Phasing the Market?
A study of the first phase of Dutch public two phase ground, water and road infrastructure projects

Master thesis submitted to Delft University of Technology
in partial fulfilment of the requirements for the degree of

MASTER OF SCIENCE

in

Construction Management and Engineering
Faculty of Civil Engineering and Geosciences

by

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To be defended in public on August 31st 2023

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Acknowledgements

This report constitutes the completion of my graduation thesis and my Master's degree in Construction Management and Engineering. This marks the end of my academic journey in Delft which has been extraordinary. My time in Delft and at the TU has taught me a lot and for this I would like to express my gratitude.

In conducting this research I have learned a lot and it is only right to express my appreciation and gratitude for the people who helped me. Starting with my first supervisor Ad Straub, who was always ready to help me and provide me with interesting and insightful conversation. Research is an iterative process in which the whole picture is only revealed at the end and your guidance helped me get there. You also brought me into contact with my second supervisor Evelien Bruggeman. Your knowledge on construction law has been instrumental in completing this research and emails on certain specifics were always greeted with enthusiasm and careful consideration, thank you. To complete the TU Delft part of my commission, I would like to thank the graduation chair Bert van Wee. First for agreeing to be my chair whilst on sabbatical and second for always reading my reports. Your feedback has been a great help and an important reason for my thesis being what it is.

Furthermore, immense gratitude goes out to my supervisors Jelyn Stegewans and Wouter de Rooij for helping me set deadlines which I could work towards and always being available for meetings in which I could be challenged. Also, the access to case projects in no small part helped me complete this research.

Finally, I would like to thank my family, friends and girlfriend. Thank you for all the support, tough conversations, laughter and much needed distraction.

Now, enjoy reading!

Peer Marie van Esch
Delft, August 17th 2023

Abstract

This study investigates the effects of the first phase of the Dutch two phase process project delivery method design on the information risk, the client-contractor relationship and risk allocation between client and contractor. The two phase process is a collaborative project delivery method which is used for infrastructure projects with the objective to reduce information risk and stimulate cooperation between client and contractor. As this project delivery method is new, knowledge on the effects of the use of this project delivery method is limited.

Using desk and case study research with semi-structured interviews and an organisational behavioural theoretical lens, this exploratory research shows that the first phase of the two phase process project delivery method reduces the information risk, can make good cooperation between client and contractor possible and may help risk allocation between client and contractor. This study recommends public clients to think about the use of a two phase process project delivery method design carefully and incorporate mechanisms to end the first phase.

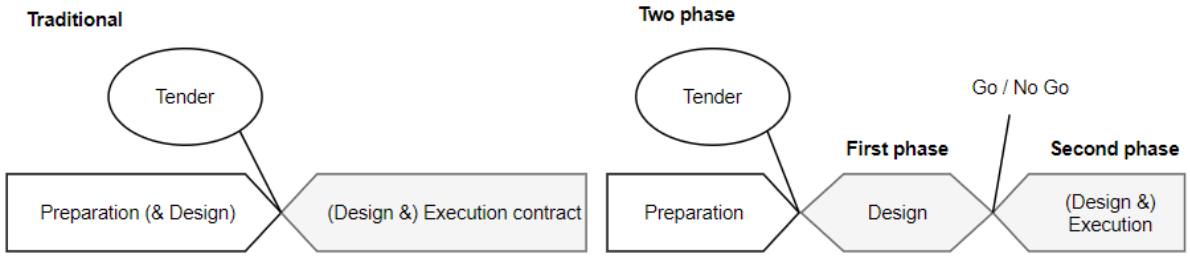
Keywords: two phase process, collaborative project delivery method, information risk, risk allocation, agency theory, stewardship theory

Summary

Following the trend of dropping bids on projects in the last decade and other challenges of the infrastructure sector the Dutch national infrastructure agency Rijkswaterstaat has called for a market transition towards a more durable market (Rijkswaterstaat, 2019). The first measure Rijkswaterstaat has identified for this goal is the use of the two phase process project delivery method. In this method the client does a joint first plan development or design phase with the contractor to reduce risks after which price setting takes place for the project. If no agreement on price can be reached then the second phase is a no go.

Figure 1

The traditional process and the two phase process



Note. Adapted from Fijneman (2020)

As can be seen in Figure 1 the two phase process project delivery method is different to traditional project delivery methods. For Rijkswaterstaat it is new, whereas some other public clients have varying degrees of experience with this type of method. It is thought to lead to better risk management through a more joint first phase which makes more information known before starting execution and therefore reduces uncertainty and financial risks (Nagelkerke & van Dijke, 2020).

The objective of this study is to see what the effects of the use of this new method are on the goals of reducing the information risk, the cooperation between client and contractor in the first phase and risk management. This way knowledge on this Dutch project delivery method is added whilst helping public clients and contractors by providing information on how to approach such projects. The main research question of this study is:

How does the two phase project delivery method design affect the information risk in the first phase and the division of responsibilities and risk allocation between client and contractor?

To answer the main research question the following sub questions have been researched:

RQ1: *Which two phase process project delivery method designs are used for the first phase?*
RQ2: *Is the information risk reduced during the first phase and, if so, how?*
RQ3: *What does the client-contractor relationship look like in practice?*
RQ4: *How are risks allocated between client and contractor?*

In order to answer these questions desk research and case study research with the use of semi-structured interviews was carried out. Case study research was done because of the exploratory nature of the study. The selected cases are from different public clients to investigate different two phase designs, but similar in challenge and from the infrastructure

sector. Furthermore, interviews have been conducted with multiple people from both the client and contractor on the researched cases. These steps ensure the findings are relevant to the research objective of the study. To further weigh the findings and their generalisability before drawing conclusions the results have been presented to experts on the two phase process.

To be able to identify what the two phase project delivery method design looks like and what characteristics it possesses, the classification of deferred price setting project delivery method designs of het Instituut voor Bouwrecht (2022) has been used. This classification helps in determining what the design is and how this affects the first phase. One of the goals of the first phase is to reduce uncertainty and identify risks. In other words to reduce the inherent information risk that exists in construction projects where an agreement is always based on assumptions regarding the project conditions (Jansen, 2021). Nagelkerke & van Dijke (2020) note that the joint first phase should reduce the uncertainty and financial risks of projects leading to better risk management. Therefore the client-contractor relationship has been researched using both agency and stewardship theory. This way the division of responsibilities between client and contractor can be investigated both on paper and in practice. Finally then, the risk allocation between the parties has been looked at to see how this is done in two phase projects.

All of these elements have been operationalised to use in the interview procedure and research of project documents. Thus it was possible to interpret what has been observed in the two case studies: Case 1 Cruquiusbrug and Case 2 Renovatie A12 IJsselbruggen. The findings of the case studies show that the joint first phase asks a lot from people in terms of openness towards the new method and willingness to work with the other party. A propensity of people on two phase projects to revert to behaviour associated with traditional project delivery methods has been observed as well as the possibility of creating an open collaborative culture during the first phase. The end of the first phase can be a grey area and point of discussion. During the first phase the information risk is reduced due to the involvement of the contractor. Different relationships between client and contractor have been observed, with case 1 showing a more agency-like relationship and case 2 a more stewardship-like relationship. The risk management is done jointly, with risks during the first phase and the second phase shared more between client and contractor than in traditional project delivery methods.

This research concludes that the first phase of the two phase process project delivery method reduces the information risk, can make good cooperation between client and contractor possible and may help risk allocation between client and contractor. The two phase project delivery method design determines the room which the people on the project have for the implementation of collaboration within the contract.

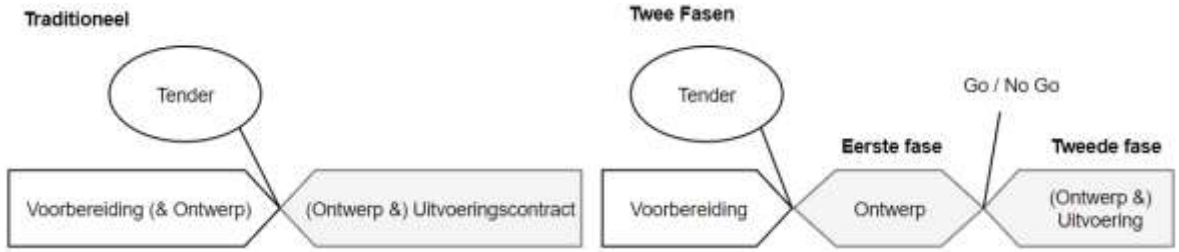
The study recommends public clients to think out the two phase project delivery method design well up front in order to manage the expectations around the collaboration in the first phase. It is important to have the right people for the first phase when considering the use of the two phase process and how to design the contract. Build room into the contract for additional research and exploration whilst also implementing a concrete mechanism to end the first phase. Finally, future research could look into how far the information risk has to be reduced during the first phase to have the desired balance between control of a project and the costs of the first phase in time and money.

Samenvatting

Als reactie op teruglopende biedingen op projecten in het afgelopen decennium en andere uitdagingen van de infrastructuursector, heeft het Nederlandse uitvoerend agentschap Rijkswaterstaat opgeroepen tot een markttransitie naar een duurzamere markt (Rijkswaterstaat, 2019). De eerste maatregel die Rijkswaterstaat voor dit doel heeft geïdentificeerd, is het gebruik van de twee fasen aanpak als bouworganisatievorm. In deze aanpak doorloopt de opdrachtgever gezamenlijk met de opdrachtnemer de eerste plannings- of ontwerpfase om zo risico's te verminderen, waarna pas de prijsbepaling voor het project plaatsvindt. Als het niet lukt om tot prijsovereenstemming te komen, wordt de tweede fase niet uitgevoerd.

Figure 2

De traditionele en de twee fasen aanpak bouworganisatievorm



Note. Adapted from Fijneman (2020)

Zoals Figure 2 laat zien, verschilt de twee fasen aanpak bouworganisatievorm van traditionele bouworganisatievormen. Voor Rijkswaterstaat is deze aanpak nieuw, terwijl sommige andere publieke opdrachtgevers uiteenlopende ervaring hebben met deze methode. De verwachting is dat het zal leiden tot betere risicobeheersing door de gezamenlijker eerste fase, waardoor er meer informatie bekend is alvorens de uitvoering begint en daardoor onzekerheid en financiële risico’s worden verminderd (Nagelkerke & van Dijke, 2020).

Het doel van deze studie is om te onderzoeken wat de effecten van het gebruik van deze nieuwe methode zijn op de doelstellingen van het verminderen van het informatierisico, de samenwerking tussen opdrachtgever en opdrachtnemer in de eerste fase, en de risicobeheersing. Op deze manier wordt er kennis over deze Nederlandse bouworganisatievorm toegevoegd, terwijl publieke opdrachtgevers en opdrachtnemers worden geholpen met informatie over hoe dergelijke projecten kunnen worden aangevlogen. De onderzoeksvraag van deze studie is als volgt:

Hoe beïnvloedt het ontwerp van de twee fasen bouworganisatievorm het informatierisico in de eerste fase en de verantwoordelijkheidsverdeling alsmede de risicoallocatie tussen opdrachtgever en opdrachtnemer?

Om deze hoofdvraag te beantwoorden zijn de volgende deelvragen onderzocht:

DV1: *Welke ontwerpen van de twee fasen aanpak bouworganisatievorm worden er gebruikt voor de eerste fase?*
DV2: *Wordt het informatierisico verminderd tijdens de eerste fase, en zo ja, hoe?*

DV3: *Hoe ziet de relatie tussen opdrachtgever en opdrachtnemer er in de praktijk uit?*
DV4: *Hoe worden risico's verdeeld tussen opdrachtgever en opdrachtnemer?*

Om deze vragen te beantwoorden is deskresearch en case study onderzoek met behulp van semigestructureerde interviews uitgevoerd. Vanwege de exploratieve aard van het onderzoek is casestudy-onderzoek toegepast. De onderzochte cases zijn projecten van verschillende publieke opdrachtgevers om zo verschillende twee fasen aanpak bouworganisatievormen te onderzoeken, maar zijn vergelijkbaar qua opgave en komen beide uit de infrastructuursector. Er zijn interviews gehouden met meerdere personen van zowel de opdrachtgever als de opdrachtnemer van de onderzochte projecten. Deze stappen zorgen ervoor dat de bevindingen interessant en relevant zijn voor het doel van het onderzoek. Om de bevindingen verder te wegen en hun generaliseerbaarheid te beoordelen alvorens het trekken van conclusies, zijn de resultaten voorgelegd aan experts op het gebied van de twee fasen bouworganisatievorm.

Om vast te kunnen stellen hoe het ontwerp van een twee fasen bouworganisatievorm eruitziet en welke kenmerken het kan hebben, is gebruikgemaakt van de classificatie van uitgestelde prijsbepaling bouworganisatievormen van het Instituut voor Bouwrecht (2022). Deze classificatie helpt bij het bepalen van het ontwerp en hoe dit de eerste fase beïnvloedt. Een van de doelen van de eerste fase is het verminderen van onzekerheid en het identificeren van risico's. Met andere woorden, het verminderen van het inherente informatierisico dat bestaat in bouwprojecten waarbij een overeenkomst altijd gebaseerd is op aannames met betrekking tot de projectspecifieke omstandigheden (Jansen, 2021). Nagelkerke & van Dijke (2020) merken op dat de gezamenlijke eerste fase de onzekerheid en financiële risico's van projecten zou moeten verminderen, wat leidt tot betere risicobeheersing. Daarom is de relatie tussen opdrachtgever en opdrachtnemer onderzocht aan de hand van zowel agency theorie als stewardship theorie. Op deze manier kan de verantwoordelijkheidsverdeling tussen opdrachtgever en opdrachtnemer zowel op papier als in de praktijk worden onderzocht. Tot slot is er gekeken naar de verdeling van risico's tussen de partijen om te zien hoe dit in zijn werk gaat in twee fasen projecten.

Al deze elementen zijn geoperationaliseerd voor gebruik in het interviewprotocol en het onderzoeken van projectdocumentatie. Hierdoor was het mogelijk om de observaties uit de twee casestudies, Case 1 Cruquiusbrug en Case 2 Renovatie A12 IJsselbruggen, te interpreteren. De bevindingen van de casestudies tonen aan dat de gezamenlijke eerste fase veel vraagt van mensen. Zij moeten open staan voor de nieuwe methode en bereid zijn om met de andere partij samen te werken. De neiging van mensen op twee fasen projecten om terug te vallen in gedrag dat wordt geassocieerd met traditionele bouworganisatievormen is geobserveerd, evenals ook de mogelijkheid om een open samenwerkingscultuur te creëren tijdens de eerste fase. Het einde van de eerste fase kan een grijs gebied en discussiepunt zijn. Tijdens de eerste fase wordt het informatierisico verminderd door de betrokkenheid van de aannemer. Verschillende relaties tussen opdrachtgever en opdrachtnemer zijn waargenomen, waarbij case 1 een relatie vertoonde die meer lijkt op agency, terwijl case 2 meer neigde naar een relatie zoals stewardship. Risicobeheersing wordt gezamenlijk uitgevoerd, waarbij risico's tijdens de eerste en tweede fase meer gedeeld worden tussen opdrachtgever en opdrachtnemer dan bij traditionele bouworganisatievormen.

De conclusie van dit onderzoek is dat de eerste fase van twee fasen bouworganisatievormen het informatierisico vermindert, goede samenwerking tussen opdrachtgever en opdrachtnemer mogelijk maakt en kan bijdragen aan de toewijzing van risico's tussen opdrachtgever en opdrachtnemer. Het ontwerp van de twee fasen bouworganisatievorm bepaalt de ruimte die de betrokkenen op het project hebben voor de implementatie van samenwerking binnen het contract.

Dit onderzoek raadt publieke opdrachtgevers aan de twee fasen aanpak bouworganisatievorm van tevoren goed te doordenken om de verwachtingen rondom de samenwerking in de eerste fase te beheersen. Het is belangrijk om na te gaan of de organisatie de juiste mensen (beschikbaar) heeft wanneer het gebruik van de twee fasen bouworganisatievorm wordt overwogen en bij het opstellen van het contract. Creëer ruimte in het contract voor aanvullend onderzoek en verkenning, maar bouw ook een concreet mechanisme in om de eerste fase te eindigen. Tot slot zou toekomstig onderzoek kunnen kijken naar hoe ver het informatierisico verminderd moet worden tijdens de eerste fase om de gewenste balans te bereiken tussen projectbeheersing en de kosten van de eerste fase in termen van tijd en geld.

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Tables and Figures

Translations and definitions

To add clarity to and help in reading the report various terms have to be translated and defined. In Table 1 below a list of the terms used in this report is presented, alongside the Dutch term if it is a translation, as well as their definitions. As a lot of the terminology is translated from Dutch and the scientific literature itself operates with a jungle of terminology (Engebø et al., 2020), this clarification is needed. Important terms and concepts are also explained in the main body of text itself.

Table 1

English terms with their original Dutch translation and definitions

English term	**Dutch term**	**Definition / Description**
Authority	Bevoegdheid	The legal right or ability to control or do something
Award(ing)	Gunning	The contract for the project or project phase is given (awarded) to a contractor
Brief	Programma van Eisen	Document that states the functional requirements for the project design
Contractor	Aannemer	Construction company that bids on and/or has won a tender
Consortium	Consortium	Group of enterprises/contractors which exists for the duration of a project
Construction company	Bouwbedrijf	Company that constructs and/or designs projects
Consultant	Adviseur	A party or person which is contracted to consult, often an engineering firm
Cost-plus contract	Werk op/in regie	Actual costs made by the contractor are reimbursed plus a margin of profit, not a fixed fee (AMS Advocaten, 2023)
Deferred price setting	Uitgestelde prijsbepaling	The (final) price of a project contract is deferred until after the first phase is complete; an initial, target or no price is set at the first contract between client and contractor
Definitive design	Definitief Ontwerp (DO)	Elaborates on the preliminary design. Includes how to realise the design.
Engineering firm / Consultancy firm with engineering expertise	Ingenieursbureau	A party which has engineering know how and advises and assists in this field
Environmental /	Omgevingsfactoren	Conditions like: geotechnical soil

Project conditions		conditions, factual conditions of buildings and infrastructures in proximity to the site, other stakes of third parties impacted by the project (Jansen, 2021)
Execution design	Uitvoeringsontwerp (UO)	Design which will be executed. Follows a definitive design and is used to communicate with subcontractors.
General Data Protection Regulation	Algemene Verordening Gegevensbescherming	European privacy and security regulation
High Water Protection Programme	Hoogwaterbescherming sprogramma	Alliance of the Water Boards of the Netherlands and Rijkswaterstaat to help in fulfilling the high water protection programme in order to protect The Netherlands (HWBP, 2022b)
Institute for Construction Law	Instituut voor Bouwrecht	An independent research centre focussed on Dutch public and private construction law (Instituut voor Bouwrecht, 2023)
Integral Project Management (IPM)	Integraal projectmanagement	A project management model introduced by Rijkswaterstaat which has five managerial roles: project management, project control, environmental management, technical management and contract management (Ministerie van Infrastructuur en Waterstaat, 2023)
Liability	Aansprakelijkheid	The fact that someone is legally responsible for something (Cambridge University Press & Assessment, 2023a)
Ministry of Infrastructure and Water Management	Ministerie van Infrastructuur en Waterstaat	Dutch ministry responsible for traffic and water management, spatial planning and quality of life in The Netherlands (Rijksoverheid, 2023a)
Model Agreement Bouwteam DC 2020	Modelovereenkomst Bouwteam Duurzaam Gebouwd (DG) 2020	This model agreement sets out how the relationship between client and contractor is set up for cooperation in a Bouwteam (Duurzaam Gebouwd, 2021)
(a) One-on-one	Bila(teraal overleg)	Bila, meaning bilateral, is a one-on-one meeting
Preliminary design	Voorlopig Ontwerp (VO)	Based on the brief, first design sketches.

