences within the project context, as highlighted in Koops, Bosch-Rekveldt, Bakker, and Hertogh (2017) study, is perceptible in both cases. The inclination towards compromise and joint solutions in case A bolstered collaboration and elicited positive reactions, demonstrating the effectiveness of adopting a collaborative approach. Conversely, in case B, the maintenance of conventional structures and behaviours introduced elements of tension at the start of the project, and rendered the management of the project's intricacies less smooth, underlining the challenges that entrenched practices can present within a dynamic project environment. However, it's worth noting that with time and conscious effort, case B has been showing signs of improvement. The traditional barriers are gradually being dismantled, and as the team grows more accustomed to a collaborative approach, their comfort in navigating the project's complexities is showing progressive enhancement.

In conclusion of the analysis on mechanism 1, it is imperative for a team to possess the skills to navigate the complexities of a two-phase approach and foster a shared mindset. This perspective suggests that the top-down implementation of the two-phase method in case B might have yielded more substantial results if it was paired with a team environment that encourages the sharing of risk and responsibility — an attitude that is increasingly adopted as the project progresses. This resonates with the scenarios observed in both cases, where the project's micro context is affected by the broader organisational (macro) context (Li et al., 2019). This insight brings an additional depth to our understanding of mechanism 1, emphasising the critical role of strategic interaction across various organisational layers. It further underscores the necessity of fostering a supportive culture and environment that facilitates these interactions. The diagram by (Li et al., 2019), which situates a project within its existing organisational field, can be extended to accommodate these new perspectives. Case B, in particular, was embedded within a program that served as an "inter-organisational field". Moreover, both cases A and B consisted of project teams with members from both the client and the contractor. Each of these members interfaced with their respective parent companies, effectively creating multiple organisational

fields. These complexities are illustrated in figs. 7.1 and 7.2 by augmenting the original model.

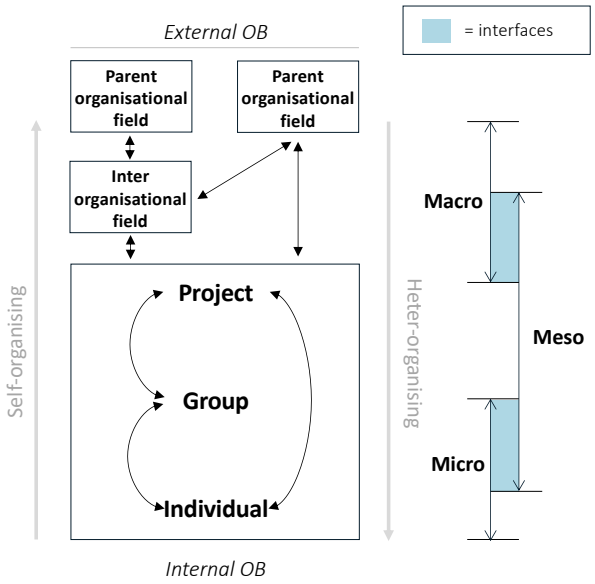

Figure 7.1: Schematic multilevel framework of organisational behaviour in mega-projects, including inter-organisational field. Reprinted and adapted from Li et al. (2019)

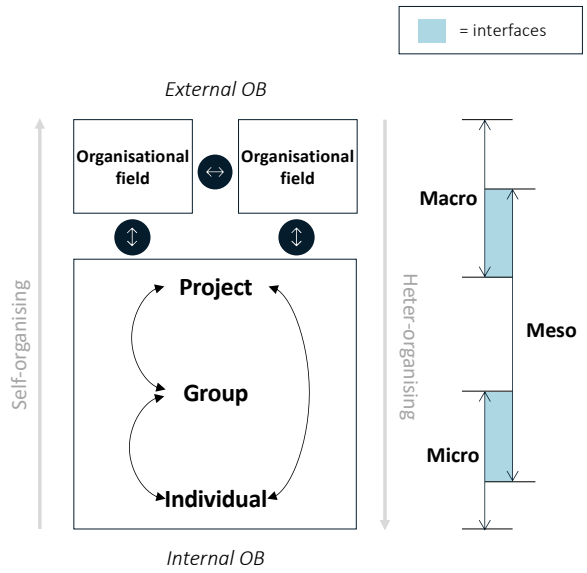

Figure 7.2: Schematic multilevel framework of organisational behaviour in mega-projects, including multiple organisational fields. Reprinted and adapted from Li et al. (2019)

Mechanism 2: Risk management

The mechanism of shared risk management versus allocated risk management, as explored in the two cases, bears a striking resemblance to the ideas presented by (Motiar Rahman & Kumaraswamy, 2002). This study emphasises the importance of collaborative relationships, relational contracting, and joint risk management for successful project delivery, particularly in high-risk, complex domains such as construction. In this study, mechanism 2 similarly emphasises collaboration and shared risk management, advocating for a shift from a traditional risk allocation model to one that encourages joint decision-making. Both sources acknowledge the potential for opportunism and the importance of balancing self-interest and collaboration. However, in

comparing the two, the insights from the cases in this study further refine the concept of relational contracting by highlighting the role of working hypotheses and demonstrating how these can be used to manage risks that cannot be readily allocated.