Price setting	Prijsbepaling	The actual price setting/determination
Process of price setting	Prijsvorming	Process of negotiation on the price
Project delivery method	Bouworganisatievorm	Project delivery methods are defined by Engebø et al. (2020) as a system which provides in the organising and financing of design, construction and maintenance in order to deliver a good
Public client	Publiek opdrachtgever	Government or governmental agency which contracts parties for a service
Reference design	Referentieontwerp	Design made to check if a design is possible based on the requirements
Resolutive condition	Ontbindende voorwaarde	A condition which terminates a right or obligation if a certain specified event occurs (cf suspensive condition) (LexisNexis, 2023a)
Rijkswaterstaat predicate green for the project estimate price	Rijkswaterstaat predicaat groen voor de kostenpooltoets	A mandatory test on project cost estimates done within Rijkswaterstaat by a pool of internal independent cost experts: the predicate green signals the test is passed (Janssen, van der Mark, Metzlar, Mulder, & Overgaauw, 2021).
Service contract	Dienstencontract	Contract for the delivery of one or more services or products
Suspensive condition	Opschortende voorwaarde	A condition that prevents an obligation arising unless and until a specific future event, certain or uncertain, occurs (cf resolutive condition) (LexisNexis, 2023b)
Task-based budget	Taakstellend budget	This budget is based on estimates for the tasks for which it is set up. The budget is fixed
Technical specifications	Bestek	Technical description of the project design and the works that will be carried out to execute it
TNR 2011	De Nieuwe Regeling 2011	The New Rules is a set of general conditions for consultants in construction processes (Chao-Duivis et al., 2018)
UAC 2012	UAV 2012	The ‘Uniform Administrative Conditions’ of 2012 (Chao-Duivis et al., 2018). A set of rules that can be used

		for contracts in construction. Often used in traditional construction processes.
UAC-IC 2005	UAV-GC 2005	The ‘Uniform Administrative Conditions for Integrated Contracts’ of 2005 (Chao-Duivis et al., 2018). A set of rules that can be used for contracts in construction. Used for integrated contracts.
Water Board	Waterschap	Regional governing body in the Netherlands that manages water surface in the area. Also known as Water Council and Water Authority

Multiple abbreviations are used throughout this thesis. In Table 2 a list of these abbreviations and their full version is shown.

Table 2

List of abbreviations and their meaning

GWR	Ground, Water and Road
HWPP	High Water Protection Programme
IPM	Integral Project Management
PDM	Project Delivery Method
TNR	The New Rules
UAC	Uniform Administrative Conditions
UAC-IC	Uniform Administrative Conditions - Integrated Contracts

1 Introduction

1.1 Context

In the last few years the amount of bids on tenders concerning large ground, water and road (GWR) infrastructure projects in the Netherlands has dropped. On projects over 250 million euros, the Dutch national infrastructure agency Rijkswaterstaat, has seen the average number of bids drop, from 3.0 in 2010-2014 to 2.5 in 2018 (Rijkswaterstaat, 2019). Especially on larger complex infrastructure projects the contractors 'up front' profit and risk margins have not been sufficient to cover the materialisation of risks, leading to big financial setbacks. In their recent report on future challenges Rijkswaterstaat (2019) notes that market competition for public construction projects is in danger of being lost, if the current market dynamic and risk management with regards to complex projects does not change. "If this trend continues, this could lead to the danger of no bids on large complex projects and failure to fulfil the societal task" (Rijkswaterstaat, 2019, p. 29).

Important context for the danger to market competition and the consequences of reduced competition is the growth of the total Dutch construction sector and the ground, water and road sector along with it. This GWR sector was projected to grow from 18 to 21 billion euros from 2018 to 2023 (Rijkswaterstaat, 2019, p. 9). Due to Covid-19 and the nitrogen crisis this growth has been less rapid, but the root causes for the growth and the need for infrastructure projects have not changed. Whilst the sector grows, the return on projects of the construction sector of the Netherlands is lower than the European average and the profits of the GWR are lower still than the Dutch construction average (Rijkswaterstaat, 2019, p. 10). This means that there is limited room for financial setbacks before contractors start to make a loss and this (high) sensitivity to project risks and uncertainties is reflected in the amount of bids on tenders. On top of this, only a few contractors and consortiums make up a large part of the market. The ten largest Dutch construction companies accounted for around 50% of GWR revenue from 2014-2017 (Rijkswaterstaat, 2019). This makes the GWR sector dependent on these contractors, especially on larger projects.

The main challenges for the GWR sector that are identified in the 2019 Rijkswaterstaat report:

1) Market competition could be lost if the market dynamic does not change:
    a) The current market dynamic stimulates potential contractors to not fully appraise risks in their price
    b) The current way of contracting reduces the appeal of the GWR sector (for contractors)
    c) Calamities can lead to financial damages which threaten the continuity of contractors
    d) Rijkswaterstaat has reduced its competencies/knowledge over the last two decades. This decline in knowledge, know-how and capacity is also identified in water boards by Significant Energy (2023).
2) There is potential for improvement in the construction industry which is not utilised (Rijkswaterstaat, 2019):
    a) Productivity in the construction industry is lower than in other industries
    b) There are multiple barriers which hinder innovation
    c) Cooperation with other industries is needed for technological innovation

The GWR sector has to change to safeguard the fulfilment of the societal task. On top of the CO2 reduction of 49% in 2030 compared to 1990 which has been agreed upon in the Paris Climate Agreement, Rijkswaterstaat has the goal to do 100% circular works in 2030. The Ministry of Infrastructure and Water Management wants to be climate neutral in 2030 and other Dutch governments also set emission reduction goals (Rijksoverheid, 2023b). This means that public clients within the GWR sector have societal, technical and market goals in infrastructure projects that they undertake.

Following these trends and challenges the Rijkswaterstaat report calls for a market transition towards a more durable market in order to stem the tide (Rijkswaterstaat, 2019). Four measures are identified to help in changing the market dynamic. These measures are based on experiences and analysis of the current market. This research focuses on one of these measures, called the two phase process.

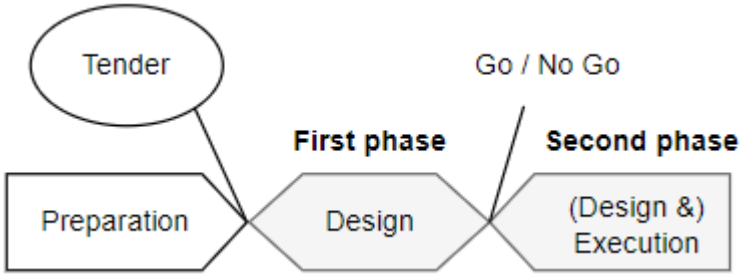
The two phase process

The first measure to help transition away from the existing market dynamic states: “Selectively reduce risks by way of a joint design phase after which price setting takes place” (Rijkswaterstaat, 2019, p. 36). This way of contracting has been called the two phase process. The two phase process is a project delivery method which differs from the project delivery methods which have traditionally been used by public clients. For Rijkswaterstaat this type of project delivery method is new, whilst some other public clients such as water boards have varying degrees of experience with this type of process.

In a two phase process the price for (risky parts of) the second phase, (design &) execution, of the project is determined after completion of the first phase, plan development and/or design. Furthermore, the first phase is done more jointly in a collaborative way with the contractor compared to traditional project delivery methods. This means that more information is known and this should reduce uncertainty and financial risks leading to better risk management (Nagelkerke & van Dijke, 2020). This importance is great as “the identification of risks resulting from design and construction is an essential task early in a project” (Degn Eskesen et al., 2004, p. 220). Gaining information should help in reducing information risk, which is important in improving the contractors outlook. Jansen (2021) defines information risk as the problematic inherent trait of construction projects that the execution agreement between client and contractor is based on assumptions regarding the (f)actual state which the project specific environmental conditions are in. In Figure 3 below a schematic representation of the two phase process is given.

Figure 3

Schematic representation of the two phase process



Note. Based on Fijneman (2020)

From Rijkswaterstaat (2019) and Jansen (2021) a couple features of the two phase process are clear. There has to be a break or cut-off between the first phase and the second phase. Here a go or no go decision is made on the contract between client and contractor for the second phase. Another important characteristic is whether there is deferred price setting with a definitive price set after the first phase. Huith (2021) describes a couple of manners in which the two phase process is organised. Most forms of the two phase process share quite some similarities. They mostly differ in how the first phase is set up and what this means for the price determination, price setting and the second phase. The role of the contractor in the first phase and the type of contracting play a large part in what responsibilities which party carries into the second phase. These variations in how the two phase process project delivery method is designed are discussed in section 3.1.

The drivers for use of the two phase project delivery method are reflected in the characteristics of the design of the method itself:

- Increased expertise from the market by involving contractors from the design phase on, or possibly even earlier. Compensating for the loss in competencies and knowledge which has taken place within public clients (Rijkswaterstaat, 2019; Significant Energy, 2023).
- Cooperation between client and contractor is stimulated, at least on paper, by collaborating during the first phase
- Risks are better known and appraised as there is less incentive and opportunity to hide risks by the contractor.
- Deferred price setting in order to have more certainty about the design which should in theory help reduce or even prevent critical losses.

All of this is designed to help in the market transition towards a more durable market, where tenders receive enough bids and contractors run a lesser risk of toppling because of the contracting method.

1.2 Problem statement

When reading recent reports and news articles on the two phase process it becomes clear that hopes are high for this new project delivery method (Nagelkerke & van Dijke, 2019; Chao-Duivis, 2019; Rijkswaterstaat, 2019). However, since a limited number of two phase projects

have been completed or have even completed phase one, a lot is still unknown. There are the first reports and hypotheses about how the structure of these types of contracts provide incentives for certain types of behaviour by the client or the contractor (Economisch Instituut voor de Bouw, 2023; Significant Synergy report, 2023; Werkgroep 2-fasen aanpak, 2023), but so far it remains only the first beginnings. This means that there is room to add to the knowledge about and around this type of contracting by investigating what is (actually) happening in these projects now that some of them are further along. Especially since research reports and evaluations published by or for clients themselves mostly focus on their own projects, not on projects of multiple clients. The overarching question is if and how successful the two phase process method is in reducing risk and improving price setting. This study starts to help answer this question by looking at how these project delivery method designs translate in the cases that have been researched. This investigation can thus provide a starting point for further research on the two phase process project delivery model.

1.3 Research objective

The two phase process project delivery method is a recent development in the Netherlands and new for the public clients that employ it. It has developed to tackle the challenges that construction processes and the GWR sector face. Therefore, it is interesting to look at what the effects of the use of these methods are on the stated goals so far. By taking the report of Rijkswaterstaat (2019) on future challenges as a jumping off point questions about the method and the reasons for its implementation arise. What does the cooperation in the joint design phase look like? Is information risk reduced during the first phase? Are there differences across different forms of the two phase process project delivery method? This research aims to make a start in investigating these questions around this project delivery method.

Scientific relevance

The knowledge on the various two phase process project delivery methods is new and limited. The classification of various two phase process project delivery method designs by the Institute for Construction Law (Instituut Voor Bouwrecht, 2023) is a first step towards identifying and classifying the project delivery methods. The effects of the various designs on the responsibilities and risks within the process are not fully known. By researching this form of a collaborative project delivery method it is possible to add knowledge on these effects within this type of method in the Dutch context to the existing body of knowledge on project delivery methods.

Societal relevance

The, previously dominant, manner of contracting in the GWR needs to change. This is reported by agencies themselves and evidenced by the drop off in bids on tenders. As this change is happening through and being helped forward by the two phase process project delivery method knowledge on this method and its variations is still limited. Especially, the practical application and approach of the underlying agreements is interesting to look at. Knowledge and indications on how the two phase process and the agreements used work in helping (or not) with the goal of reducing uncertainty can help policy makers and people working for clients and contractors in how to approach projects in the GWR sector.

1.4 Scope

This research focuses on the first phase of the two phase process project delivery model. The second phase process is not taken into consideration. The end of the first phase dictates when and under what conditions the second phase starts, but the course of the second phase itself is outside the scope of this research. The reasoning for this is twofold. Firstly, the first phase is the most consequential one of the two when looking at the difference with other project delivery methods. This phase dictates how the client and the contractor design the project, divide responsibilities and identify risks before proceeding to set a price and start the second phase. It sets the (process of) risk allocation between the parties and how future (un)expected events can or need to be dealt with. Therefore, this phase is determinative for the information risks and how these are managed. The second reason is that currently too few two phase projects are fully completed. This means that it is not yet feasible to fully research the second phase of the two phase process project delivery method.

A more certain price that appraises risks correctly through deferring the price setting until after the joint first phase is an important driver for the use of the two phase project delivery method (Rijkswaterstaat, 2019). This research does not investigate the price setting in two phase projects directly, but looks at the information risk, relationship between client and contractor in the first phase as well as the risk allocation to see how these variables are affected by the design of the first phase. These variables relate to other drivers for the use of the two phase PDM such as involving the expertise of the contractor, stimulating the cooperation between client and contractor and the increase in project specific knowledge and risk identification. This way they tell something about how the first phase works. The deferred price setting is an important part of the two phase project delivery method but not the focus of this research. The focus lies on the effects on the relationship between client and contractor and risk management, which inform the price setting.

A deferred price setting construct like the two phase process delivery method can be classified as a type of early contractor involvement. Early contractor involvement is a type of project delivery method in which the contractor gets involved earlier than in traditional construction project delivery methods, early in the process (Wondimu et al, 2016). The place within and connection to early contractor involvement of the two phase PDM is not the focus of this research and lies outside the scope of the study. In order to not overly complicate the focus of the study therefore, early contractor involvement is not a part of this report.

1.5 Research questions

This research aims to gain knowledge on, and insight into, how the collaborative relationship between client and contractor seen in the two phase process project delivery method in the Netherlands affects the information risk, division of responsibilities and risk allocation in projects. This research aim leads to the following research question:

How does the two phase project delivery method design affect the information risk in the first phase and the division of responsibilities and risk allocation between client and contractor?

In order to investigate how the information risk is managed as well as how responsibilities and risks are divided, it is necessary to look both at the agreements on paper and how the

relationship plays out in practice. To help answer the main research question, sub research questions have to be researched.

RQ1: *Which two phase process project delivery method designs are used for the first phase?*
In order to research how the design of the first phase affects information risk, division of responsibilities and risk allocation first the various possible designs need to be mapped out. By looking at the different designs of the two phase process and the contract types used it has been possible to form a picture of the landscape. Some designs put more of the responsibilities on the client and others on the contractor. Within this landscape the two phase process has been researched and designs of the first phase explored. Different two phase project delivery method designs and contracts dictate how parties work together, at least on paper. In order to research how practice actually relates to paper, knowledge of the paper and therefore the various designs and contracts is needed.

RQ2: *Is the information risk reduced during the first phase and, if so, how?*
In order to see if more knowledge is gathered and risks are identified in the first phase. The identification of risks during the first phase is essential in order to reduce the risk of unexpected circumstances arising during the execution phase, before the execution phase starts.

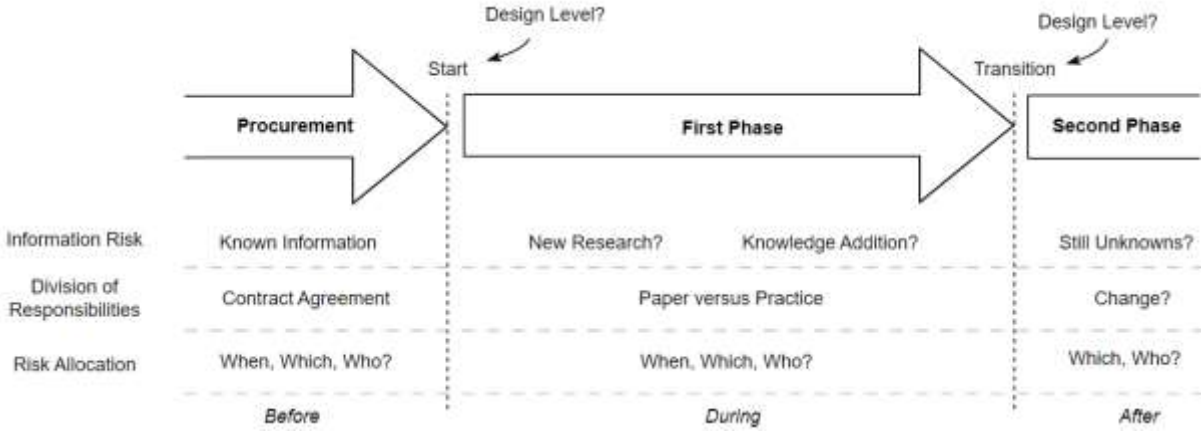
RQ3: *What does the client-contractor relationship look like in practice?*
To investigate how the design of the first phase affects responsibilities in the first phase and for the second phase, as well as how and which information gets shared between the parties it is important to look at the working relationship in practice. On paper responsibilities might get divided one way, but the roles client and contractor assume can differ. Chao-Duivis (2019) notes that the chosen project delivery method and contract type does not always align with how clients naturally tend to behave. Therefore, this relationship needs to be looked at in order to see what it is actually like and answer how this relates to the chosen method and contract. To do this a 'lens' through which to view the relationship has been established from the existing literature.

RQ4: *How are risks allocated between client and contractor?*
In order to see what is done with the risks that are identified and with possible information risks which have presented themselves. These can't be allocated as such, but they can be covered under risk allocation. One of the principal goals of implementing two phase processes is the reduction of risks before starting the second phase and comes from the issues stemming from unmanageable risks that the contractor has to bear.

Figure 4 shows the conceptual model of the research.