Koolwijk (2010) emphasises the inherent uncertainties and risks in construction contracts that require collective and dynamic risk management, prompting a 'cultural revolution' towards collaborative teamwork within project culture. This theme resonates strongly with the principle of mechanism 2 of shared versus allocated risk management. In particular, the experience of Case A exemplifies how a shift towards a culture of shared risk management and collaboration can result in more effective handling of unpredictable risks, such as those related to water levels. However, Case B's experience with working hypotheses highlights the potential for these mechanisms to be seen as 'deferred disappointments', suggesting that this cultural shift must also be accompanied by a genuine commitment to collaboration and collective success. Under alliance as a PDM, all risks are shared, there is the presence of a no dispute clause with no liability between participants, the client and contractor share common goals for project success, all transactions are open book format and all participants win or lose, depending on the project outcome. The alliance is like two-phase delivery model, a PDM which integrates design and delivery teams, under the umbrella term *relational contracting* (Walker & Lloyd-Walker, 2012; van de Rijt & Witteveen, 2021). Under (hybrid) alliance projects, risk sharing or allocation is guided by who is best equipped to handle certain risks. The client, lacking construction competence, won't carry construction-related risks, while the contractor's risks are defined by the client's requirements. Shared risks lie between these two boundaries, including potential mistakes in contract requirements and circumstances such as soil contamination or unexploded ordnance, with set limits or 'caps' for responsibility (Koolwijk, 2010). Mechanism 2 presents the idea of handling risk collectively, not only based on who is best equipped to handle the risk, but also through the use of working hypotheses that allow for joint decision-making and problem-solving. This could suggest a more comprehensive and adaptable approach to risk management that can cater to a wider range of risks and scenarios.

Finally, the insights from this study are recognised by Badenfelt (2010) and Flyvbjerg (2017). These sources discuss the potential negative impact of excessive control mechanisms and the importance of acknowledging and managing uncertainties and risks. In contrast, the mechanism 2 emphasises the positive role of control mechanisms such as working hypotheses in providing a structure for collaborative risk management, while also recognising the inherent uncertainties and unpredictability of risks. This comparison underscores the importance of striking a balance between control and flexibility, and between acknowledging risks and actively managing them through collaboration and joint decision-making.

Two-phase delivery and organisational behaviour

Large and complex projects inherently carry significant risks and uncertainties, which makes it challenging for any single stakeholder to grasp the entire scope and potential consequences of decisions (Koops et al., 2017). The two-phase delivery method introduces a structured and manageable approach to mitigate this complexity, but its implementation significantly changes the project's organisation and has repercussions on organisational behaviour at different levels (Li et al., 2019).

1. *Individual level:* Two-phase delivery impacts individual behaviour in several ways. It clarifies roles and responsibilities for team members, which can lead to a better understanding of tasks, thus reducing complexity at the individual level. However, it might also trigger resistance or anxiety as it changes traditional ways of working. Here, effective communication and leadership are essential to explain the reasons behind the shift and to offer training and support, encouraging individuals to adapt their behaviour to the new procurement process, to the requirements of each phase, and their understanding and perception of risk and collaboration are critical in both phases.
2. *Group level:* The two-phase delivery method might affect group dynamics as it fosters enhanced collaboration and information sharing between different parties during the project's early stages. This collaboration can lead to the formation of high-performance teams, which is critical to the project's success. However, relationship management becomes crucial at this level due to the increased interactions

among different groups, which can create potential conflicts. Mechanisms 1 and 2 play out differently across the two phases based on the group dynamics and interactions within the team, shaping the team's effectiveness.

3. *Project level:* At the project level, two-phase delivery requires an adaptation of the project organisation to accommodate the structured, phased approach. This adjustment could mean reshaping the project's governance, developing new management strategies, and adopting tools to cope with the complexity of large-scale projects.The initial phase, involving feasibility studies and risk allocation, may instigate more contractual, less collaborative behaviours. However, the second phase requires more collaboration, adaptability, and shared risk management, as reflected in Mechanism 2. The use of working hypotheses can also come into play in the second phase to address unforeseen risks and scenarios.
4. *Inter-organisational field level:* As the program sits between the project and Rijkswaterstaat, it becomes an "inter-organisational field". At this level, the behaviour is characterised by the interaction between the different organisations involved across the two phases of the project. The interplay between collaboration and competition can vary across the phases, influenced by risk management strategies and the nature of relationships between organisations. Understanding and aligning the goals of the project with those of Rijkswaterstaat is crucial for the successful implementation of this change. Here, power and politics come into play, as different stakeholders may have differing views on the proposed change.
5. *Organisational field level:* Here, the overall culture, strategies, and policies of the parent organisations involved in the project define the behaviour. The organisational philosophies concerning risk allocation or sharing, the stance on collaboration versus competition, and the preference for two-phase delivery over other models are some of the determinants at this level. However, this does not automatically mean that these philosophies and preferences trickle down to project level.

In conclusion, addressing complexity via a two-phase delivery method involves changes that occur at different levels of organisational behaviour. It is crucial to recognise and manage these changes effectively to ensure the successful implementation of the new procurement process. It's important to remember that individual, group, and project behaviours are intertwined and influence each other; managing change must account for this interplay. By addressing the complexity in a systematic and phased manner, the two-phase delivery method can help mitigate the risks associated with large and complex projects, potentially leading to better project outcomes.

Conclusion on reflection

The two-phase contracting method involves a variety of key components: embedding project culture, bringing about structural changes (tools that project organisations can offer), and determining risk distribution in line with the overarching vision. Yet, these components aren't isolated facets; they are interlinked elements that must all be turned simultaneously for success to be attained. Mere ingredients won't suffice; the method and context must also be present and functioning. As suggested by Motiar Rahman and Kumaraswamy (2002), this notion is situated within the broader framework of relational contracts (as per van de Rijt and Witteveen (2021)).

Therefore, it is insufficient, and likely ineffective, to adopt a single element and assume that constitutes the execution of a two-phase approach. Such an assumption oversimplifies the complex and multifaceted nature of project management, leading to sub-optimal results. Notably, the challenge goes beyond the project level; it requires a shift in culture at the level of the parent organisation too (Suprapto, 2016). This paradigm shift further accentuates the challenge, bringing to light the multifaceted intricacies of implementing a two-phase method.