Figure 4

Conceptual model of the research



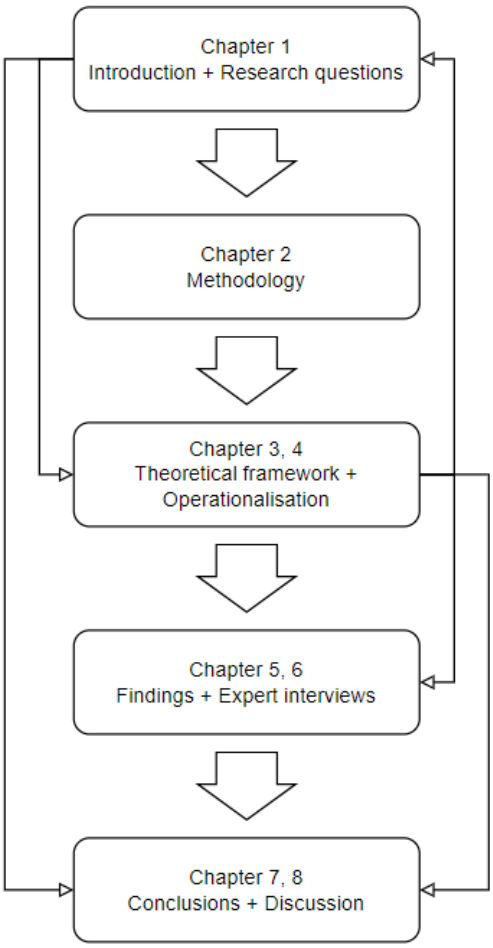
Note. Conceptual model of the scope of this research. The first phase is researched on the variables information risk, the division of responsibilities and risk allocation.

1.6 Thesis outline

After the introduction and the research questions have been presented this thesis has the following set up. First, the methodology of the research is discussed. This chapter features both an explanation of the methods used as well as a presentation of the way in which they have been used. Second, information which has been collected in a literature search will be presented. This will cover four main topics. The first is the two phase process delivery method designs, the second is the information risk, the third is on collaborative project delivery methods through the stewardship and agency theory lens and finally the fourth is risk management and allocation. Third, the cases which have been researched are discussed and the results presented. To finish, conclusions are drawn and the research and its implications are discussed in the discussion chapter. Figure 5 below shows the thesis outline.

Figure 5

Thesis outline



2. Methodology

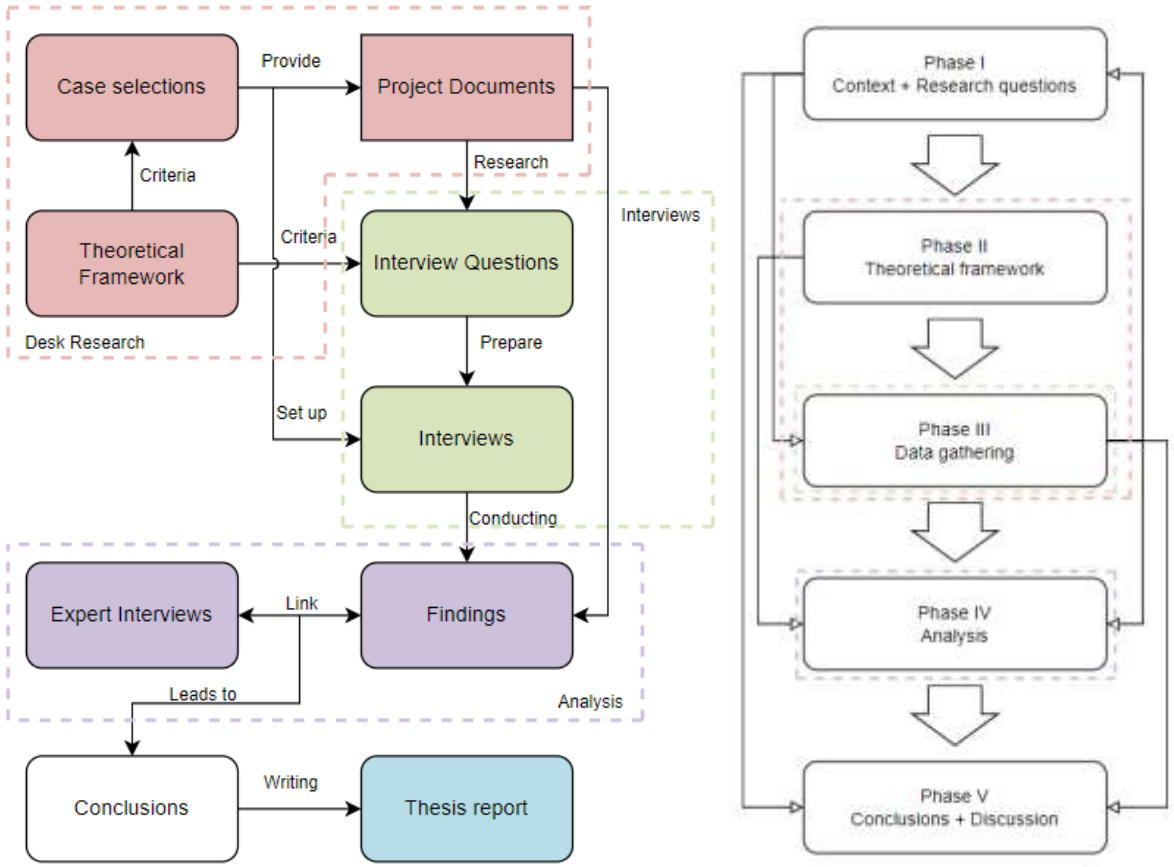
In this chapter the methodology of the study is presented. First the design of the research is provided along with reasoning as to how this helps answer the research questions. The choices made on how the research has been carried out are then further explained and substantiated. After this the case selection and operationalisation of theories and concepts needed to perform the case studies is given.

2.1 Research design

In the figure below the research design is presented. Research is an iterative process in which by learning more on the subject the process itself changes. There are, however, five phases which can be distinguished in this report and in how the research has been conducted. The first phase consists of setting the context and formulating the research questions. In the second phase the literature and existing knowledge is mined to shape the framework by and from which to gather data. In the third phase data is gathered, from grey literature, project documents and interviews. The fourth phase consists of analysing this data and finally in the fifth phase the conclusions are drawn and presented. Important to note is that these are rough phases and due to the iterative nature of research cannot be viewed as completely sequential and separated in time. These phases form the general research design which is presented in Figure 6 below.

Figure 6

Research design flow diagram and research phases



Note. The inputs, activities and outputs of the research presented in a flowchart.

As can be seen in Figure 6 this exploratory research makes use of various qualitative research methods to answer the research questions. RQ1 relating to the various PDM designs is investigated through the use of desk research and checked in the case studies. RQ2, RQ3, RQ4 are mostly investigated in the case studies, through desk research on project documents and interviews conducted with people involved. The research done on the data gathered is based on the theoretical framework constructed. The methods used are desk research, case study research and interviews. In the following sections these research methods are discussed and the way they have been applied is presented.

2.2 Desk research

This research made use of desk study to aid in the study of the two phase project delivery method. Desk research is a form of secondary research in which existing data and sources are collected and reviewed in order to learn about and gain insight into the area(s) of interest. This means the research of information that consists of sources and data that has been collected by others (Stewart & Kamins, 1993). In order to carry out this research knowledge was needed on various topics and theories. Desk study helped in systematically investigating: firstly, relevant concepts and theories on uncertainty and risk management. Then Dutch contracts and the two phase project delivery method designs. Followed by research on collaborative project methods and agency as well as stewardship theory. Finally desk study was performed on project documents and other grey literature as part of the case studies and to perform interviews.

The literature study was carried out to find out what ideas and concepts exist in and around project delivery methods as well as risk management in construction projects. These concepts are explored in order to answer the research questions. Various search engines have been used and literature databases explored. For each concept different search terms were employed. Below a table, Table 3, is provided showing the subjects of interest and the search terms used as well as the databases consulted.

Table 3

Design of the literature search

Concept	**Research relevance**	**Search engine and source**	**Search terms**	**Sources used**
Two phase process and Dutch contracts	RQ1, RQ2, RQ4	Bouwkunde Library, Google, TU Library, Dutch civil code (book 7)	Twee fasen aanpak, Twee fasen proces, Twee fasen contracten, Dutch building contracts	Chao-Duivis (2019), Chao-Duivis et al. (2018), Fijneman (2020), Huith (2021), Jansen (2021), Leloup (2016), Nagelkerke and van Dijke (2020), Rijkswaterstaat (2019), Significant Synergy (2023), Wermer (2018)

Risk, Uncertainty and Risk management	RQ2, RQ4	Google, Google Scholar, Scopus	Risk management, Risk management construction project, “Risk management” AND “construction projects”, Risk management infrastructure	Abrahamson (1984), Deane (2021), Degn Eskesen et al. (2004), de Ruijter and Guldenmund (2016), ISO (2018), Leloup (2016), Management Yogi (2019), Tah and Carr (2000), Rumsfeld (2002), Wondimu et al. (2016)
Construction process / Project delivery methods	RQ1, RQ3	Google Scholar, Scopus	Project delivery methods, “Collaborative project delivery methods”	Engebø et al. (2020), Kent and Becerik-Gerber (2010), Oakland and Marosszeky (2017)
Agency theory	RQ3	Google Scholar, Scopus	Agency theory, Agency theory review, Principal-agent theory construction	Arrow (1984), Bryde et al. (2019), Ceric (2012), Chrisidu-Budnik and Przedańska (2017), Eisenhardt (1989a), Jensen and Meckling (1976), Panda and Leepsa (2017), Schillemans and Bjurstrøm (2020),
Stewardship theory	RQ3	Google Scholar, Scopus	Stewardship theory, Stewardship theory review	Corbetta and Salvato (2004), Davis et al. (1997), Donaldson (2008), Hernandez (2012), Maslow (1943), Schillemans and Bjurstrøm (2020)

Note. Here the search terms are presented as well as the results which have been used for this research.

These search terms returned articles on the concepts of interest. These articles, including systematic reviews on some of the subjects, have subsequently been used to find other papers and reports of interest. This method is known as the snowball method or citation chaining and is much used in various fields of research (Ellis, 1993). Desk research was also used to collect relevant policy and judicial literature as well as other grey literature on the two phase project and the cases which have been researched. As such desk research was necessary and instrumental in exploring the literature, operationalising theories and investigating project documents.

2.3 Case study research

The goal of this study is not to build or test theory, but to explore a phenomenon and interpret what information is discovered. To do this multiple case studies have been carried out. Case

study research is a research method that is widely used and accepted within social sciences (Zainal, 2007). The case study method is fitting for a descriptive and exploratory research, where what happened and how is researched (Shavelson & Towne, 2002; Yin, 2009). It is defined by Seawright and Gerring (2008, p. 296) as “the intensive analysis (qualitative or quantitative) of a single unit or small number of units (the cases), where the researcher’s goal is to understand a larger class of similar units.”. By looking at various examples of the use of the two phase process project delivery method in projects it is possible to say something about what this use could mean for the selected variables of interest in other two phase projects. To do this successfully the selection of cases is important, as these dictate what information is gathered, from how broad a source and therefore how inferable possible conclusions are.

2.3.1 Case selection criteria

When performing any task, but especially research, within limited time, a trade-off has to be made. In this case a trade-off between the amount of cases and the depth of research. Although researching all two phase projects which have been completed or are currently ongoing would be the most complete, a selection has been made in order to make the research viable in terms of time and money whilst upholding the quality and generalisability of the conclusions. In this way it is possible to go in depth and research them fully.

Seawright and Gerring (2008) provide multiple methods for selecting cases to use in case study research. They state that selecting cases purely at random leads to problems when the number of cases in the case study research is small. Eisenhardt (1989b) agrees that random selection is not preferable. Employing pure pragmatism on the other hand is also problematic and therefore Seawright and Gerring (2008, p. 296) offer seven techniques to purposely make a case selection. Depending on the goal of the research, the nature of the cases and the amount of cases that are researched the selection of cases will vary.

Looking at Seawright and Gerring (2008) it becomes clear that the scope and goals of the research help when and in making this selection. Case selection in case study research has two objectives: “... (1) a representative sample and (2) useful variation on the dimensions of theoretical interest.” (Seawright & Gerring, 2008, p. 296). Determining what constitutes a representative sample is difficult to do. In selecting the cases this objective has been strived for by studying two phase projects from different public clients. To help in achieving the second objective this research used theoretical sampling for the case selection. This means that the choice of cases is based on theoretical reasons. In this case to differentiate in the two phase design and type of contract used for the first phase. By viewing the research goals and underlying theory with this in mind the case selection criteria have been created.

Criterion 1: the selected cases have different two phase project delivery method designs and contract types for the first phase. This has been chosen as a criterion to be able to see what the effect of the contract is on information risk, the division of responsibilities and risk allocation. To further increase the generalisability of the results and conclusions of the case studies, projects from different public clients have been selected. Whilst this adds more variables to the mix making the research more complex it is necessary for two reasons. The first is that the same public client either uses the same type of contract for all of their two phase projects, thereby making differentiating on contract type impossible within projects of the same client, or a public client has not yet completed more than one two phase project. This means

projects from different public clients have to be selected in order to research different contract types for the first phase. The second reason is that even though it makes the interpretation of results more complex by adding more interferences and explanatory factors in the mix, it also makes the results more true to the reality by laying bare these factors. Factors which could also explain the results and otherwise might have been overlooked. This supports the generalisation of results, which is justified by sufficiently different cases (Shavelson & Towne, 2002).

Criterion 2: the first phase of the project is completed. Pragmatically, for this research the first phase needed to be completed in order to be usefully researched. The variables which are the focus of this research, like the division of responsibilities and risk allocation for the second phase, would not be fully researchable in case the first phase is not completed. This is due to the possibility of the process changing during the first phase. It is for instance imaginable that certain risks are discovered which uproot the plans made or that the responsibility division in practice changes due to the process of moving towards the end of the first phase. Therefore, a selected case needed to have the first phase completed in order to not limit possible discoveries on the first phase process too much.

Criterion 3: the case project has to be an GWR infrastructure project. This criterion is implemented in order to have somewhat similar types of projects. This is needed because the motivation for the use of this type of project delivery method comes from trends and issues seen in the ground, water and road sector.

Criterion 4: the projects deal with a similar challenge. This criterion helps in possibly reducing the number of different factors that influence the projects and areas of study by having more of these be the same or similar across the cases.

Criterion 5: multiple relevant interviews (see 2.3.2) with both the client and contractor are possible and available on time. This is a pragmatic and content driven criterion. If access to relevant actors is not given on time or they do not want to cooperate then the case could not be researched. Therefore, interviewees' access and availability has been a criterion used for case selection.

2.3.2 Case interviews

To gather information on the cases beyond project documents and grey literature interviews have been carried out. By gathering different perspectives from people involved in the projects more can be said about the way the design of the first phase impacts how the client and contractor relate to each other in that phase and what that means for the discovery of uncertainties, the division of responsibilities and risk allocation.

Semi structured interviews have been conducted for this research. This is due to the information asymmetry between the researcher and the person being interviewed. The interviewee could often be expected to have a significant leg up over the researcher not only in terms of pure knowledge on the specific case but also in avenues of inquiry. This type of interview provides the freedom to the interviewee to pursue various, non-obvious, trains of thought and make connections between subjects which enhances the output of an interview.

Seeing as the research was exploratory this freedom was necessary. The interviewer then could guide the interviewee but not limit him or her.

An interview procedure has been set up to conduct the interviews. The main variables are covered in the questions in order to have been able to gather information with which the research questions could be answered. When project documents could not be seen or referred to, interviewees have been asked if they could state that the information they present was written down somewhere. In this way more substantiation for an answer was achieved. For the full interview procedure that was used see Appendix A. In order to provide room for the interviewee's perspective and trains of thought this interview procedure has been applied flexibly, as Flick (2022, p. 195) notes one should.

2.3.3 Case interviews selection criteria

In order to get the most out of the interviews, not only the manner in which the interviews are conducted is important but also the selection of the interviews itself. One person on a project might not be as interesting in relation to this study as another. Therefore, case interview selection criteria have been used in selecting interviewees for this study. This way it is possible to get relevant information to help answer the various research questions. The selection and underlying reasoning for the chosen selection can be found in section 5.2 Interview selection.

2.4 Data analysis

The information retrieved in project documents such as agreements, tender documents and published articles as well as data gathered through interviews has to be structurally analysed in order to produce findings and conclusions for the research.

The interviews held for the case studies have been coded to organise the data and provide clarity in the results. This has been done by transcribing the interviews held verbatim and coding the relevant parts for this research. The four topics of main interest have been highlighted in the transcriptions in order to be able to group relevant parts and aid the search for relevant information in the interviews. These coded statements are statements relevant to the project delivery method design, the information risk, the relationship between the client and the contractor and risk allocation. These statements and expressions have then been used for the case studies, the findings of which are presented in section 5.3 and 5.4.

The coded transcriptions of the interviews are not included in the public thesis. Due to the fact that the researched case projects are still ongoing and the transcriptions include possibly identifying personal characteristics and other sensitive information. Interviewees have been presented with an informed consent form, Appendix B. Further keeping in line with the TU Delft regulations and the General Data Protection Regulation a data management plan for the safe handling and storing of the data has been set up and used. This plan can be found in Appendix C.

The validity of the results has been increased by triangulation of data where possible. This triangulation is done both by the use of a combination of methods in data gathering as well as by using multiple sources within one method whenever possible. For instance, multiple people have been interviewed per side per project. This can help make triangulation possible when

other interviewees confirm what another has said or what is written down. Finally, to further increase the validity of the results expert interviews have been held.

2.5 Expert interviews

In order to further analyse the results gotten from the desk research and case studies expert interviews have been held. Expert interviews are a method which can be used in various ways (Von Soest, 2022). In this research they have been used to affirm or test the results gotten from the desk and case study research. Von Soest (2022, p. 3): “Expert interviews may serve as a method of affirmation, meaning the confirmation or disproving of prior research results, information from other sources, or anecdotal evidence”. Von Soest bases this on the four uses of elite interviews which are established by Tansey (2007, pp. 766-767), in which the first one is to corroborate what has been established from other sources. In order to use the expert interviews in this manner the interviews were held at the end of the research, when the results were known and could be used as the basis for inquiry. This use of expert interviews can be seen as a sort of external validation of the findings. The results are discussed with the experts and their judgement and opinion on the results is used to weigh the generalisability and provide some more foundation to draw conclusions.

Important to this end is the selection of the experts. Indeed, the right selection of experts is vitally important for the value of their input. Seeing as the subject of this study is a new development of which little is yet known, this is doubly so. For this reason the selection of experts has to be substantiated. The relevant expertise of the experts has thus been used as a guiding principle in their selection. Relevant here means that the expert has experience with the two phase process project delivery method in multiple projects, either through (direct) involvement or research. Additionally, to be selected an expert should not have been directly involved in the projects selected for the case studies. Furthermore, the expert had to be available for an interview. In section 6.1 the expert interview selection and their expertise is presented.