Change management encapsulates culture, structure, and people (Barends et al., 2014). In the context of implementing the two-phase approach within Rijkswaterstaat, recognising the significance of these three aspects is critical. The successful application of the two-phase method necessitates a broader understanding and conscientious application of these factors, recognising their interplay and mutual influence.

In summary, the implementation of a two-phase method within Rijkswaterstaat, or any organisation for

that matter, necessitates a comprehensive approach that recognises and addresses the intricate interplay of culture, structure, and people. It's not a matter of merely activating one lever but rather a simultaneous, harmonious orchestration of multiple facets that together drive successful project outcomes. It's a complex process that requires dedicated efforts to foster a culture conducive to the two-phase approach, structured tools and strategies for implementation, and a people-centric focus to ensure the adaptation and acceptance of the new method.

7.3 Recommendations for practice

Regarding the findings and discussions presented throughout this research, there are several modifications and adaptations that could be considered to enhance the success of its activities when implementing the two-phase delivery method. These adjustments aim to address identified gaps and capitalise on the strengths of the approach, ultimately improving project outcomes. The following section outlines a series of practical recommendations that a commissioning authority or public client can explore to maximise the effectiveness and success of their two-phase delivery projects. These suggestions are grounded in the research findings and offer potential solutions or ideas to the specific needs and challenges associated with the two-phase approach.

1. *Are we ready? Evaluate yourself*

Evaluate the project and its surrounding environment using a comprehensive model like the Inter-organisational Collaborative Capacity model (Hocevar et al., 2011). The aim is to determine whether the organisation is supportive enough to facilitate genuine collaboration within the project team. This comprehensive evaluation should cover aspects such as the project's complexity, the team's capabilities, the availability of resources, and the organisation's overall readiness for implementing the project.

2. *Bob the Builder: Can he fix it? And does he have the right tools?*

For successful collaboration, it is essential to ensure both the right tools and the right people are in place. Equip your teams with the necessary instruments that facilitate effective collaboration. Simultaneously, put significant effort into selecting individuals who exhibit strong collaborative skills and align well with the project's objectives and methodology.

The selection of team members in a fair manner is a crucial factor in the successful execution of two-phase projects. This point is underlined by both the contractor's expert group and Rijkswaterstaat's expert group, emphasising its importance. Investing in employees with technical knowledge and skills is essential to foster collaboration and informed decision-making.

Contractor companies are proactively employing strategies such as assessments to align team members' attributes with specific project needs. Techniques like analyzing intrinsic motivations, management drives, or management colours are leveraged to assemble effective teams. It's noteworthy that Rijkswaterstaat typically perceives this as primarily a responsibility of the contractor. This perspective could be limiting, as having competent individuals on Rijkswaterstaat's side is equally important for effectively managing, evaluating, and collaborating with the contractor's team. The assembly of proficient, knowledgeable, and capable teams on both sides can enhance communication, decision-making, and overall productivity.

One hurdle to the realisation of this recommendation is a noted shortage of capacity. This could be in terms of insufficient staffing or a lack of personnel with the required expertise. Strategies to address these challenges might involve investing in the training and development of current team members or attracting new talent with necessary competencies.

The emphasis on selecting team members based on their competencies is supported by the guidelines detailed in the "Application of 2-phase approach in Rijkswaterstaat projects" (Rijkswaterstaat, 2023). By adhering to this guideline, Rijkswaterstaat can ensure that both they and their contractors have teams equipped with the necessary skills and competencies to effectively execute two-phase projects.

In terms of organisational behaviour in two-phase projects, the two-phase delivery model can significantly influence this, as it forms part of the project's mesocontext. It affects the relationships within and beyond the project and is shaped by the macrocontext, such as political and institutional interest in the two-phase approach. Such interest could lead to variations in behaviour at project, group, or individual levels.

Internally, at the project's microcontext, factors such as organisational complexity, organisational pressure, commitment, and management tools sway behaviour. Even when implemented as a top-down intervention, the two-phase delivery model might impact these elements and, in turn, influence the overall project outcome.

Furthermore, the choice of a two-phase delivery method brings certain deviations in collaboration compared to an integrated project delivery method. These alterations in organisational behaviour under two-phase projects can potentially facilitate the identification and mitigation of risks, lead to lower tender costs, and improve collaboration, ultimately resulting in enhanced project outcomes. However, the question remains whether the two-phase delivery model directly influences the issues identified or if other factors unrelated to the delivery method contribute to these aspects in two-phase delivery projects.

3. *Embrace yoga; be flexible*

Understand that true collaboration may require flexibility and potential adjustments in long-standing processes that have been conducted in a particular way for many years. Consider revisiting and revising these processes if they seem to impede collaborative efforts in the project.

In light of the ICC model (Hocevar et al., 2011), enhancing the success of the two-phase delivery method in Rijkswaterstaat requires careful balancing of structure and flexibility. Review and adapt existing, possibly rigid, procedures to ensure compatibility with the new project management approach. Foster a culture of adaptability, enabling teams to respond to changing project circumstances and needs of other organisations involved. Create roles and processes designed for effective collaboration, with an emphasis on structural flexibility. Develop supportive metrics that recognise adaptability and collaboration, and support individual efforts towards flexibility through additional resources and incentives. By integrating these elements, Rijkswaterstaat could better facilitate inter-organisational collaboration and navigate industry complexities and uncertainties.

4. *Control projects by letting go*

Recognise the "control paradox" that might emerge in project management (Koolwijk, van Oel, & Bel, 2022). The paradox suggests that an increased desire to control processes might inadvertently hamper ownership and deteriorate the project's outcome. Therefore, rather than imposing strict control, foster a culture of trust, autonomy, and shared responsibility, which can stimulate ownership and potentially lead to more favourable project outcomes.