3. Theoretical framework

Czarniawska in her book on social science research states: “For some reason, the general assumption about literature reviews seems to be that the more references the better. … The loser is the reader who must wade through piles of scientific products, only to discard them.” (Czarniawska, 2014, p. 12). This statement encompasses the spirit in which the literature presented here has been selected and should be kept in mind while reading the report. The choice has been made to give preference to well-known and reputable sources over an abundance in references which say roughly the same.

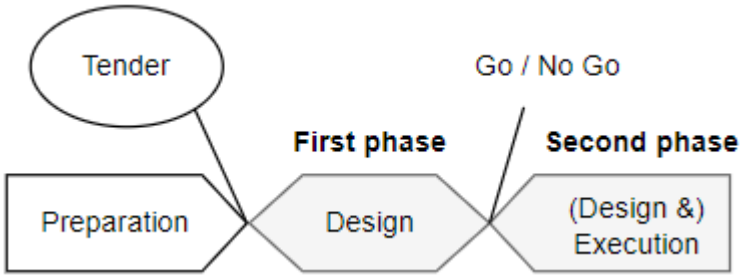
3.1 The two phase project delivery method

In order to explain the two phase process and its various designs some background and history on construction project processes is given. For the sake of clarity and to not needlessly complicate things the focus of this background exploration will be on the main predecessors of the two phase process and their characteristics relevant to this study.

Before the introduction of the two phase process and similar deferred price setting project delivery methods there were two main construction project delivery methods. The traditional project process design and the integrated contract project delivery method design. In the next section these are discussed, along with various two phase process project delivery method designs. First, a schematic representation of the general two phase process is given in Figure 7. Here the deferred price setting and cut-off between design and execution phase can be seen.

Figure 7

Schematic representation of the general two phase process



Note. Based on Fijneman (2020)

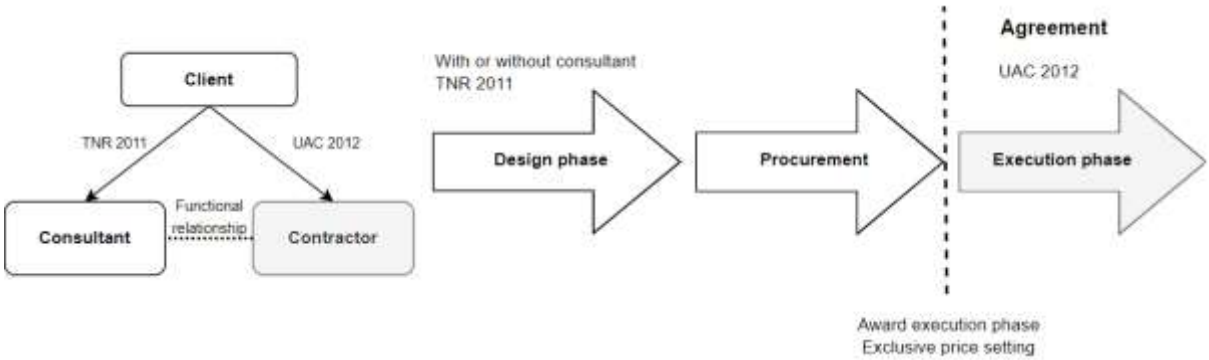
3.1.1 The traditional project delivery method

The traditional project delivery method can be seen as a ‘triangle’ relationship between the (public) client, a consultant and a contractor. The client, with or without the help of a consultant, for example an engineering firm, develops the design and only signs an agreement with a contractor for the execution of this fully developed design (Chao-Duivis, 2019; Jansen, 2021). The design phase is therefore fully separate from the execution phase: there is a cut-off or caesura between the design phase and the execution phase. The design is thus also developed to the stage of specifications, with the contractor contracted to execute this design. Projects that follow this process nowadays (usually) use the Uniform Administrative Conditions (UAC) 2012 to contract the execution phase with the contractor. In the traditional process the contractor is responsible for the execution but does not bear responsibility for the design and

risks stemming from this responsibility. This responsibility is for the client and/or the consultant and governed by The New Rules (TNR) 2011 (Chao-Duivis et al., 2018). See Figure 8 for a schematic representation of the process.

Figure 8

Schematic representation of the traditional project delivery method



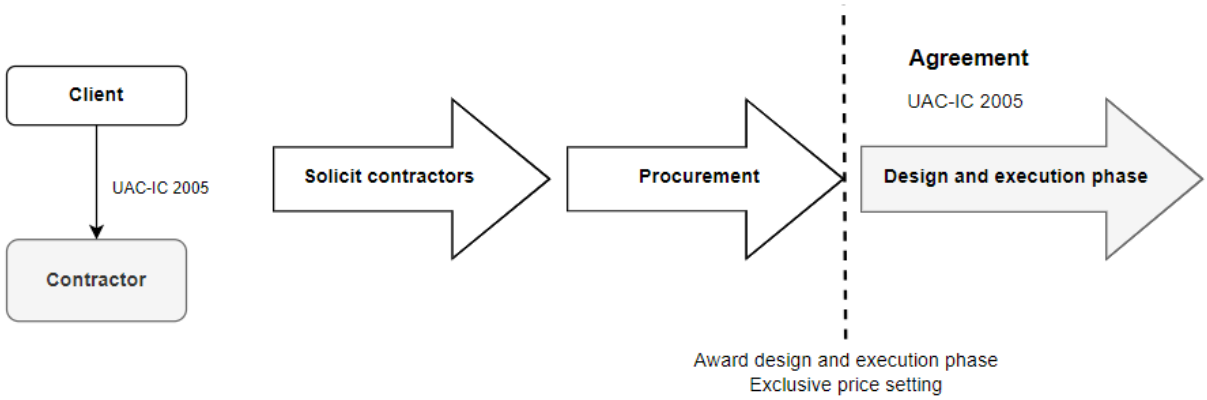
Note. based on Chao-Duivis et al. (2018), Jansen (2021).

3.1.2 The integrated contract project delivery method

In the eighties and nineties another project delivery method started to be developed: the integrated contract project delivery method (Chao-Duivis, 2019; Jansen, 2021). This Dutch project delivery method should not be confused with the 'integrated project delivery method' where generally all parties are involved early in the entire construction project and contracted through a multiparty agreement with shared risks and reward (Kent & Becerik-Gerber, 2010). In the Dutch integrated contract PDM integrated contracts are used in which the contractor both develops the design and does the execution of the project. Hence the term integrated: in its elemental form the client only has a contractual relationship to one party, which integrates both design and execution. This type of contract is often called design and construct (D&C) or design and build (D&B) (Chao-Duivis et al., 2018, p. 111), as the contract encompasses both the design and execution of the project. The Uniform Administrative Conditions for Integrated Contracts (UAC-IC) 2005 is usually followed for these projects. The fact is that the client takes on fewer liabilities and less responsibility in this project delivery method design compared to the traditional model. This is because the contractor is responsible for the design as well as the execution, and all ensuing risk, in this project delivery method design (Chao-Duivis et al., 2018). It depends on the project however, how much of the design and/or the design parameter is (already) provided by the client when the market is approached and procurement is carried out. This affects the responsibilities and liabilities of both parties during the design and execution phase. See Figure 9 for a schematic representation of the integrated contract project delivery method.

Figure 9

Schematic representation of integrated contract project delivery method



Note. Based on Chao-Duivis et al. (2018)

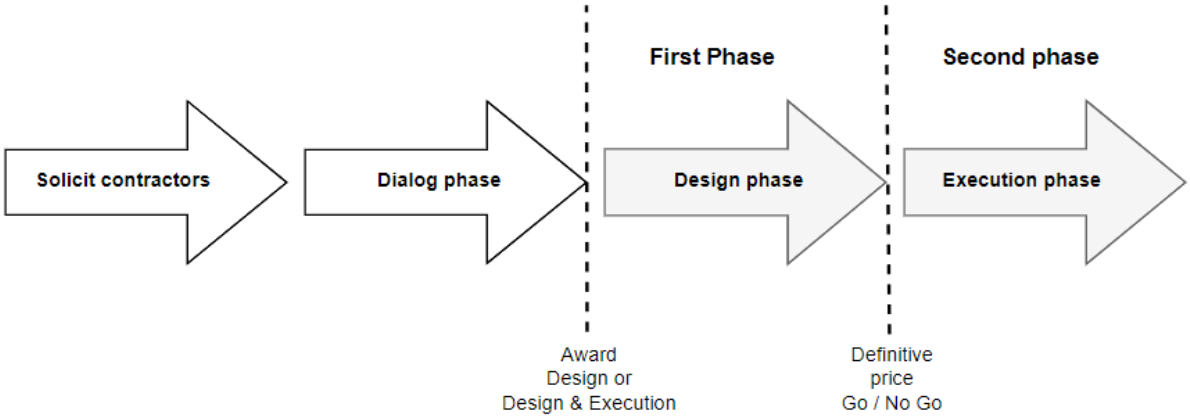
3.1.3 The two phase project delivery method designs

The traditional project delivery methods work without problems on a majority of projects (Rijkswaterstaat, 2020a). However, on larger and more complex (thus more unique) projects the scope is so big and the uncertainties so great that it is very difficult to accurately assume and predict the conditions and associated risks. In order to win tenders contractors have to be competitive on price, whilst much of the liabilities lie with them. This dynamic has led to under appraisal of risks by contractors in their bid price (Rijkswaterstaat, 2020a) and threatening financial damages when calamities do occur (Rijkswaterstaat, 2019). To help transition away from this dynamic another type of project delivery method in the form of the two phase process has developed.

The two phase process is a process or method for the realisation of a construction project. In this type of process the price for (uncertain and therefore seen as risky parts of) the execution phase of the project is determined after completion of the first, often design, phase. This means that more information is known and this should reduce uncertainty and financial risks leading to better risk management (Nagelkerke & van Dijke, 2020). This deferred price setting combined with a cut-off between the phases is a characteristic of the two phase process. This makes it similar to the traditional project process, where these phases are also split (Chao-Duivis, 2019). However, the two phase process seeks to reduce unknowns and in doing so risks by involving the contractor earlier and cooperating with them (Rijkswaterstaat, 2019), which differs from the traditional process. This should help to reduce the information risk associated with construction projects. See Figure 10 for a schematic representation of the two phase process.

Figure 10

Schematic representation of the two phase process



Note. Based on the article of Jansen (2021), the article by Huith (2021) and the report by Rijkswaterstaat (2019).

Rijkswaterstaat has started to use the term two phase process in recent years to describe a new way to approach projects. This use coincides with the shift in way of thinking about the relationship to the contractor that Rijkswaterstaat seeks. Other public clients however, have been approaching projects in manners similar to the 'two phase process' already. Dutch water boards within the High Water Protection Programme or HWPP (Hoogwaterbeschermingsprogamma) have done multiple two phase process projects (Significant Synergy, 2023). Currently, seven process types or methods with deferred price setting are identified in Dutch construction projects procured by public clients (Instituut voor Bouwrecht, 2022). These fall into two main categories: 'opt in' and 'opt out'. The main difference between these two categories is whether (final) price setting is used to meet a suspensive condition to start the second contract, opt in, or if it is used to possibly end the contract, opt out.

Aside from these main categories, public clients have another choice when designing and shaping the first phase: the way the project team is organised. This is not directly a characteristic of a certain type of design, but it is an important characteristic in the design of a first phase itself. The way people who work together are organised or structured can influence the behaviour exhibited by people in that organisation (Mintzberg, 1983) and project teams are no exception. Rijkswaterstaat has introduced its own model for the organisation of a project team in infrastructure projects: Integral Project Management (IPM). The IPM model is used by more public clients than Rijkswaterstaat alone (Wermer, 2018). This model differentiates five managerial roles: project management, project control, environmental management, technical management and contract management (Ministerie van Infrastructuur en Waterstaat, 2023). It comes in two 'flavours': mirrored and integrated. A mirrored IPM team has both parties, both client and contractor, providing one manager per role each. An integrated IPM team on the other hand will have one manager per role, either provided by the client or the contractor (Wermer, 2018). In closer collaboration, the mirrored structure, which provides more clarity on the team and about the roles everyone plays, can become wasteful as two different people are fulfilling the same roles (Wermer, 2018, pp. 84-85). The integrated

version of the IPM team is often used in Bouwteam designs as this is a close collaboration design, see the next section for more in depth information on Bouwteam designs.

Below the various forms of deferred price setting projects identified are presented. For the sake of clarity only the characteristics of these project delivery method designs that are relevant to this study are discussed.

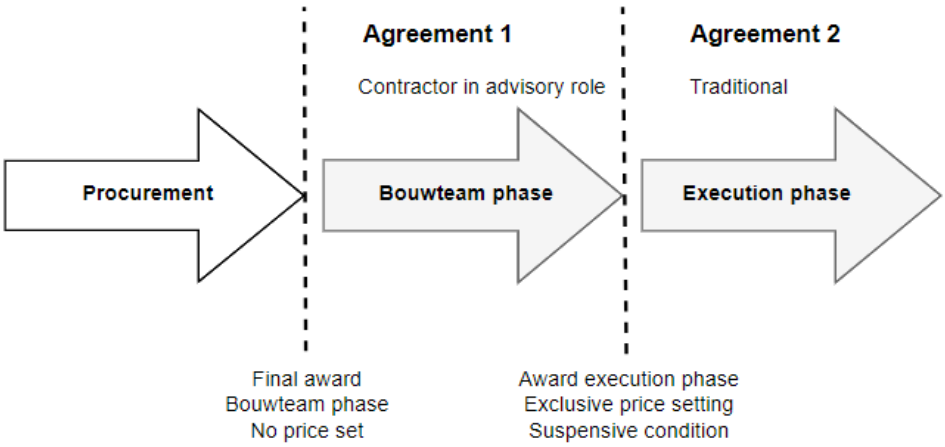
3.1.3.1 Opt in designs

Opt in two phase process project delivery method designs are characterised by a go / no go decision which is based on a suspensive condition. This means that there are conditions that have to be met by the contractor in order to secure the contract for the second phase. The main condition, which is the same across all the designs, is an agreed price or price arrangement for the second phase. The Institute for Construction Law (Instituut voor Bouwrecht, 2022) distinguishes five different opt in deferred price setting project delivery method designs. These five designs and their characteristics are presented below.

Opt in design I: Traditional Bouwteam

Figure 11

Schematic representation of traditional Bouwteam process



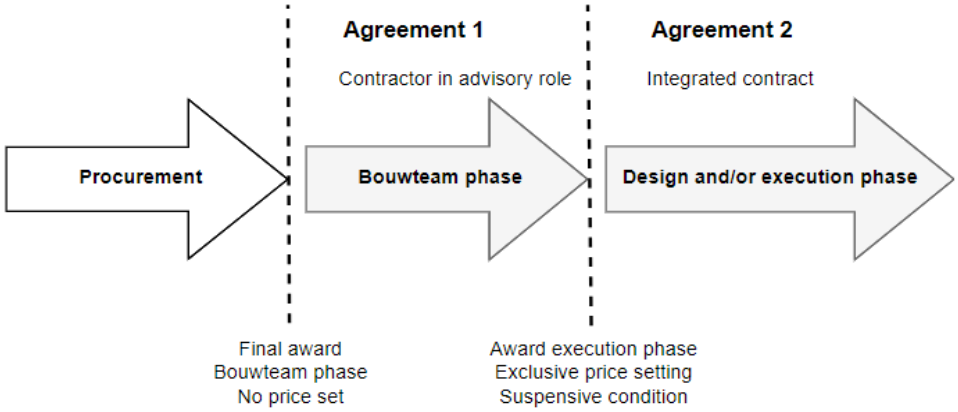
Note. Adapted from Instituut voor Bouwrecht (2022)

In Figure 11 the traditional Bouwteam project delivery method process is shown. This project delivery method design consists of two phases: a Bouwteam phase and an Execution phase. In a Bouwteam, literal translation Building team, the contractor advises the client on the design of the project in the first phase and then gets the exclusive right to set a price for the second, execution, phase of the project (Jansen, 2021). This is done so that the client can already benefit from the knowledge and competency of the contractor during the design phase. If a price is agreed after the first phase a contract for the second phase starts, otherwise another contractor can be contracted for the second phase. The contractor is contracted using the UAC 2012.

Opt in design II: Integrated Bouwteam, Bouwteam 2.0 / Bouwteam with UAC-IC

Figure 12

Schematic representation of Bouwteam 2.0 process



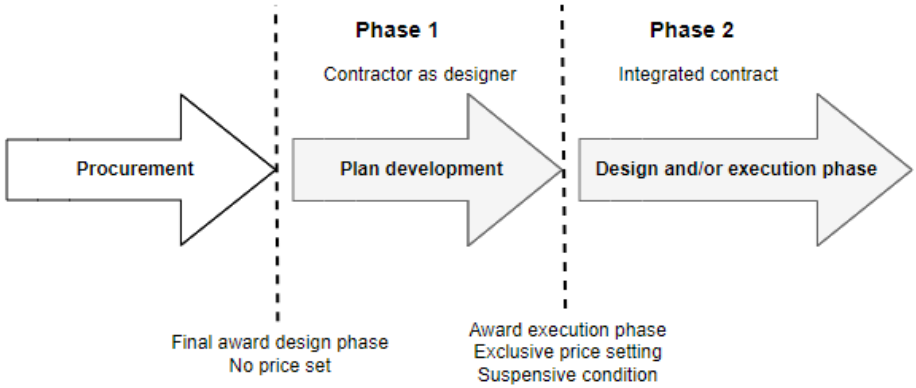
Note. Adapted from Instituut voor Bouwrecht (2022)

In Figure 12 the Bouwteam with UAC-IC project delivery method design is shown. This design is similar to the traditional Bouwteam opt in design. However, there is a clear difference in the role and responsibility of the contractor in the first phase. Where in the traditional Bouwteam the contractor only acts as a consultant in the first phase, giving advice on design choices of the client, in the Bouwteam with UAC-IC design the contractor can make design choices themself. These can be made in collaboration with the client or on their own, depending on the specific design. After the first phase, which can conclude with a full final design or a less developed design, the contractor has the exclusive right to set a price for the second phase, consisting of the remaining design work and the execution (Jansen, 2021). If a final price cannot be agreed upon the Bouwteam contract for the first phase has an exit possibility to end the agreement. This means that the design consists of two contracts with price setting happening during the Bouwteam phase. The second phase is contracted under the UAC-IC 2005.