5. *Address the lack of competition: Embrace and adapt to the one-on-one dynamic*

The unique dynamic of the two-phase approach in project management often necessitates an adjustment in conventional competitive practices. Specifically, Rijkswaterstaat and the contractor enter into a one-on-one relationship relationship, which calls for specially tailored processes and an organisational culture re calibration within Rijkswaterstaat to adeptly navigate this dynamic.

To enhance the success of two-phase projects, Rijkswaterstaat should focus on several key aspects. Firstly, it is important to establish clear and transparent processes that support the one-on-one collaboration. This involves defining guidelines and frameworks that outline how the engagement between Rijkswaterstaat and the contractor should occur throughout the project phases.

In addition, Rijkswaterstaat stands to gain by promoting a cultural metamorphosis within its ranks. Such a transformation would champion an ethos of openness, trust, and effective communication, thus empowering Rijkswaterstaat to fully harness the collaborative potential of the two-phase approach. This cultural evolution

should underscore mutual comprehension, collective decision-making, and an eagerness to draw upon each other's expertise.

By addressing the lack of competition through the development of appropriate processes and a supportive organisational culture, Rijkswaterstaat can effectively navigate the one-on-one dynamic inherent in two-phase projects, leading to improved project outcomes and successful implementation of the approach.

6. *Collaboration till death do us part*

The sixth recommendation addresses the need for collaboration and shared responsibility during both phases of a two-phase project. Currently, phase one tends to be collaborative, but the execution phase often reverts to a traditional Uniform Administrative Terms for Integrated Contracts (UAV-GC) model, which assigns rigid roles and responsibilities, along with fixed risk allocations. This traditional model can hinder the benefits of collaboration fostered in the design phase, leading to a return to the old way of working.

To address this, it would be beneficial to investigate how the principles of collaboration and shared responsibility can be extended into the second phase. For example, NEC4 contracts, a new model for construction contracts, could serve as an inspiration. NEC4 contracts promote a more collaborative and proactive management approach, with both parties actively working together to identify and manage risks and opportunities.

The idea is to combine this level of collaboration with the two-phase approach to create a more synergistic and productive relationship throughout the entire project, rather than just in the first phase. This change could allow for improved risk management, better problem-solving, and potentially more successful outcomes. This concept is one of the most critical findings of the research, emphasising its significance in improving the success of the two-phase project approach.

7. *Good is good enough*

The last recommendation emphasises the need to cultivate a mindset of "good is good enough" during the first phase of the two-phase approach. This principle can help ensure that resources are used efficiently and that progress is made without getting caught in a loop of pursuing perfection that might be unnecessary or impractical.

Particularly in the design phase, where the focus is on planning and exploring potential solutions, it is crucial to steer the process towards efficiency. The contractor might not inherently prioritise this aspect, given that their main engagement usually begins in the second phase. Therefore, it is Rijkswaterstaat's responsibility to take the lead in promoting this mindset and managing resources effectively in this phase.

Developing an understanding of when to proceed with an adequate solution rather than seeking the perfect one can enable the organisation and its partners to progress more smoothly and rapidly. This approach requires an ability to evaluate solutions effectively, balancing quality and practicality while keeping the project's broader goals and timelines in focus. This, in turn, can lead to a more predictive and cost-effective project delivery.

7.4 Limitations

In this study, the validity and generalisability of its findings must be understood in light of the limitations that might have influenced the research process and outcomes. Acknowledging these constraints provides context for the results, informs their interpretation, and points to potential areas for further research. In this section, several limitations that might have affected this research into the two-phase delivery method are discussed.

- Limited available literature at research commencement: The dearth of literature at the outset posed a challenge, as it made comprehensive understanding and contextualising the subject difficult. The scarcity of comparable studies and established theories may have potentially impacted the precision of the findings.

- Absence of a (international) standard for the two-phase delivery method: This absence resulted in various subjects being interpreted as two-phase delivery, potentially causing confusion or inconsistencies in understanding this method. This could lead to data discrepancies, posing challenges in data comparisons or aggregation.
- Use of a limited number of case studies: The study's reliance on a few case studies could restrict the generalisability of the findings. Given the contextual diversity of different projects, a small sample size might have skewed the insights or overlooked relevant information that could be gleaned from a larger, more diverse set of cases.
- Interview absentee in case A: Due to unsuccessful attempts, it was not possible to interview the project or contract manager from the constructors' side in case A. This limitation may have potentially skewed the results of this case study.
- Selection of non-standard cases for the two-phase method: The cases chosen for this study might not represent a 'typical' application of the two-phase delivery method, as both diverge from the newly established standards set forth in the guidebook "Application of 2-phase approach in Rijkswaterstaat projects". In case B, for instance, the project primarily used the first phase to assess the feasibility of an existing design, in stead of a normal first phase where the works is designed. This deviation might lead to insights that are more specific to these particular cases, rather than reflecting the general characteristics of the two-phase delivery method. Including additional cases, such as the A12 IJsselbrugge project, might have offered a more comprehensive understanding of the method's implementation.
- Timeline constraints of two-phase delivery at Rijkswaterstaat: The absence of finalised projects at Rijkswaterstaat made it difficult to assess the entire life cycle of the two-phase delivery method, including its long-term outcomes. Exploring this method's application in other organisations, such as Waterschappen or Municipalities, could have yielded alternative insights and broadened the understanding of the method's practical applicability and effectiveness.
- Concurrent publication of the guideline "Application of 2-phase approach in Rijkswaterstaat projects": The guideline was published concurrently with the conclusion of this research. As such, Rijkswaterstaat's significant strides towards standardising elements of the two-phase delivery method could not inform the research. This timing issue might have affected the relevancy or precision of the results.