Opt in design III: Two phase integrated

Figure 13

Schematic representation of integrated two phase process



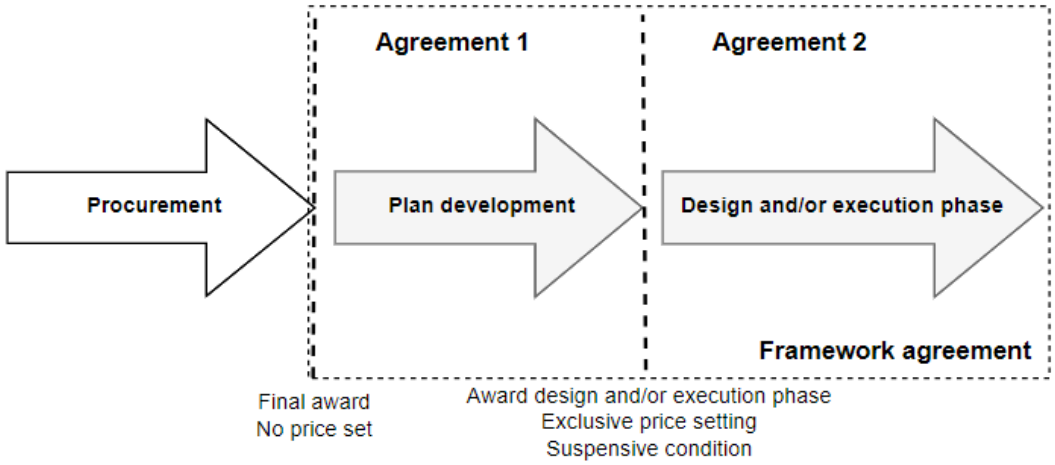
Note. Adapted from Instituut voor Bouwrecht (2022)

In Figure 13 the Two phase integrated project delivery method design is shown. The award for the first phase includes a contract for plan development in which the contractor fulfils an advisory role. This award does not include a price. Then after the design is further along the contractor gets the exclusive right based on the first phase contract to set a price for the second phase. If a price is agreed upon and the other suspensive conditions that are part of the contract are met, the second phase, consisting of remaining design and execution, is contracted with the UAC-IC 2005 (Instituut voor Bouwrecht, 2022). This design of contracting means that the client is responsible for the design up until the end of the first phase and then a transfer towards the contractor happens in the second phase.

Opt in design IV: Two phase with framework agreement

Figure 14

Schematic representation of two phase process with framework agreement



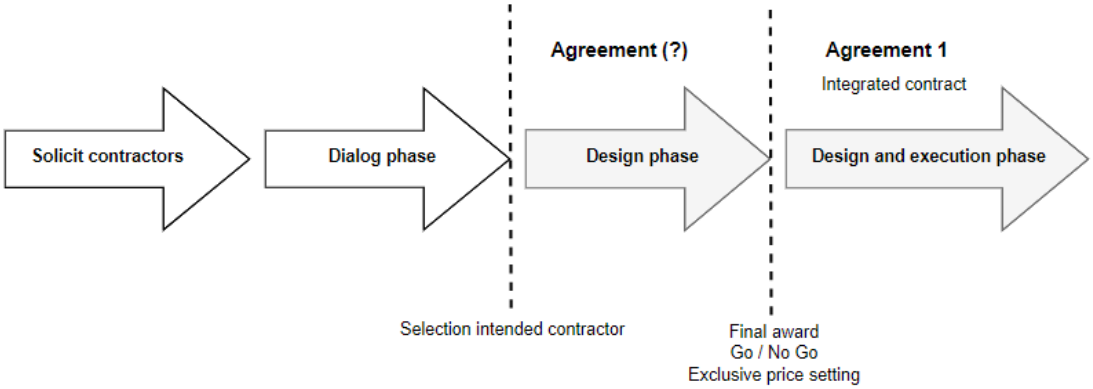
Note. Adapted from Instituut voor Bouwrecht (2022)

In Figure 14 above the Two phase process with framework agreement is schematically shown. In this design a framework agreement is awarded after the tender. This award is for the framework contract that encompasses the two contracts, or agreements within the framework, corresponding to phase 1 and phase 2. The first phase contract within the framework is a more detailed agreement on how the first phase is tackled. In the first phase plan development is carried out until a certain design level is reached. This level of detail depends on the framework agreement and the specific terms agreed upon in the first phase contract. After the plan and design is worked out up until the desired degree, the contractor, once again, has the first opportunity to set a price with the client (Instituut voor Bouwrecht, 2022). If a price can be agreed upon and other possible conditions met the contract for the second phase starts. This again is a more detailed contract which fits within the framework agreement agreed which is awarded at the start.

Opt in design V: Two phase before final award

Figure 15

Schematic representation of two phase before final award process



Note. Adapted from Instituut voor Bouwrecht (2022)

Above, in Figure 15, the Two phase before final award is schematically presented. The final opt in project delivery method design is the two phase before the final award. In the plan development first phase the intended contractor and client work together towards a more developed design. However, the contractor has been selected for the plan development phase based on their plan on how to bring the plan and design from a basic level to a more developed stage. After the more developed design is finished and a price is agreed upon the two enter into a contract for the design and execution phase. This is the design Jansen championed back in 2000 (Jansen, 2021) and the price setting is based on the plan the contractor won the award with, which has to provide unity prices and so on for the execution phase. If no price can be set the contract for the design and execution phase falls through.

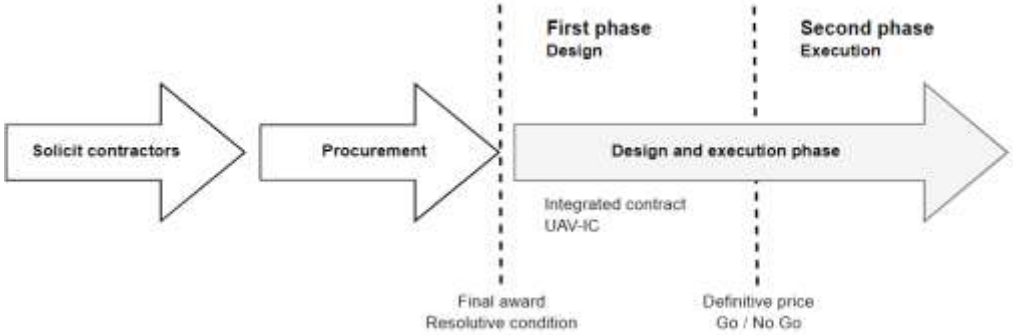
3.1.3.2 Opt out designs

Opt out two phase process project delivery method designs are characterised by a go / no go decision which is based on a resolutive condition. This is different to the opt in designs where the go / no go decision is based on a suspensive condition. A resolutive condition after the first phase means that there are options to terminate the contract if the specifics of the condition are not met. If a price cannot be agreed upon the contract is terminated. These designs award a contract for both phases with an option to opt out after the first phase, instead of a contract for the first phase with an option to opt in for the second phase. This means that (often) an initial price or price range for the project is already included in the first award, which is often not the case in the opt in designs. The Institute for Construction Law (Instituut voor Bouwrecht, 2022) distinguishes two different opt out designs, which are presented and discussed in this section.

Opt out design I: Two phase after final award

Figure 16

Schematic representation of two phase after final award process



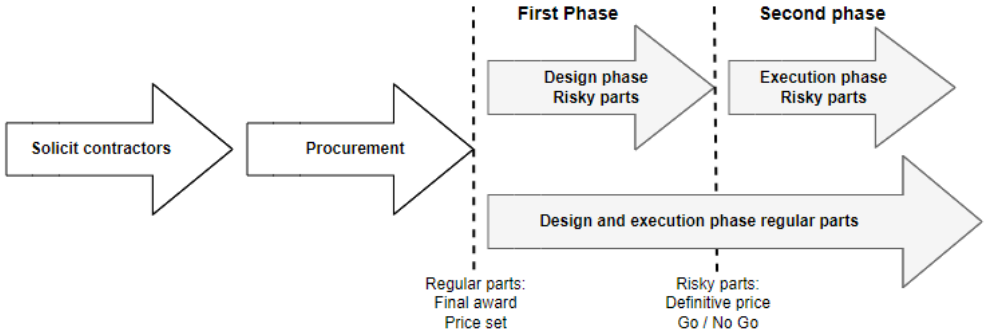
Note. Adapted from Instituut voor Bouwrecht (2022)

The first opt out design is the Two phase after final award, shown in Figure 16. Here a contract is awarded for both the first and second phase. Unlike in a traditional integrated contract however, the contract has a resolutive condition based on the price for the second (or first and second) phase. If after the first phase the price cannot be agreed upon, then the contract can be terminated. In theory this should incentivise the parties to agree on a price.

Opt out design II: Two phase hybrid model

Figure 17

Schematic representation of two phase hybrid process



Note. Adapted from Instituut voor Bouwrecht (2022)

In Figure 17 the Two phase hybrid process is shown. This is a project delivery method design in which the ‘risky parts’ of the project are awarded in a two phase contract whilst the rest is contracted in a ‘normal’ integrated contract under UAC-IC 2005 with a fixed price. The risky parts, or parts with high uncertainty, are price deferred until after the first phase for those parts is completed. These parts follow the opt out design with a resolutive condition under which the contract can be cancelled for the second phase (Instituut voor Bouwrecht, 2022). This design presents the advantage of being able to start work on the ‘safer’ or better known parts of the project whilst the ‘risky parts’ get figured out.

As the classification by het Instituut voor Bouwrecht (2022) makes clear there are quite some

variations between deferred price setting project delivery method designs. In order to be able to investigate how the designs affect the first phase, sections 3.2, 3.3 and 3.4 focus on the information risk, division of responsibilities: the client-contractor relationship and risk management. An outline of the theoretical framework is presented in 3.5.

3.2 Information risk

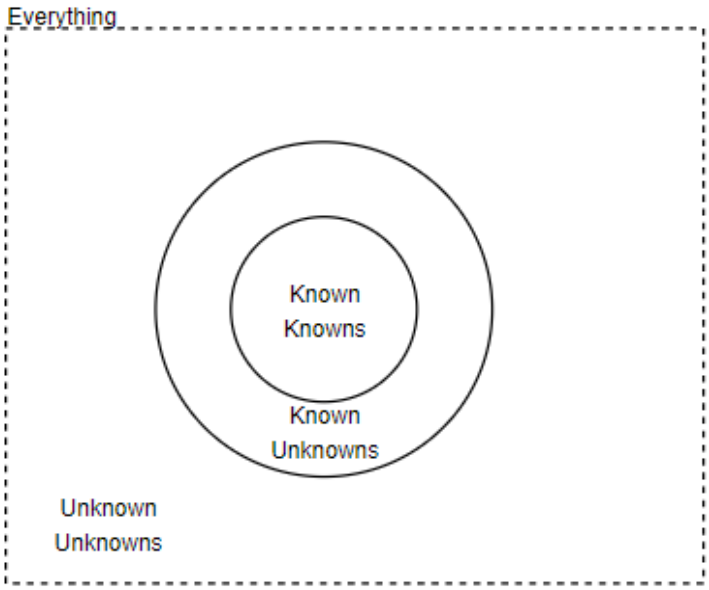
In this section a definition and discussion of the terms information risk, uncertainty and risk is presented to clarify what is meant by these terms in the report. This is needed because these terms are not universally understood the same and without a clear definition further discussion is made difficult and blurry.

The first phase in a narrow sense has the goal of reducing information risk (Jansen, 2021). Information risk is defined by Jansen (2021) as the problematic inherent trait of construction projects that the execution agreement between client and contractor is based on assumptions regarding the (f)actual state which the project specific environmental conditions are in. These assumptions are needed because the actual state of the project's environmental conditions can only be approximated or guessed based on limited information. This is true both during the procurement, when only limited information is provided, and, to a lesser extent, after the first phase. This is because not everything can be researched and it is impossible to fully know the state of environmental conditions, even with research. It is possible however, to get a better picture of what conditions are unknown, important to know or are not as important. Principally, this is what the first phase needs to accomplish in order to reduce the (impact of) risks. This can be accomplished by identifying risks, allocating them to the party which can best carry them and investigating what is unknown. By combining the expertise and competencies of both the client and the contractor as well as reducing the incentives and room for adversarial behaviour the information risk should be reduced before price setting takes place (Fijneman, 2020; Jansen, 2021).

As Donald Rumsfeld (2002) said: “...there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns—the ones we don't know we don't know.”. Figure 18 below visualises this statement. The crux lies in the unknown unknowns. To reduce the amount of unknown unknowns by making them either known unknowns or known knowns is the underlying goal of the first phase. This makes it possible to set a more accurate price than when this information was not known to be unknown and had remained an unknown unknown. Furthermore, knowing more information about the conditions and about what is not known about the conditions should make it easier to allocate liability between client and contractor according to who can best carry them, a stated goal of Rijkswaterstaat (2019).

Figure 18

Diagram of known knowns, known unknowns and unknown knowns



Note. In the figure the (possible) knowledge of everything and how it is divided is shown. Not everything is, or can be, known. Outside and around (figuratively) the known knowledge lie the known unknowns - the things one knows one does not know

Known unknowns have to be explained further for the purposes of this research. There are multiple possible interpretations of known unknowns in this context: they can refer only to the knowledge that you do not know and that you cannot know something. For instance you know there are things you cannot predict. Known unknowns can also refer to the knowledge that something is uncertain and the implications are possible to know. This is a difference in how 'known' the unknown is. Does the 'known' only refer to the existence of the unknown or does it also imply a certain level of insight into the unknown. The interpretation of known unknowns in this research is the following: a known unknown refers to the knowledge, that the knowledge on a particular object or condition is uncertain but it can be made into a known known with more research and there is knowledge on what the implications of the knowledge are. This means that known unknowns refer to identified (known) uncertainties. Practically, known unknowns are risks which are not completely clear but are known. Think of a contractor knowing about a tendency of a bridge part to require additional welding during renovation but needing to do research in order to identify how probable it is on a certain bridge. Unknown unknowns are not known or even unknowable risks, like extreme events. To help clarify, Table 4 is presented.

Table 4

Possible states of knowledge

Status of Knowledge	Knowns	Unknowns
Known	Current facts	Identified unknown facts; Conscious ignorance

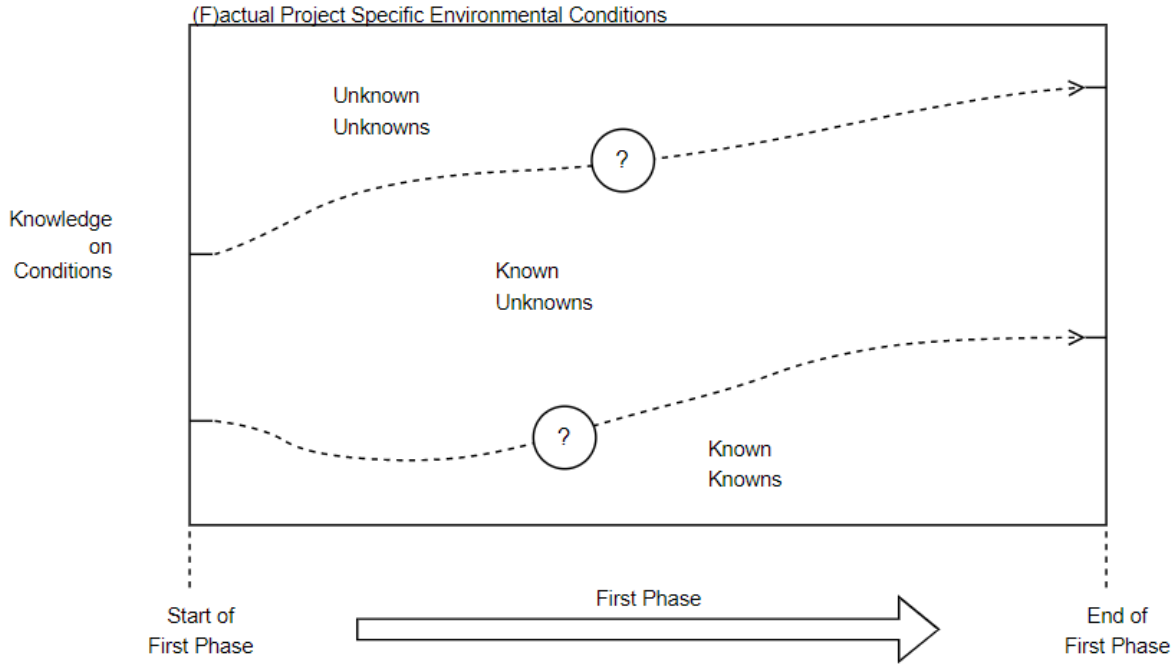
Unknown	Hidden facts; tacit knowledge	(Meta-) Ignorance

Note. Adapted from Deane (2021), Management Yogi (2019)

To further illustrate what the status of knowledge on conditions can mean in a project, Figure 19 is provided. In section 3.4 risks and risk allocation is discussed further.

Figure 19

Hypothetical example of knowledge development through first phase



Note. The division of knowledge on project conditions over the duration of a first phase of a hypothetical project

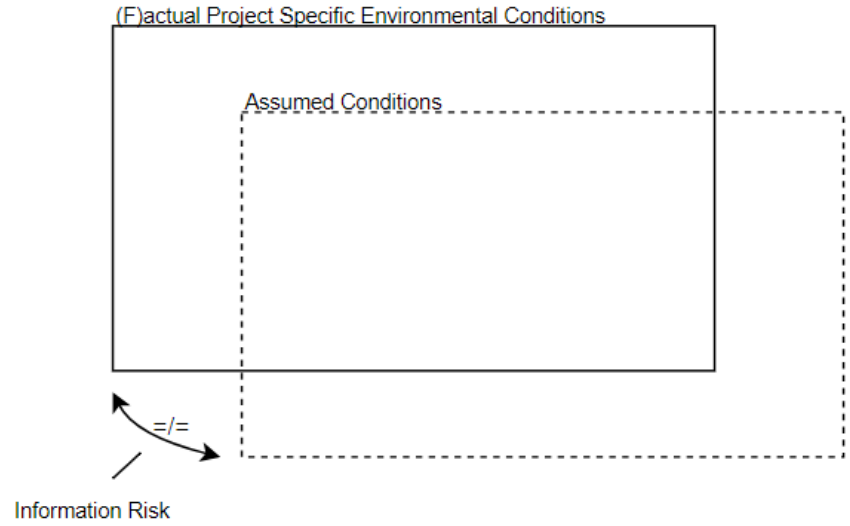
Figure 19 above shows how the knowledge on project conditions might evolve over the duration of the first phase. In this example after the first phase starts the share of known knowns first decreases as the existing knowledge is challenged by the contractor. After more research and cooperation this share rises again whilst the plan or design is further developed. The known unknowns in this, hypothetical, first phase of the project increases at the start. This is because the knowledge added by the contractor challenges some of the existing known knowns - turning those into known unknowns - and transfers some unknown unknowns into known unknown territory. So in this case the addition of the contractor means less fully unknowns quickly after the start of the first phase, but it takes some time, research and work before the total certainty increases. Of course, in reality this evolution in knowledge share is hard to precisely express. It is however, this underlying process which determines how accurately and which risks are known, how they are divided and which price can be put on them.

Information risk can be a confusing term. The term is made up of the words risk and information, which are both knowns, but is used to refer to something which comes from

uncertainty and assumptions, both (known) unknowns. In order to help visualise and clarify the concept of information risk below in Figure 20 a conceptual diagram is presented.

Figure 20

Conceptual diagram showing information risk



Note. Information risk is the inherent risk of construction projects where an agreement is always made based on assumptions regarding the (f)actual project specific environmental conditions, which may or may not turn out to be right (Jansen, 2021).

Reducing information risk is however too narrow a picture to paint of the goal of the first phase. Information on the environmental conditions not only reduces the information risk, but also reduces uncertainties in general and in so doing helps in identifying risks. In their report on future challenges Rijkswaterstaat notes that there exists an 'inherent uncertainty on the risks' during initial price determination and planning (Rijkswaterstaat, 2019, p. 25). Chao-Duivis (2019, p. 13) notes that, as caution with transferring risks to the contractors early in the process was advised back in 2003 by a parliamentary inquiry, this implicitly means that risks have been transferred to the market (contractors) too early in the process. This early transfer of risks is dealt with by the use of a two phase process project delivery method in which the final agreement for the execution is made after the first phase. Apart from reducing information risks and charting more 'traditional risks' the first phase should therefore also help in gaining more information in general. Information on the environmental conditions, the design specifications, the collaboration between client and contractor as well as deeper insight on relevant information to both accommodate and further carry out the construction process. In section 3.4 the management and allocation of risks is delved into.

3.3 Division of responsibilities: client-contractor relationship

As Jan Hendrik Dronkers, former general manager of Rijkswaterstaat, put it (Projectteam DOEN & Rijkswaterstaat, 2016, p. 8):

"The connection is more important than the contract. Does that mean that the contract is not important? Of course not. The contract should lay down some things. But the behaviour and the culture, mutual equality, taking each other seriously, thinking about each other's interests and concerns, mutual respect, that should take centre stage. That truly is a new way of thinking. That is what it means to break old patterns".

In this chapter collaborative project delivery methods as a concept is discussed and rooted in literature on how to view and study them.

3.3.1 The client-contractor relationship

In order to investigate what the first phase process actually looks like a jumping off point is needed. To know what to look for it is important to 'root' the research in a secure foundation of knowledge and theory on client contractor relationships and collaboration in general. To do this first this body of knowledge has been explored to find types of theory and sections of academic literature from which to investigate. The difference in views or models on collaboration from economics to psychology to sociology or organisational management have an effect on the findings of the study. Therefore, the existing literature on client contractor relationships is a good place to start.

In addition to exploring the first phase design and contracting choices this research also seeks to glance at what the process actually looks like. By this the way in which the client and contractor behave in practice is meant, for instance how information gets shared and between which people. In order to investigate what the process looks like it is helpful to look at existing theories and literature on how to view the (collaborative) relationship between client and contractor. Within the field of social science there are various ways to view relationships, this viewpoint often differing based on the academic discipline and its approach.

Literature on the contractor and client relationship is often based on the more traditional model of procurement and contracting. The two phase process is stated to be different, at least in how it is set up and what should 'incentivise' the contractor. Indeed, the two phase process can be seen as a new project delivery method (PDM). Project delivery methods are defined by Engebø et al. (2020) as a system which provides in the organising and financing of design, construction and maintenance in order to deliver a good. Specifically, Engebø et al. (2020) give a literature review on collaborative project delivery methods. The literature on this type of project delivery method is not uniform and knows many different definitions and uses for similar terms. Engebø et al. (2020, p. 280): "the literature operates with what might be considered a jungle of terminology". However, the alignment of the client's interest with that of the market is seen as a part of a collaborative delivery model. Oakland and Marosszeky (2017) note that it is because of this aligning of interests between the client and other parties that these new methods are often labelled collaborative. This feature, combined with the stated importance of collaboration in the two phase process by public clients (Rijkswaterstaat, 2019; Significant Synergy, 2023) themselves, means that it can be classified as a (new) collaborative project delivery method.

The theories used to view the relationship and its insights can therefore be used in order to investigate the two phase process and possibly get a glance at how the method functions. From the literature two theories to view organisations, relationships and knowledge sharing have been selected to investigate the first phase. These are agency theory and stewardship theory.

Schillemans and Bjurstrøm (2020) provide multiple reasons why agency and stewardship theory are suited for the study of the governance of autonomous agencies, such as public clients like water boards and Rijkswaterstaat. Importantly, these theories come from various fields of social sciences and have been used extensively in governance research as well as contracting research. In contracting research "agency theory is often used to understand why some contracts are "hard" or "complete" in the sense that they aim to cover all eventualities, while elements from stewardship theory are used to explain "soft" or "relational" contracts that are based on trust and cooperation" (Schillemans and Bjurstrøm, 2020, p. 3). In their research the decision is made to combine both theories instead of contrasting both perspectives. The conclusion suggests that the optimal governance model is characterised by a combination of both theoretical models (Schillemans and Bjurstrøm, 2020).

Furthermore, agency theory with the principal-agent relationship paradigm has been used to investigate communication risk in construction projects (Ceric, 2012). For these reasons agency theory is an interesting theory to use for investigation.

3.3.2 Agency theory

Historically, organisation and management theory has been greatly influenced by agency theory (Davis et al., 1997, p. 20). This theory is focused on the principal-agent relationship in which one party, the principal, delegates work to another party, the agent (Eisenhardt, 1989a). As Shapiro (2005, p. 263) clearly states: "In an agency relationship, one party acts on behalf of another". Agency theory tries to reduce the risks that lie in the separation of ownership and control: as the principal (owner) and agent (manager) act in rational self-interest which creates a misalignment of interests (Panda & Leepsa, 2017).

Agency theory itself originates from literature focused on risk sharing and is concerned with solving problems that can occur in agency relationships (Eisenhardt, 1989a). Eisenhardt states the first problem is the agency problem that "arises when (a) the desires or goals of the principal and agent conflict and (b) it is difficult or expensive for the principal to verify what the agent is actually doing" (Eisenhardt, 1989a, p. 58). This 'agency problem' is also described by Panda and Leepsa (2017). The second problem arises when the risk preferences of the agent and principal differ and Eisenhardt (1989) calls this 'the problem of risk sharing'.

Important underpinning assumptions of (classical) agency theory are that humans act in self-interest, with bounded rationality and are risk averse. Furthermore, information asymmetry exists between principal and agent, whilst information itself is a commodity (Eisenhardt, 1989a). This can lead to problems in both discussed forms, 'agency' in the form of moral hazards and adverse selection and 'risk sharing' when actions don't match both (or either) the principal and agent goals and risk preferences.

The main agency problems as Eisenhardt (1989a) lays out are moral hazards and adverse selection. The problem of moral hazards can always occur when two parties enter into an agreement. It alludes to one of the parties acting with a lack of effort, going against the agreement without the other party (the principal) being able to detect it (Eisenhardt, 1989a). This behaviour of not working hard enough is also known as 'shirking' (Shapiro, 2005). Adverse selection refers to a misrepresentation of the agent which is possible due to information asymmetry. The principal and agent have different information on the quality of the product/agent and therefore the opportunity exists for the agent to enter into an agreement at the expense of the principal. This adverse selection can refer both to transactions of physical products, in which the hidden information as Arrow (1985) calls it can be on both sides of the transaction, or to the misrepresentation of ability by the agent as Eisenhardt (1989a) defines it. The problem of risk sharing stems from differences in attitude towards risks between the agent and principal. These differences in goals and risks preferences can lead to a preference of different courses of action between the principal and the agent (Eisenhardt, 1989a).

The view of agency theory presented here, called 'positive agency theory' by Eisenhardt (1989a), proposes two propositions. These come from researchers of positive agency theory who have focused on identifying situations where principals and agents experience problems and then describing possible mechanisms which help limit these (Eisenhardt, 1989a, p. 59). The first proposition states that if the contract is outcome based, that the agent is more likely to act in the interests of the principal. This means that compensation is outcome-oriented instead of behaviour-oriented. As Eisenhardt (1989a, p. 60) notes: "The argument is that such contracts coalign the preferences of agents with those of the principal because the rewards for both depend on the same actions, and, therefore, the conflicts of self-interest between principal and agent are reduced". The second proposition states that if the principal has information to verify the behaviour of the agent that the agent will be more likely to act in the interests of the principal. This is because there is less room for opportunistic behaviour by the agent, as the principal cannot be (easily) deceived.

Looking at the two phase process it seems to, at least in theory, address the issues of opportunistic behaviour and information asymmetry better than traditional or integrated contracts. In their article on the agency theory approach to public procurement Chrisidu-Budnik and Przedańska (2017, pp. 157-158) state that:

"A characteristic element of the public procurement system is the double-sided asymmetry of information. Both the principal (the awarding entity) and the agent (the contractor) can be affected by asymmetry of information. The awarding entity knows which services it needs, but does not always know how to obtain the service on the market to make the contract effective. … Regardless of how the asymmetry of information is distributed among the parties to the transaction, the adverse consequences of the symmetry of information will affect the awarding entity to a greater extent. Therefore, the awarding entity should be motivated to gain knowledge to enable it to effectively prepare a description of the subject matter of the procurement.".

When viewing the two phase process through this lens it would seem to reduce the double-sided asymmetry associated with public procurement and therefore be of interest to the public client (the awarding entity). This is done by jointly going through the first phase and therefore better aligning goals, increasing access to information by the client and thereby increasing control of the contractor without the opportunity of shirking and/or strategic behaviour.

This agency view of relationships can be used both 'inside' an organisation as well as to look at the relationship between actors. Specifically in a contractual agreement between two parties, as is the case in a client-contractor relationship. A contract metaphor is even used to illustrate or describe an agency relationship in agency theory. Here the principal (client) through a contract gets the agent (contractor) to perform a service and, depending on the contract, cedes decision-making authority to the agent (Bryde et al., 2019; Jensen & Meckling, 1976). This lens has been used to view client-contractor relationships in diverse fields, including transportation and construction (Bryde et al., 2019), and is therefore of interest to use when looking at the first phase in order to glean insights on the two phase process.

3.3.3 Stewardship theory

Agency theory has its limitations however. Especially from the fields of psychology and sociology, critiques have been made. Hernandez (2012) notes that agency theory comes from an economics-based paradigm in which humans are rational actors who act to maximise self-interest, regardless of the outcome for the principal (or agent). Stewardship theory is a contrasting theory springing from a sociology and psychology paradigm, which describes relationships between actors and their behaviour in the relationship. Actors prioritise maximising, in this view, long-term utility by engaging in prosocial behaviour instead of "self-serving, short-term opportunistic behavior" (Hernandez, 2012, p. 172).

"Stewardship theory defines situations in which managers are not motivated by individual goals, but rather are stewards whose motives are aligned with the objectives of their principals" (Davis et al., 1997, p. 21). The best interest of the group or organisation is placed above self-gain and personal interest, in so acting in the interest of the principal. The organisational goals take precedence. Interestingly, not only the behaviour itself is seen as different but some researchers also see the reasons for actors to act in this way as different. Actors do not only act in the interest of the principal because they see this as advantageous towards their long term utility but feelings of autonomy and responsibility makes them want to perform (Donaldson, 2008). In this light, control activities and measures could be seen as unnecessary and possibly even counterproductive (Hernandez, 2012).

Essentially, an individual's perspective on who benefits from his or her actions makes that an individual is willing to put their and/or the collective needs/welfare above his or her own needs. Hernandez (2012) poses that there are 2 underlying psychological mechanisms. The first is that people value actions that benefit the collective long-term welfare and second that a positive connection/relation with others prompts them to positively influence the collective.

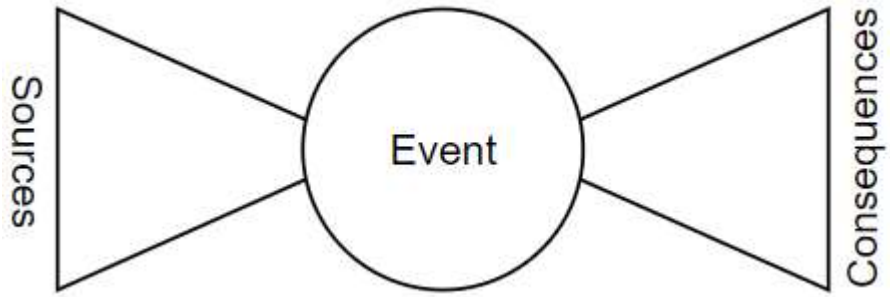
These psychological mechanisms show the perspective of self-actualisation in which the theory of stewardship is rooted (Corbetta & Salvato, 2004). The drivers for stewards are self-realisation, respect and achievement and not pure self-interest (Davis et al., 1997). Self-actualisation and esteem are higher needs in the pyramid of Maslow (Davis et al, 1997; Maslow, 1943), indicating that in stewardship theory people are intrinsically motivated to fulfil these needs and do their work. This contrasts agency theory and makes it interesting to use when investigating the collaborative contractual relationship between client and contractor in two phase projects.

3.4 Risk management and allocation

The ISO 31000 states that risk is “the effect of uncertainty on objectives” (ISO, 2018, p. 1). Where “an effect is a deviation from the expected. It can be positive, negative or both, and can address, create or result in opportunities and threats. (ISO, 2018, p. 1)”. This means risks do not have to have a negative effect, although this used to be the case in earlier guidelines and is still a much associated definition (Cambridge University Press & Assessment, 2023b). Risk is often expressed in terms of risk sources, potential events, their consequences and their likelihood (ISO, 2018). The consequences of the event multiplied with the likelihood of the event occurring then constitutes the risk. A model of risk illustrating this definition, see Figure 21.

Figure 21

Bowtie risk model



Note. Here a ‘bowtie model’ of risk is shown (de Ruijter & Guldenmund, 2016), with on the left the sources of risks and on the right the consequences. It shows how various risk sources can cause an event to happen and that this event can have various consequences.

The construction industry is plagued by risk (Tah & Carr, 2000) and this makes trying to reduce risk in order to improve project performance logical. Abrahamson (1984) was a pioneer in the field of risk management (Leloup, 2016) and introduced the five principles of risk management. These principles set out possible ways to deal with risks. Namely, that risks should be managed, minimised, shared, transferred or accepted. Abrahamson (1984) advocates against an adversarial contracting approach whilst understanding the necessity of contracting itself: “It is only honest of a lawyer to tell you that if you live by the contract you are likely to die, or at least become extremely sick, by it. … But if any of us has a choice between responsibility and survival, of course it is survival that usually will win. That is why, for all its faults, a legal framework is necessary.” (Abrahamson, 1984, p. 264).

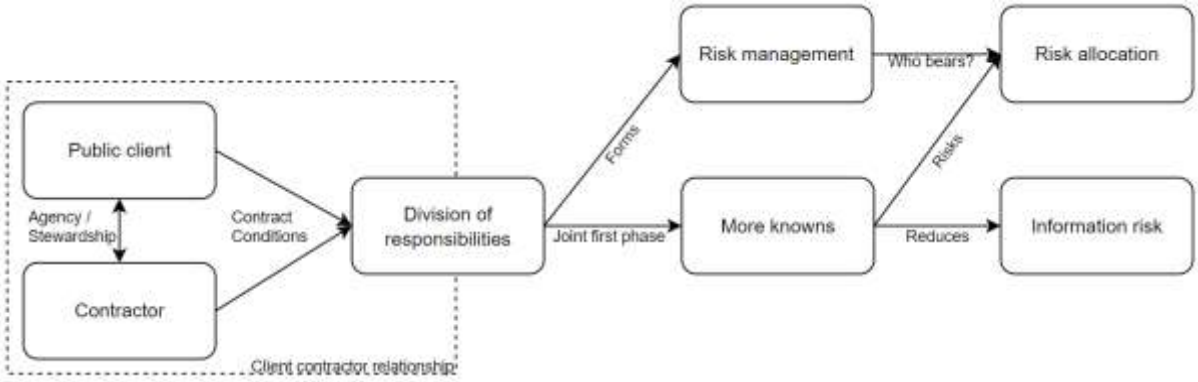
In addition to the various ways there are to deal with risks the question exists of who deals with, or ‘bears’, them. Abrahamson (1984) indicates that a party should bear a risk when it can control its happening, the effects or consequences it could cause or is able to transfer it as well as enjoy the economic benefit of the risk. Risk allocation in construction projects then, should reflect this view of openly and actively addressing risks and risk management. This view of risk management in construction projects is echoed in both the report of Rijkswaterstaat (2019) on future challenges and the report on the HWPP (Significant Synergy, 2023) as part of the two phase process project delivery method.

3.5 Theoretical framework overview

To show the relation between and enhance the coherence of the various concepts introduced in Figure 22 below an overview of the theoretical framework is presented. This gives a simplified picture of how the framework is made up and used for this research.

Figure 22

Overview of theoretical framework



Note. This figure shows the relationships in the first phase design and the variables that are researched

The overview broadly shows the relationships in the theoretical framework. The client and contractor work together, in an agency and/or stewardship manner, in order to develop the plan and get to know more about the project conditions. This way the information risk is reduced. Furthermore, the division of responsibilities is agreed upon in the contract and can decide how risks are managed and finally allocated. However, whether the relationship is actually like agreed upon in the contract or whether it changes is investigated, using agency and stewardship theory. By looking at the information risk, the division of responsibilities and the risk allocation something can be said about how the design of the first phase affects these variables. This in turn can be used to reflect on what is important to stimulate cooperation and better risk management, the overarching goals of the use of the two phase process. The idea being that good cooperation and risk management combined with price setting deferred until after the first phase leads to a more accurate and certain price.

To research the implications of all of this, the theoretical framework and the variables are operationalised in the following chapter, chapter 4. This is done according to the parts in the main research question: 4.1 operationalises the two phase process project delivery method designs, 4.2 information risk, 4.3 the division of responsibilities through agency and stewardship theory, 4.4 risk allocation and 4.5 presents an overview of this operationalisation.

4.Operationalisation

To research the process of the first phase it is important to know what to look for: in other words the relevant theories have to be operationalised. This operationalisation does not have to be worked out as detailed as possible due to the scope and intent of the research. It is necessary to at least have an inclination on how responsibilities and risks are divided, both on paper and in practice, as well as to see if actors behave in a way that can be explained by or is indicative of agency or stewardship theory. In other words what elements or factors can be differentiated and what possible indicators look like. In this section literature is presented which aides in this operationalisation and an operationalisation is given.