7.5 Contribution of this research

7.5.1 Academic contribution

The academic contribution of this research is twofold: on one hand, this study fills a gap in the research on the two-phase delivery models. On the other hand, it provides an opportunity for a longitudinal perspective on two-phase approach and organisational behaviour in construction projects. The research literature review conducted for this study showed a significant scarcity of resources on the topic of two-phase delivery models. Where Clemens (2021) provided the definition for the two-phase delivery method, he further focused on the improvement of risk management in the design-phase. Miedema (2022) outlined the different elements present in PDM's and compared these to the elements present in the two-phase delivery method, in order to optimise the organisation of said elements for the first phase of a two-phase project. Most recent, Kuster (2023) provided insight into the effect of empathy on project outcomes and proposed a framework to improve project performance through empathy and collaboration.

This research provides an addition to those studies by contributing an overview of the possibilities and necessities for a successful adaptation of the two-phase delivery method at client organisations. It describes the emergence of current challenges for commission authorities, by outlining the historical context of the Dutch infrastructure sector. The study provides insight into expressions of organisational behaviour, their interaction with the implementation of a new approach, and how to improve this practice to enhance the success of two-phase delivery in construction projects. Due to the limitations as described in section 7.4, the contribution on an academic plane as well as a societal could be improved by adapting this research into a program. By repeatedly conducting this research at several Rijkswaterstaat projects, with a focus on organisational and

strategic behaviour and how it manifests to varying degrees over time in two-phase projects, enriching insights could be obtained.

7.5.2 Societal contribution

As the largest commissioning authority in the Netherlands, Rijkswaterstaat has a significant influence on societal infrastructural development. Gaining a deeper understanding of its internal operations and strategies on delivering high-quality, cost-efficient projects, especially in technically or politically complex environments, carries substantial potential for enhancing Rijkswaterstaat's effectiveness.

This research on the implementation of the two-phase delivery approach at Rijkswaterstaat, therefore, provides valuable insights that can facilitate the improvement of their project outcomes. These insights could assist in refining the next version of the guideline "Application of 2-phase approach in Rijkswaterstaat projects", enabling Rijkswaterstaat to more accurately anticipate and manage the challenges associated with complex projects, resulting in less cost-overrun and higher quality deliverables.

Beyond benefiting Rijkswaterstaat, this study has broader implications, serving as a guide for other client organisations contemplating the adoption of the two-phase delivery model. The lessons learned from Rijkswaterstaat's experience can help these organisations to better navigate the implementation process, and to tailor the approach to their specific needs and contexts, thus enhancing their project management efficiency and the overall success of their projects.

Conclusion

8

This chapter presents the conclusion of this study by answering the four sub-questions, followed by an answer to the main research question, which is presented below.

Main research question

How can the two-phase delivery model be enhanced to address the prevalent issues in the infrasector with the procurement of construction projects?

8.1 Conclusion

This main research question has been answered along the lines of the five sub-questions as introduced in section 2.2. The objective of this research is to identify and propose improvements to the two-phase delivery model that can effectively tackle the prevailing challenges encountered in the procurement of construction projects.

The first sub-question of this research was *"What are the current challenges a commissioning authority encounters with the procurement of projects?"* In the realm of procurement for construction projects, several prevailing challenges demand immediate attention. The first pain point revolves around determining the price during the procurement period, based on the information available at that time. Risk estimations, confined by limited time and project scope, often result in undesirable outcomes if not accurately executed. The next hurdle relates to the high tender costs incurred from the extensive planning and preparation of bids, often consuming several months and substantial resources, which are wasted if the tender is unsuccessful. Interpretation of collaboration also poses a significant challenge. Both the private and public sector voice concerns over project scope, division of tasks, and collaborative activities. Early price determination coupled with unknown risks, the high cost of tendering, and differences in collaborative interpretations are the primary challenges that need to be overcome to streamline the procurement process.

To address these issues, various project delivery models have been proposed and used over the years. As answer to the second sub-question *"What are the different project delivery models for procurement of projects?"* has been given. A spectrum of models exists, from traditional procurement methods to models that promote a more integrated and collaborative team approach to design and delivery. Understanding the strengths and weaknesses of these models is key to adopting the most effective approach for each unique project. One model that stands out for its potential to mitigate these procurement challenges is the two-phase delivery model. The third sub-question of this research was *"To what extent are the procurement challenges overcome by the introduction of two-phase delivery in projects?"* A review of application of the two-phase delivery model reveals that the success of a project using this model hinges significantly on the attitudes and behaviours of those involved. Selecting project participants based on their capacity to adapt and collaborate effectively is crucial, rather than solely focusing on their availability.

While the concept of later pricing is seen as an advantage of this two-phase approach, it introduces its own complexities. This deferred pricing mechanism engenders a degree of uncertainty, thereby presenting a potential political drawback. Yet, it's worth noting that historically, the seeming security offered by fixed pricing amounted to little more than an illusion of certainty. Overcoming these complexities requires innovative thinking and flexibility in managing the procurement process. The two-phase delivery model also appears to promote a healthier approach to risk management by encouraging all parties to collectively contemplate risks and management measures. However, it is crucial to strike a balance, as non-optimal distribution of risk may spur strategic behaviour, which could undermine the benefits of a collaborative approach.