4.1 Two phase process project delivery method design

The classification of various two phase process project delivery method designs made by the Instituut voor Bouwrecht (2022) presented in section 3.1 provides a framework from which to view the projects that have been researched. Looking at the various different types of methods there are a couple of features and characteristics which help in identifying what two phase process project delivery method design an investigated project is. In Table 5 these are presented.

Table 5

Identifying characteristics of two phase project delivery method designs

Feature	**Characteristic**	**Question interview procedure**
Opt in or opt out contract (Instituut voor Bouwrecht, 2022)	Existence of a suspensive or resolutive condition(s) for agreement second phase	1.1, 1.1b, 1.2, 1.2a, 1.6
Contract used for the first phase	Service contract, integrated contract, Bouwteam, other	1.1, 1.1a, 1.2, 1.2a
Contract conditions used for the first phase	UAC 2012, UAC-IC 2005, TNR 2011, Model Agreement Bouwteam DC 2020, other	1.1, 1.1b, 1.2, 1.2a, 2.6
Organisation project team(s)	IPM model, Mirrored IPM Team	1.2, 1.2a, 3.1, 3.1a, 3.1b, 3.7

In addition to identifying the design of the two phase process project delivery method and mapping/charting what agreements have been made within this method and how it is shaped, the motivation for the use of this type of method is also investigated. This in order to see whether the motivation or reasoning for a certain type of method is reflected in the method and choices within the method itself. This operationalisation leads to questions used in the interview procedure provided in Appendix A.

4.2 Information risk

Information risk, or specifically what is known and what is assumed, has to be operationalised in order to answer how it is affected by the two phase process project delivery method design. To do this, what is known, how much is known and when in the process it is known has to be investigated. These questions provide the operationalisation of information risk within this research, which is provided in Table 6 below.

Table 6

Operationalisation of information risk

Information	**Indicator / Source**	**Why?**	**Question interview procedure**
Known unknowns and known knowns	(additional) Research into project specific conditions	This shows if there is a progression in knowledge during the first phase by questioning whether (additional) research was done during the first phase. Research done in the first phase suggests that this information was not yet there and possibly not yet known not to be there before the first phase. Subquestions concern whether the research was a result of cooperation between the client and the contractor and what the research yielded.	2.1, 2.1a, 2.1b. 2.3, 2.3a
	Risks identified at the start and at the end of the first phase e.g. a risk register.	This shows if there is a difference in the amount and/or size of the risks identified before and after the first phase. The subquestion 2.2a concerns whether or not cooperation between client and contractor is responsible for the new identified risks.	2.2, 2.2a
Design level before and after the first phase	Brief, Preliminary design, Definitive design, Executive design, Technical Specifications	The level of design reveals something about the level of confidence in the assumptions and choices.	2.5
Transition to second phase	Content of resolutive or suspensive condition(s)	The resolutive or suspensive condition dictates when the agreement for the second phase can be terminated or agreed upon. Follow up questions concern when in the process this was decided and by who(m).	2.4, 2.4a, 2.4a, 2.6

4.3 Division of Responsibilities

In order to investigate the division of responsibilities it is needed to not only look at the divisions in the contract on paper but also at how this relationship plays out in practice.

4.3.1 Responsibility division

Responsibility can be interpreted in different ways. There exists the final responsibility for products and outcomes of the first phase. This concerns which party is liable for design choices and risks which stem from these. The other 'type' of responsibility is concerned with which party is responsible for completing the tasks to get certain jobs done. For instance: parties can share liability (responsibility) for a design choice whilst the design task (responsibility) has been done by one of them or a third party. This difference is important to note in order to understand how responsibility has been operationalised and researched. In addition to this difference in interpretation of the term responsibility, there can also exist a difference in what is written down in agreements and how the responsibility division plays out in reality.

The division of responsibility is investigated by looking at project documents and asking for agreements that have been made before, during and after the first phase. Both on the carrying out of the tasks as well as (design) responsibility for the outcome and products of this process and these tasks. Understanding that it is possible for the reality on the ground to differ from what is written down in the agreements, in interviews this reality has been looked at. This has been done by asking multiple people involved in the cases per side what the agreements were and what the division of tasks and responsibilities was actually like in the project.

In order to further investigate how the relationship between the client and the contractor plays out in practice in comparison to what is written down on paper the theories of agency and stewardship from section 3.3.2 and 3.3.3 are used. These are operationalised in section 4.3.2 and 4.3.3.

4.3.2 Agency theory

Agency theory is one of the two theoretical models used to investigate the relationship and behaviour exhibited between client and contractor in this research. In section 3.3.2 agency theory is explained in depth, in this section the operationalisation of the theoretical model is presented.

Agency theory is a well-known and much used theoretical model which has also greatly influenced organisation and management theory (Davies et al, 1997). For the operationalisation reviews of the literature on agency theory are therefore used, in order to get a grip on the most important elements of the theory in the literature. Agency theory originates from risk sharing theory and this can be seen in the elements and propositions seen in the literature, which are heavily based on information and access to information. This can be seen in Table 7, where the problems associated with agency theory (from section 3.3.2) are presented along with indicators.

Table 7

Operationalisation of agency theory

Element	**Indicator**	**Question interview procedure**
Goal conflict (Eisenhardt, 1989a; Panda & Leepsa, 2017; Schillemans and Bjurstrøm, 2020)	Differing goals between principal and agent	1.1, 3.1, 3.1a, 3.1b, 3.2, 3.7, 3.7a
Information asymmetry (Eisenhardt, 1989a)	Agent has more information than principal (Arrow, 1985; Eisenhardt, 1989a; Chrisidu-Budnik and Przedańska, 2017)	3.1, 3.1a, 3.1b, 3.2, 3.3, 3.3a
	Principal has more information than agent (Arrow, 1985)	3.1, 3.1a, 3.1b, 3.2, 3.3, 3.3a
	Hidden information (Arrow, 1985)	3.1, 3.1a, 3.1b
Strategic behaviour (Eisenhardt, 1989a)	Interplay of information and incentives; information is held back or provided in order to gain something by one of the parties	3.1, 3.1a, 3.1b, 3.2, 3.3, 3.3a, 3.4
Opportunism (Eisenhardt, 1989a; Herandez, 2012)	Response to events unfolding that benefits one party; self-serving (Hernandez, 2012).	2.2, 2.3, 3.3, 3.3a
Detailed boundary conditions (Schillemans and Bjurstrøm, 2020)	Accountability on following procedure is high and relationship is contract driven; ‘hard’ contracting (Greve, 2000; Schillemans and Bjurstrøm, 2020)	3.4, 3.4a, 3.4b, 3.4c, 3.5, 3.6, 3.6a,
Formal relationship management (Schillemans and Bjurstrøm, 2020)	Hierarchical relationship; minimisation of informal contacts in extreme cases (Schillemans and Bjurstrøm, 2020)	3.4, 3.4a, 3.4b 3.4c, 3.5

Agency theory is used, together with stewardship theory (see 4.3.3), in order to see what the relationship between client and contractor looks like in practice. For this the main characteristics of agency theory have to be known in order to make a judgement on what elements can be seen in the projects that have been researched. The work of Schillemans and Bjurstrøm (2020) has been used as a guide in the selection due to the focus of their research on governance in public agencies.

In addition to these characteristics Eisenhardt (1989a) provides mechanisms or interventions which can be put in place which help combat the problems which can arise in the relationship between principal and agent. Schillemans and Bjurstrøm (2020) identify some of these mechanisms as characteristics of agency theory. These are interesting to look at in order to see if they are present in the researched projects. Table 8 shows these mechanisms.

Table 8

Operationalisation of agency theory model mechanisms

Mechanism	**Indicator**	**Question interview procedure**
Outcome-based contract (Eisenhardt, 1989a)	Compensation is based on the final product, not the process or behaviour. Material incentives (Schillemans and Bjurstrøm, 2020).	1.1, 1.1.b, 1.2, 2.6
Agent's behaviour is monitored (Eisenhardt, 1989a)	Monitoring and verification of agent behaviour (Schillemans and Bjurstrøm, 2020). Verification reduces the possibility of opportunism (Eisenhardt, 1989a)	3.4, 3.7, 3.7a

These indicators of agency costs, characteristics and mechanisms to combat and reduce these are looked at both in the written down agreements and through interviews which are held. See Appendix A for the interview procedure, section 3 contains most of the questions which are used to investigate agency theory (directly).

4.3.2 Stewardship theory

Besides the agency theory model this research makes use of the stewardship theory model in order to investigate the division of responsibilities between client and contractor. In section 3.3.3 the theoretical model is explained, here its operationalisation relevant to this research is presented.

Stewardship theory is a response to agency theory (Hernandez, 2012; Schillemans and Bjurstrøm, 2020). This is reflected in its characteristics which differ clearly to those of agency theory presented in 4.3.2. As Schillemans and Bjurstrøm (2020) note, stewardship differs from agency theory in the motivation of agents. Actors will put the organisational goals above self-serving ones. Hernandez (2012, p. 177) provides "A Model of Stewardship Antecedents". The model gives factors which precede mechanisms in actors which lead to stewardship

behaviour. These antecedents are split into multiple categories, from ‘Structural factors’ to ‘Psychological factors’ leading to the mediating variable of psychological ownership and the outcome of stewardship behaviours. Davis et al. (1997), Donaldson (2008) and Schillemans and Bjurstrøm (2020) also provide characteristics of stewardship. These different characteristics and mechanisms are reflected in the operationalisation of stewardship theory for this research in Table 9 below.

Table 9

Operationalisation of stewardship theory

Characteristic	**Indicator**	**Question interview procedure**
Shared leadership practices (Hernandez, 2012)	Joint project team, jointly chaired meetings, shared workplace, cooperation ‘rules’	1.2, 1.2a, 3.2, 3.4, 3.4a, 3.4c, 3.5, 3.6, 3.6a
Feeling of ownership and responsibility (Donaldson, 2008; Hernandez, 2012)	Joint project team, do involved actors feel the project and process is ‘theirs’: mutual social exchange (Hernandez, 2012).	1.2, 1.2a, 3.1, 3.1a, 3.1b, 3.2
Alignment of goals / shared interest (Davis et al., 1997; Schillemans and Bjurstrøm, 2020)	In contrast to agency theory: overlapping goals. Do the client and contractor want the same thing for/in the first phase?	1.1, 1.2, 1.2a, 3.1, 3.1a, 3.1b, 3.2, 3.5
Collective responsibility for work outcomes, co-production (Hernandez, 2012; Schillemans and Bjurstrøm, 2020)	Feeling of cooperation, joint project team, shared workplace, shared responsibility in contract and practice.	1.2, 1.2a, 3.1, 3.1a, 3.1b, 3.2
Substantial discretion, self-management (Schillemans, 2007; Schillemans and Bjurstrøm, 2020)	Contract not perfectly detailed/open ended (Schillemans, 2013), social and psychological safety, trust	3.4, 3.4a, 3.4b, 3.4c, 3.5, 3.6, 3.6a
Immaterial rewards/professional rewards (Hernandez, 2012; Schillemans and Bjurstrøm, 2020)	Verbal praise, reputation (Schillemans and Bjurstrøm, 2020, p. 656), intrinsic benefit from working (Hernandez, 2012)	1.1, 1.2, 1.2a, 3.2, 3.4, 3.4a, 3.4b, 3.4c, 3.5 3.6, 3.6a, 5
Internal control (Schillemans and Bjurstrøm, 2020)	Open access to documents, monitoring is quite lean and done within the relationship (Schillemans and Bjurstrøm, 2020)	3.4, 3.4a, 3.4b, 3.4c, 3.5, 3.6,

		3.6a, 3.7, 3.7a
Informal relationship management (Schillemans and Bjurstrøm, 2020)	Equivalence in the working relationship (Schillemans and Bjurstrøm, 2020), joint team, shared workplace	3.1, 3.1a, 3.1b, 3.2, 3.4, 3.4a, 3.4b, 3.4c

Stewardship theory is mostly researched through interviews with people involved in the projects due to it being used in order to see what the relationship between client and contractor is like in practice. However, certain information on how the client and contractor have agreed to work together and the organisation of the relationship can also be learned from project documents like the contract or project management plan. Where possible information from project documents is used to back up data gathered from interviews using this operationalisation. For the interview procedure which uses the operationalisation of stewardship theory see Appendix A.

4.4 Risk allocation

Risk allocation is investigated by looking at both project documents which contain agreements made on risks as well as through data gathered in interviews. Important questions on the allocation are around whether or not there existed a plan for risk allocation before the first agreement, if it came to be during, or after the first phase. The risk allocation is a part of the agreement for the second phase. The parts of interest are who carries the risks and when and how this allocation came to be. In Table 10 the questions in the interview procedure related to risk allocation are presented.

Table 10

Risk allocation interview questions

Risk allocation	**Question interview procedure**
Risks second phase	4.1
Design risks	4.2
Agreement on risk division	4.3, 4.3a, 4.3b, 5

4.5 Overview of operationalisation

In Table 11 an overview of the operationalisation of all variables of interest for this research is presented. It is a broad overview which shows how collected data is researched and looked at for this research.

Table 11

Variables and their operationalisation

Variable	**Interview questions**
Two phase process project delivery method design	1.1, 1.1a, 1.1b, 1.2, 1.2a, 2.6, 3.1, 3.1a, 3.1b, 3.7, 5
Information risk	2.1, 2.1.a, 2.1.b, 2.3, 2.3.a, 2.4, 2.4.a, 2.5, 2.6, 5
Division of responsibilities	1.1, 1.1b, 1.2, 2.2, 2.3, 3.1, 3.1a, 3.1b, 3.2, 3.3, 3.3a, 3.4, 3.4a, 3.4b, 3.4c, 3.5, 3.6, 3.6a, 3.7, 3.7a, 5
Risk allocation	1.1., 2.3a, 2.4, 2.4a, 4.1, 4.1a, 4.1b, 4.2, 4.3, 4.3a, 4.3b, 5

Having operationalised all variables of interest: the two phase process project delivery method design, information risk, the division of responsibilities with both agency and stewardship theories and risk allocation it is possible to meaningfully look at the researched projects. In chapter 5 these projects and the findings are presented. The interview procedure based on the operationalisations presented in this chapter is shown in appendix A.

5. Case Studies

In this section the case studies are presented and discussed. First the selection of cases (5.1) and interviews held (5.2) is presented. Afterwards the case projects themselves are described (5.3) and finally the case findings from the case studies are presented (5.4).

5.1 Case selection

The case selection criteria presented in section 2.3.1 lead to the following selected cases, presented in Table 12. The cases are described more in depth in section 5.3, see 5.3.3 on how the selected satisfy the selection criteria.

Table 12

Case selection

Case project	**First phase contract type**	**Public client**
Case 1: Cruquiusbrug	Bouwteam under DC 2020 (Bouwteamovereenkomst; Interview 1A).	Province of Noord-Holland (Provincie Noord-Holland, 2021).
Case 2: Renovatie A12 IJsselbruggen	Cost-plus contract under UAC-IC 2005 (Interview 2A).	Rijkswaterstaat (Rijkswaterstaat PPO, 2021).

Two cases have been selected and researched. This amount is the result of the trade-off between the width and the depth of research within the limited time that was available for the research. This amount of cases provides enough grounding by looking at two similar projects in different contexts to be able to somewhat confidently extrapolate results whilst providing enough room to go in depth and find enough information of interest.

5.2 Interview selection

The choice has been made to interview two people from both the contractor and the client side per project. This has been done in order to guarantee multiple perspectives on the project, both within each side and across the relationship between the contractor and the client. This is needed to provide validity to the findings and to remove, or at least better locate, personal beliefs from facts or more widely held views. From each party of each project the project manager has been interviewed. The second interviewee per party differs, but is either a project control manager or contract manager. These choices were based on the research questions, for which both risks and the responsibility division have been studied. These are covered by the project manager and either contract or project control. Contract managers have been approached first and in case of unavailability, project control managers due to the integral nature of their role. This way information regarding the agreements made on paper and the reality of the projects has been retrieved in the interviews. In Table 13 below the interview selection per case is presented along with the role and involvement of the interviewee in the case project. In 5.3 and 5.4 the findings from the case interviews are presented.

Table 13

Interview selection

Project	Nr.	Project role	Side	Involvement
Case 1: Cruquiusbrug	1A	Project Manager	Public client	Entirety of the first phase, tender until now (Bouwteamover eenkomst).
	1B	Project Manager	Contractor	Entirety of the first phase, tender until now (Bouwteamover eenkomst; Interview 1D).
	1C	Contract Manager Advisor	Public client	Start of the first phase until over halfway first phase (Interview 1C).
	1D	Contract Manager	Contractor	Tender phase, second phase (Interview 1D).
Case 2: Renovatie A12 IJsselbruggen	2A	Project Manager	Public client	Entirety of the first phase, tender until now (Interview 2A; Rijkswaterstaat PPO, 2020).
	2B	Project Manager	Contractor	Entirety of the first phase, tender until now (Interview 2B).
	2C	Manager Project Control	Public client	From about one third into the first phase until the end, into phase two (Interview 2C, 2D).
	2D	Manager Project Control	Contractor	From about halfway through the first phase until the end, into the second phase (Interview 2D).

All interviewees have signed an informed consent form, which can be found in Appendix B. Furthermore, all data gathered has been handled confidentially and according to the code of conduct of the TU Delft. See Appendix C for the data management plan. Not all information which has been gathered and used for this research can be made public. The transcriptions from the interviews are not included in the public thesis due to the sensitive and identifying information included relating to projects that are still ongoing. This is done in line with the guidelines from the TU Delft and consent gotten from the interviewees. When reference is made in 5.3.1 and 5.4.1 to Cruquiusbrug documents such as “Basisovereenkomst”, “Bouwteamovereenkomst”, “Integraal Plan van Aanpak Bouwteamfase” or “Kennisgroep bouwteams” this means that insight and access to these documents and agreements has been given by interviewees and enjoyed by the researcher. However, due to the confidentiality of these documents they are not themselves included in the report. These documents are all agreements and specifications of those agreements between the client and the contractor of the case project. In case 2: Renovatie A12 IJsselbruggen all project documents which have been used are public and can be found in the bibliography.

5.3 Case descriptions

In this section the case projects which have been researched are described. The information on the cases comes from grey literature, project documents and interviews.

5.3.1 Case 1: Cruquiusbrug

In Table 14 the key information on case 1: Cruquiusbrug is presented.

Table 14

Key information on case 1: Cruquiusbrug

Status	Project currently in the second phase (Bouwteamovereenkomst; Interview 1B, 1C, 1D).
Design	Bouwteam with UAC-IC 2005 (Province Noord-Holland et al., 2022).
Contract	Bouwteam under Model Agreement DC 2020 (Interview 1A, 1D).
Client	Province of Noord-Holland (Provincie Noord-Holland, 2021; Provincie Noord-Holland et al., 2022).
Contractor first phase	Van Hattum en Blankevoort - Hollandia Infra (Provincie Noord-Holland, 2021; Provincie Noord-Holland et al., 2022).
Award price	20 000 000 EUR (Provincie Noord-Holland, 2021).
Total price	30 275 000 EUR Total budgeted by the province of Noord-Holland, after the first phase due to rising costs (Provincie Noord-Holland, 2022).