Given the benefits and challenges that the two-phase delivery model presents, certain modifications could enhance its efficacy. These modifications can answer the fourth sub-question: *What are proposed changes to the use of two-phase delivery in projects?* These include fostering a greater understanding of the broader organisational context at the project level, adopting a shared risk management approach, and using working hypotheses for complex risks. Additionally, fostering a genuine cooperative culture, selecting projects suited to a two-phase model, encouraging cross-project learning, and investing in innovation within project contracts are some of the proposed changes that could enhance the two-phase delivery model.

However, the successful implementation of the two-phase delivery model isn't only about the presence of certain elements or steps. It depends on the context in which the approach is implemented, both within and outside the project. The environment must foster collaboration and be flexible to provide support when necessary. The organisation's readiness, willingness to learn, adapt and support the project team, along with understanding that success is a result of a dynamic process, are all pivotal to the successful implementation of this model. With this, the last sub-question of the research *"What conditions could ensure the success of two-phase delivery?"* has been answered.

The main research question of this study was *"How can the two-phase delivery model be enhanced to address the prevalent issues in the infrasector with the procurement of construction projects?"* In conclusion, the two-phase delivery model can be considered a tool. It serves as a starting point, inviting and providing space for critical thinking, fostering innovation, and enhancing collaboration. However, it is important to note that this model does not automatically instigate collaboration; instead, it paves the way for it. This distinction, while subtle, is extremely significant.

Collaboration emerges from an amalgamation of facets, upheld by the project's organisational context, a sense of curiosity, acknowledgement of differing goals, understanding, and realistic management of these variations. In the mix of these factors, the overlaps and common grounds must be sought and capitalised on. Compared to traditional and integrated project delivery models, the two-phase delivery method encourages reflection on, and provides more space for, facilitating collaboration. It creates an environment where collaboration can potentially emerge. =However, fostering this level of collaboration requires substantial effort. It would be misguided to assume that one could simply "adopt a two-phase approach", mechanically execute its elements without a genuine intent to collaborate, and anticipate successful outcomes. Such an approach would inevitably lead to failure.

To enhance the two-phase delivery model and address prevalent issues in the procurement of construction projects, it's crucial to understand the holistic aspect of the model, which requires a thorough understanding of its elements, a readiness to adapt and innovate, an appreciation of the complexity of collaboration and the dynamics of the procurement process. In essence, the two-phase delivery model has the potential to address the challenges faced by the infra sector in the procurement of construction projects. However, it requires an active, cooperative, and adaptive approach from all parties involved. It's not merely a procurement strategy; it's a tool that, when used effectively, can inspire innovation, facilitate collaboration, and ultimately drive the successful execution of construction projects.

8.2 Recommendations for further research

Based on the discussion presented in chapter 7 and the conclusion in section 8.1, this section presents recommendations for further research.

1. *Exploring NEC4 and its potential for collaboration:* NEC4 contracts, an evolution of the New Engineering Contract family, emphasise mutual trust and collaboration, and could therefore offer significant potential for improving collaboration in the two-phase delivery method. Research should investigate the use and effectiveness of NEC4 in collaborative construction projects, such as the *Oosterweelverbinding* project in Antwerp, considering the benefits and drawbacks of this contract type in promoting true cost sharing and joint liability in the occurrence of risks. While the two-phase method and NEC4 contracts might not be a universal solution, understanding their potential can enhance the industry's approach to collaboration.
2. *The role of engineering consultancies in the two-phase delivery method:* With the increasing complexity of construction projects and potential lack of technical knowledge on both client and contractor sides, the role of engineering consultancies becomes more prominent. Research should examine how these firms are involved in the two-phase method and their potential role as a shared resource to support decision-making for both parties.
3. *Lessons learned from the implementation of the two-phase delivery method in regional water authorities and municipalities:* Given that this method has already been employed in regional water authorities and municipal contexts, a comparative study could yield valuable insights. Given the historical and operational differences that may influence their approaches to collaboration and risk sharing, a comparative study could be undertaken. The shared goal of long-term sustainability and water protection presents a different starting point compared to the execution of infrastructural works. Therefore, investigating the differences in strategic behaviour in these contexts compared to Rijkswaterstaat's experiences could identify potential lessons and strategies for improvement. This future research direction could contribute significantly to our understanding of the two-phase delivery method's adaptability across diverse project contexts.

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Interview protocol

A

The interview setup itself exists of a short introduction into this research, followed by the questions. The overarching themes as subtracted from the conclusion of the literature study in chapter 5.6, are the three identified issues in the procurement process in the infrasector, organisational behaviour and its manifestation on different levels throughout the project context and the two-phase delivery method as an intervention. These three themes will act as a framework for the interview. The questions as enumerated below will act as a guide. The focus, however, will lie on researching the areas of interest and the examples hereof the interviewees will provide.

A.1 Introductie

- Fijn dat u wilt meewerken aan dit interview.
- Voorstellen student en introductie van het afstudeeronderzoek.
  - Onderzoek naar twee-fasen aanpak als interventie.
  - Start van het interview behelst een verkenning naar de context van het project, de organisatie en houding van projectleden.
  - Het tweede deel van het interview is een verdiepende vorm, waar naar voorbeelden van situaties wordt gezocht, waar twee-fasen een positieve of negatieve invloed op heeft.
- Uitleggen privacybeleid
  - De geïnterviewde neemt vrijwillig deel aan het interview, is niet verplicht om vragen te beantwoorden en mag het interview ten alle tijden stoppen.
  - De naam van de geïnterviewde wordt niet genoemd in het eindrapport en de interviewresultaten worden volledig geannonimiseerd. De rol van de geïnterviewde wordt wel benoemd, om het gedrag en zienswijze vanuit die rol te verklaren.
  - Het interview wordt opgenomen en getranscribeerd, waarna de geïnterviewde de gelegenheid wordt geboden om het interview te beoordelen alvorens het wordt opgenomen in de onderzoeksresultaten.
  - Na het afronden van het afstudeerproces wordt de opname van het interview verwijderd.
  - Gaat de geïnterviewde akkoord met bovenstaande?

A.2 Interview vragen

A.2.1 Introductie en project context

1. Kunt u kort uwzelf introduceren, uw achtergrond, opleiding, ervaring in de constructie sector?
2. Kunt u kort het project introduceren en uw rol hierin?
3. In welke fase bevindt het project zich en hoe lang bent u hierbij betrokken?

A.2.2 Twee-fasen binnen de casus

4. Wat zijn de projectdoelstellingen en wat is uw rol bij het invullen hiervan? Hoe verhoudt de twee-fasen aanpak zich hierbij?
5. Heeft het projectteam zelf gekozen voor een twee-fasen aanpak als onderdeel van de projectstrategie? Wat waren hierbij de afwegingen?
6. Hoe ervaart u de relatie tussen RWS en de markt in dit project? Is deze ervaring bijgesteld naarmate het project vorderde? Heeft u daar een voorbeeld van?
7. Hoe voelt u zich in het project? Is het project goed georganiseerd? Ervaart u druk van de omgeving buiten het project? Heeft u daar voorbeelden van?
8. Hoe is de risicoverdeling in het project? Hoe ging de samenwerking met de andere partij (Rijkswaterstaat, dan wel het consortium) tijdens fase 1? Heeft het samen risico's identifieren en alloceren de samenwerking tussen beide partijen beïnvloed? Zo ja, op welke manier?
9. Kunt u uitwijden over de prijsvorming in dit project en of er, naar uw mening, een betere realisatiefase is ontstaan door de twee-fase aanpak? Kunt u dit ondersteunen met voorbeelden?
10. Heeft u voorbeelden van momenten waarop de samenwerking met de andere partij (Rijkswaterstaat, dan wel het consortium) tot spanning leidde of juist heel goed ging? Waar lag dit aan? In hoeverre zou u zeggen dat het implementren van twee-fasen hier een postive dan wel negatieve invloed op had?

A.2.3 Twee-fasen in relatie tot andere projecten

11. Zou, bij de voorbeelden die u beschrijft, een andere contractvorm dan de twee-fasen aanpak een andere uitkomst hebben verzorgd? Waarom denkt u dat? Kunt u een voorbeeld geven van een gelijke situatie waar de uitkomst anders was?
12. Zou, bij de voorbeelden dit u beschrijft, de twee-fasen aanpak de reden is voor de uitkomsten zoals u ze beschreef? Zouden er nog andere factoren onderliggend kunnen zijn? Welke andere factoren dan? Waarom denkt u dat?
13. Wat denkt u dat er nodig is om de twee-fasen aanpak te doen slagen? Kunt u uitleggen waarom u dat denkt?

A.2.4 Afsluiting

14. Heeft u nog vragen of toevoegingen? Zijn er dingen die ik heb gemist dit interview, of waar u me graag nog op zou willen wijzen?

Codebook and analysis results

B

In this appendix, a simplified representation of the co-occurrence table from Atlas.TI has been added, along with a Sankey diagram. These tools allow for statements to be made about the interaction between repeating terms and the various levels of organisational behaviour where these occur.

	Level 1 (8)	Level 2 (9)	Level 3 (4)	Level 4 (8)
Investering (16)	0	0	0	0
Werkproblemen (19)	4	1	0	1
Onduidelijkheid (10)	1	0	0	0
Aanpassingen (22)	2	0	0	0
Risico's (14)	0	0	1	0
Werkgerelate... (9)	1	0	0	0
Frustratie (11)	0	2	0	0
Risicomanage... (28)	0	0	0	0
Werkcultuur/... (27)	0	1	1	3
Communicatie... (34)	1	0	1	2
Zoekende (20)	0	0	0	0
Samenwerking (99)	0	2	2	4
Interactie (14)	2	0	0	0
Besluitvorming (11)	1	1	0	0
Twijfel/Onzek... (22)	1	0	0	2
Projectmanag... (20)	0	3	0	1
Onzekerheid (68)	1	3	0	1
Uncertainty (9)	0	0	0	0
Organisatiestr... (17)	2	0	0	0
Frustratie (2) (22)	0	0	0	0
Organisational... (27)	1	0	0	1
Management (23)	1	0	0	0
Vraagstelling (8)	0	0	0	2
Vertrouwen (15)	0	0	2	0
Emoties (25)	0	1	2	0
Zakelijk mana... (16)	2	0	0	1
Ontwikkeling (9)	1	0	0	0
Teamwork (8)	0	0	0	0
Twijfel (27)	0	1	0	1
Planning (13)	0	1	0	0
Risicomanage... (8)	0	0	0	0
Samenwerkin... (14)	1	0	0	0
Verantwoorde... (12)	0	0	0	0
Efficiëntie (15)	1	0	0	1

Figure B.1: Code Co-occurrence Diagram

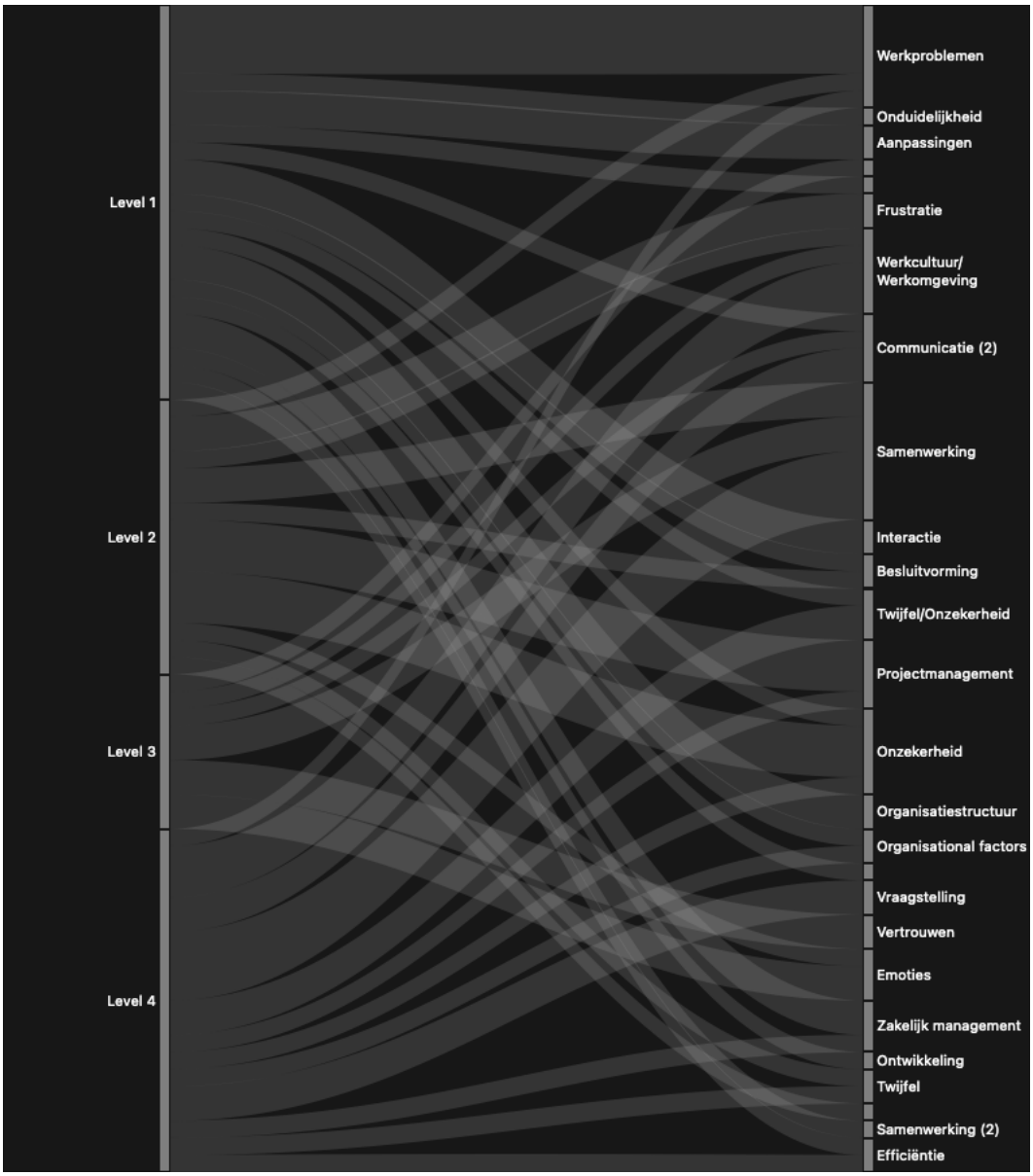

Figure B.2: Code Sankey Diagram

Expert evaluation

C

In chapter 6, the expert evaluation design is explained. The expert meetings have been divided into two sessions, according to the table below.

	ID	Organisation	Function and experience
Session 1			
Expert 1	E1.Con	Heijmans	Director; 16 years of experience in business development within the construction industry, particularly in the infrastructure sector.
Expert 2	E2.Con	TBI Infra	Director (CEO); >25 years of experience with managing mega projects, director of large infrastructural projects, chairman of the board of one of the largest construction companies in the Netherlands
Expert 3	E3.Con	AT Osborne	Senior project manager; >10 years experience with a focus on project management, contract management and strategic procurement.
Session 2			
Expert 4	E1.Cl	Rijkswaterstaat	Program director '*Market in transition*'; >10 years of experience as project manager. As director responsible for improving collaboration with market parties.
Expert 5	E2.Cl	Rijkswaterstaat	Coordinator '*Two phase delivery method*'; >30 years experience as (senior) expert on strategic procurement.
Expert 6	E3.Cl	Rijkswaterstaat	Senior Advisor ICG; > 20 years of experience as a senior contract manager for large projects. Responsible for ethical market policy and improving specialised issues related to market policy and conflicts of interest.

Table C.1: Experts' information

C.1 Set-up

The agenda and structure of the meeting were the same for both meetings with construction industry participants and Rijkswaterstaat participants.

- Welcome: Introduction of the session, its goal and the participants. *[5 min]*
- Overview of the study: research design and initial findings. *[10 min]*
- Discussion: the seven statements as listed in the next section. *[40 min]*
- Recap *[5 min]*

C.2 Statements

The statements and their origin are explained in section 6.2. Below, the Dutch translation as used in the expert evaluation can be found.

1. Rijkswaterstaat is als moederorganisatie nog niet gesteld om projecten met twee-fasen aanpak te facliteren.
2. Een top-down keuze voor twee-fasen is desastreus voor het projectverloop.
3. De twee-fasen aanpak leidt tot oud (negatief) gedrag.
4. De twee-fasen aanpak biedt ruimte voor innovatie en samenwerking.
5. De keuze voor twee-fasen aanpak is voornamelijk politiek gemotiveerd.
6. Het gebruik van werkhypothesen bij de allocatie van risico's leidt tot een betere samenwerking in fase twee.
7. De eerdere stelling "Twee-fasen biedt ruimte voor innovatie en samenwerking" werd ook bij de introductie van D&C genoemd. Het maakt blijkbaar niet uit welke contractvorm je kiest.