The Cruquiusbrug, or Cruquius bridge, is a project by the province of North Holland. It features two different challenges, corresponding to the two bridges, within its scope. The first is a bridge which needs to be renovated and has its life span increased by around 30 years in order to stay safe and up to standards. The second, eastern, bridge needs to be completely replaced (Provincie Noord-Holland, 2021; Provincie Noord-Holland et al., 2022). Provincie Noord-Holland et al. (2022, p. 2) state: “The high traffic load on the N201 combined with the technical complexity, many surrounding stakeholders and high sustainability goals make a good design and realisation process crucial”. The sustainability goals refer to the ambitions the public client had and has with this project on circularity, energy and maintenance (Provincie Noord-Holland, 2021).

5.3.2 Case 2: Renovatie A12 IJsselbruggen

In Table 15 the key information on case 2: Renovatie A12 IJsselbruggen is presented.

Table 15

Key information on case 2: Renovatie A12 IJsselbruggen

Status	Project currently in the second phase (Interview 2A, 2B, 2C, 2D).
Design	Two phase after final award (Rijkswaterstaat, 2020b).
Contract	E&C contract under UAC-IC 2005 (Rijkswaterstaat PPO, 2020).
Client	Rijkswaterstaat (Rijkswaterstaat PPO, 2021)
Contractor first phase	Savera IJsselbruggen consortium: Dura Vermeer and Hollandia Services (Rijkswaterstaat PPO, 2021).
Award price	45 000 000 EUR (Rijkswaterstaat PPO, 2021).
Final price	61 024 204,70 EUR (Rijkswaterstaat PPO, 2023).

Renovatie A12 IJsselbruggen is a Rijkswaterstaat project for the renovation of a bridge over the river IJssel. The design is a version of the opt out design I: Two phase after final award. The project award states that (Rijkswaterstaat PPO, 2021, p. 3): “The contractor must perform the following activities: The engineering (mainly in Phase 1) and execution (mainly in Phase 2) of the renovation of the main supporting structure of the steel IJsselbruggen in the A12”. The contractor is contracted with an Engineering and Construct (E&C) contract under the UAC-IC 2005 (Rijkswaterstaat, 2020). A target price has been given as part of the award (Rijkswaterstaat PPO, 2020). This price was based on the total project estimate and was used as a reference in validating the eventual offer at the end of the first phase (Rijkswaterstaat PPO, 2020). The project is a DOEN project which are projects in which Rijkswaterstaat tries to improve the relationship with the market and the collaboration between them and the market (Project DOEN, 2022). This collaboration ambition has led to more projects with deferred price setting by Rijkswaterstaat. The unofficial slogan of the DOEN ambition is: “Honest pay for honest work” (Project DOEN, 2022).

5.3.3 Case selection criteria compliance

Having presented the cases more in depth it is clear that these cases satisfy the case selection criteria presented in section 3.2.1. The cases have different two phase project delivery method designs and contract types for the first phase. Furthermore, both projects have completed the first phase and both are bridge projects and thus from the ground, water and road sector. The cases are similar in challenge as they concern a bridge renovation and a bridge renewal or both. Finally, it has been possible to conduct interviews with the relevant project team members.

5.4 Case findings

In this section the case findings are presented for both cases. The case findings are organised into four parts corresponding to the subjects of interest: the two phase process project delivery method design, information risk, division of responsibilities and risk allocation. The findings are first presented in the form of the operationalised tables from chapter 4 and then discussed further afterwards.

5.4.1 Case 1: Cruquiusbrug

In this section the findings of the case project Cruquiusbrug are presented. These findings are the result of the study of project documents as well as interviews with involved actors.

5.4.1.1 Two phase process project delivery method design

With the Cruquiusbrug the public client wanted to provide room for innovations to be tried as well as have the ambition of a circular project be realised. To help accomplish this a deferred price setting project delivery method design in the form of a Bouwteam was chosen (Interview 1A, 1B, 1C). This means the client is able to take advantage of the market and its knowledge and competency. The Cruquiusbrug can be classified as an example of an opt in design, design II: a Bouwteam with UAC-IC 2005. The first, Bouwteam, phase has been completed and the project is currently in the second phase. In Table 16 the findings regarding the specific project delivery method design are presented.

Table 16

Cruquiusbrug project delivery method design findings

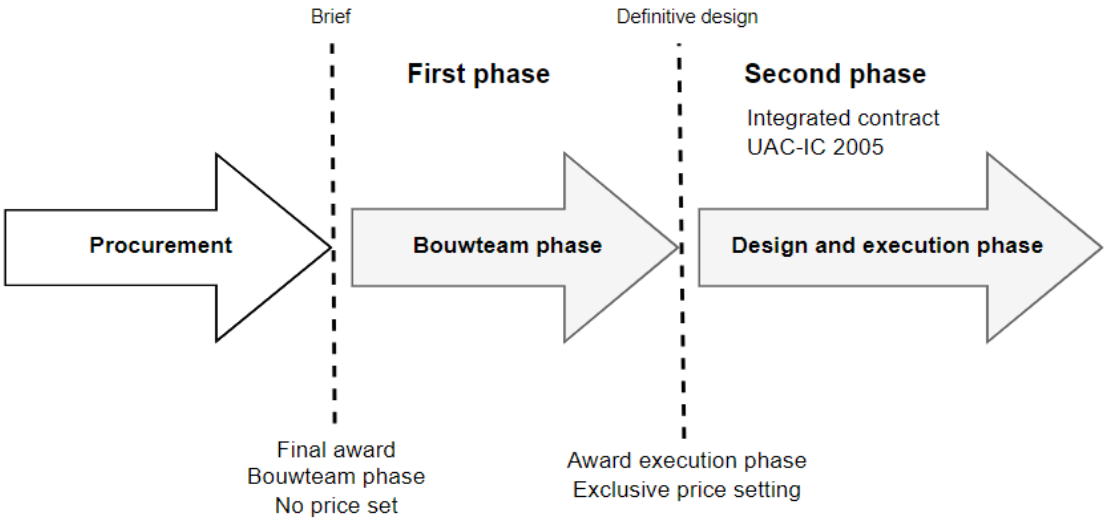
Characteristic	**Observed**	**Example / Explanation**
Existence of a suspensive or resolutive condition(s) for agreement second phase	Suspensive condition for the second phase agreement.	Agreement on price is a suspensive condition for the execution phase (Basisovereenkomst; Interview 1A, 1B, 1C, 1D). Interestingly, the contract for the execution has been signed together with the Bouwteam agreement at the start of the first phase (Interview 1D)
Service contract, integrated contract, Bouwteam, other	First phase is a Bouwteam. Second phase integrated contract.	Bouwteam 2.0 is followed for the first phase with shared liability for certain products of the Bouwteam phase and the design (Basisovereenkomst; Bouwteamovereenkomst; Interview 1A, 1B, 1C, 1D), see 5.4.1.3 for more in depth explanation.
UAC 2012, UAC-IC 2005, TNR 2011, Model	First phase under adapted Model Agreement Bouwteam	The Model agreement Bouwteam DC 2020 has been

Agreement Bouwteam DC 2020, other	DC 2020, Second phase under UAC-IC 2005	used (Interview 1A, 1B, 1D).
Integrated IPM team, mirrored IPM team, other	Integrated IPM team was used for the first phase.	The Bouwteam agreement states that the team used would be an integrated IPM team with the client providing the managers (Bouwteamovereenkomst). The interviewees differ in their recollection: the client remembers a mirrored IPM team (Interview 1A, 1C) whilst the contractors say it was an integrated team (interview 1B, 1D).

The Cruquiusbrug is an example of a Bouwteam 2.0 project delivery method design, see Figure 23 below. This is evidenced by the use of an integrated contract for the second phase as well as the use of an integrated IPM team in the first phase. In the design seen here the client and contractor made design choices together and the contractor also carries responsibility for these choices (see 5.4.1.3), instead of only advising the client.

Figure 23

Schematic representation of the PDM of Cruquiusbrug



Note. Based on Basisovereenkomst; Bouwteamovereenkomst; Interview 1A, 1B, 1C, 1D.

5.4.1.2 Information risk

In Table 17 the findings regarding information risk in the first phase of the Cruquiusbrug project are presented.

Table 17

Cruquiusbrug information risk findings

Information	**Indicator / Source**	**Observed**	**Example / Explanation**
Known unknowns and known knowns	(additional) Research into project specific conditions	Yes. Additional research into project specific conditions has been conducted in the first phase.	Interview 1B states that additional unplanned research has been done into possible re-use of a part, the leaf, of the renovation bridge as well as planned research for the replaced bridge. According to interview 1C the planned first phase research related to innovation opportunities and was needed to complete the first phase.
	Change in risks identified at the start and at the end of the first phase e.g. a change in risk register.	Yes. Risk register was updated periodically and jointly (Integraal Plan van Aanpak Bouwteamfase; Interview 1B)	The part that could possibly be reused or not, the leaf, was not included in the risk register at the start of first phase and was introduced by the contractor (Interview 1B). Risks have been added during the first phase (Interview 1D), even though extensive research had been done before the first phase (1C).
Design level before and after the first phase	Brief, Preliminary design, Definitive design, Execution design, Technical Specifications	The first phase went from a brief to definitive design (Bouwteamovereenkomst; Interview 1A, 1B)	A design, a sort of reference design made by an engineering firm existed (Interview 1B, 1C). This design was not available to the contractor.
Transition to second phase	Content of resolutive or suspensive condition(s)	A suspensive condition was observed.	The suspensive condition was price agreement on the definitive design (Bouwteamovereenkomst; Interview 1A, 1B, 1C, 1D). There was discussion on the take-over point and what constituted a definitive design (Interview 1B).

From the project documents and the interviews held it is clear that the first phase was used to do additional research on the project specific conditions. Furthermore, part of this research was unplanned and came to be during the first phase and because of the involvement of the contractor. New risks have been discovered during the first phase as well. It is therefore possible to conclude that information risk has been reduced over the course of the first phase. Interestingly, even with a detailed plan and definition of the definitive design it took some discussion and work between client and contractor during the first phase to decide what actually constitutes a definitive design in practice (Interview 1B, 1C). Furthermore, the client expressed that they learned more about the contractor and their way of working through the first phase (Interview 1A).

5.4.1.3 Division of responsibilities

The agreement for the first phase works on the basis of products which define tasks that have to be completed (Bouwteamovereenkomst). The responsibilities for the tasks and the liability for the results within the Bouwteam phase differ per product. Appendix III of the Bouwteamovereenkomst stipulates different work packages and products and which party is responsible for getting the work done as well as which party carries the liability for the product and how much of it. Most of the design products have a 50/50 split in liability for the end result. This means that both parties carry 50% of the risks for choices made in the design during the first phase (Bouwteamovereenkomst; Interview 1A, 1B, 1C, 1D). The take-over point of the definitive design by the contractor was a difficult process which led to a lot of discussion (Interview 1B, 1C, 1D) about what actually constituted this definitive design.

The standard Bouwteam was seen as giving too few responsibilities to the contractor by the client (Interview 1A), as this sees the contractor in a consulting role. This in combination with the results of the market consultation and ambitions around innovations and sustainability was the reason for the use of this Bouwteam project delivery method design (Interview 1A; Kennisgroep bouwteam).

In order to see what these agreements and division of responsibilities mean for the relationship between the client and contractor on the project, the findings regarding agency and stewardship theory are presented in Table 18 and Table 19.

Table 18

Cruquiusbrug agency theory findings

Element	**Indicator**	**Observed**	**Example / Explanation**
Goal conflict (Eisenhardt, 1989a; Panda & Leepsa, 2017; Schillemans and Bjurstrøm, 2020)	Differing goals between principal and agent	Somewhat observed in transition or take over point at the end of first phase.	There was discussion between client and contractor on what constituted the definitive design (Interview 1B, 1C, 1D). The client consultant sees a possible incentive for the contractor to keep engineering and reduce risks further (Interview 1C). Contractor sees them having to split responsibility whilst not

			getting the full design say (Interview 1D).
Information asymmetry (Eisenhardt, 1989a)	Agent has more information than principal (Arrow, 1985; Eisenhardt, 1989a; Chrisidu-Budnik and Przedańska, 2017)	Yes.	The Bouwteam model was chosen because of the high ambition level with the project by the client and the expertise and experience of market parties on this type of project (Interview 1A, 1C). As evidenced by the unidentified possible reuse of the leaf the contractor at least had some more relevant information/knowledge (Interview 1B).
	Principal has more information than agent (Arrow, 1985)	Yes.	A ‘proof of concept’ reference design made by the engineering firm which was part of the client existed which was not given to the contractor (Interview 1B, 1D), at least not during the procurement phase (Interview 1C).
	Hidden information (Arrow, 1985)	Yes. Perceived by the contractor.	According to the contractor the reference design was used by the client as input for requirements (Interview 1B, 1D). No insight into this design was had by the contractor (Interview 1B). It is confirmed that such a design existed and the contractor did not have access during the procurement process at least (Interview 1C).
Strategic behaviour (Eisenhardt, 1989a)	Interplay of information and incentives; information is held back or provided in order to gain something by one of the parties	Yes. Perceived by the contractor.	The contractor was of the perception that the design made by the engineering firm was not shared in order to shun liability for design choices made (Interview 1B). Consultant to client indicates the design was not shared, at least during procurement, in order to give space for different design interpretations in line with the innovation ambition (Interview 1C).
Opportunism (Eisenhardt, 1989a;	Response to events unfolding that benefits one	No.	No clear indications from the interviews held.

Herandez, 2012)	party; self-serving (Hernandez, 2012).		
Detailed boundary conditions (Schillemans and Bjurstrøm, 2020)	Accountability on following procedure is high and relationship is contract driven; 'hard' contracting (Greve, 2000; Schillemans and Bjurstrøm, 2020)	Yes.	"The contract was monitored in a very traditional UAC-IC way by the client" (Interview 1B). "It was very much contractually driven [by the client]" (Interview 1B). Contractor said it could have been a normal integrated contract and it was handled like an integrated contract by the client (Interview 1B, 1D). Monitoring by client on staying inside the task-based budget for the first phase took place based on design phases defined before the first phase (Integraal Plan van Aanpak Bouwteamfase; Interview 1A, 1B, 1C).
Formal relationship management (Schillemans and Bjurstrøm, 2020)	Hierarchical relationship; minimisation of informal contacts in extreme cases (Schillemans and Bjurstrøm, 2020)	Somewhat observed.	It depended on the people in the teams how formal they acted towards the 'other side' and some on the side of the contractor needed reminding that the first phase was done together (Interview 1A). Atmosphere was informal but not completely open and everyone did revert to the traditional client-contractor roles during the first phase (Interview 1B). "Not very Bouwteam minded" (Interview 1B).
Outcome-based contract (Eisenhardt, 1989a)	Compensation is based on the final product, not the process or behaviour. Material incentives (Shillemans and Bjurstrøm, 2020).	Somewhat.	There was a task-based budget for the first phase and a task-based budget for the second phase agreement based on a suspensive condition of price agreement (Bouwteamovereenkomst).
Agent's behaviour is monitored (Eisenhardt, 1989a)	Monitoring and verification of agent behaviour (Schillemans and Bjurstrøm, 2020). Verification	Somewhat observed. Not by an external party or very formally.	One shared sharepoint with open access (Interview 1A, 1B, 1D). Two joint working days a week on the same location (Interview 1B). The Contractor needed to provide an open

	reduces the possibility of opportunism (Eisenhardt, 1989a)		budget for the definitive design (Bouwteamovereenkomst Appendix III).

From the case findings it is clear that quite some elements of the agency theory model can be, at least somewhat, differentiated in case 1 Cruquiusbrug. However, not all of the defining characteristics are clearly visible, or they can only be backed up by the contractor's side of the relationship. It does seem however that the first phase was traditionally contract driven and there was some strategic behaviour exhibited by the client with regards to the client not sharing the design which the engineering firm that was part of their team had made. The client could exert influence on the design process by being involved and having the knowledge of their own design whilst carrying 50% of the liability for, at least some of, the design choices.

Furthermore, it is interesting to note that at least one of the mechanisms that Eisenhardt (1989a) states help limit agency problems has been implemented. There was a budget for the first phase and for the second phase which the design had to adhere to (Interview 1C). Of note is that the first phase took nine months, which is quite short according to the contractor (Interview 1B). This, even though there were discussions around the take-over (Interview 1B, 1C).

Table 19

Cruquiusbrug stewardship theory findings

Characteristic	**Indicator**	**Observed**	**Example / Explanation**
Shared leadership practices (Hernandez, 2012)	Joint project team, jointly chaired meetings, shared workplace, cooperation 'rules'	Yes.	One of the results of the project start up were 8 cooperation agreements which the project managers would bi-weekly reflect on and for which an app was used to monitor (Integraal plan van Aanpak Bouwteamfase). One shared sharepoint with open access (Interview 1A, 1B, 1D). Two joint working days a week on the same location (Interview 1B). The two PMs did joint presentations (Kennisgroep bouwteams).
Feeling of ownership and responsibility (Donaldson, 2008; Hernandez, 2012)	Joint project team, do involved actors feel the project and process is 'theirs': mutual social exchange (Hernandez,	Somewhat observed. Differs per side.	Perception of the contractor is that the client was somewhat hands-off in terms of getting the tasks done in the first phase (1B). Client sees this as having been a cooperative process (1A, 1C). Technical disciplines seem

	2012).		to have had this more than others (Interview 1B, 1D).
Alignment of goals / shared interest (Davis et al., 1997; Schillemans and Bjurstrøm, 2020)	In contrast to agency theory: overlapping goals. Do the client and contractor want the same thing for/in the first phase?	No.	A clear alignment of goals has not been observed. There was discussion between client and contractor on what constituted the definitive design (Interview 1B, 1C, 1D). Client advisor sees an incentive for the contractor to keep engineering and reduce risks further (Interview 1C). Contractor sees them having to split responsibility whilst not getting a real design say (Interview 1D).
Collective responsibility for work outcomes, co-production (Hernandez, 2012; Schillemans and Bjurstrøm, 2020)	Feeling of cooperation, joint project team, shared workplace, shared responsibility in contract and practice.	No.	The Bouwteam was an integrated IPM team (Bouwteamovereenkomst Appendix I), but in the client's recollection it was a mirrored team (Interview 1A, 1B, 1C, 1D). The contractor described the task division as if it was a traditional D&C contract (Interview 1B, 1D). Furthermore, the fact that on certain products the client made the final call whilst the responsibility was split caused some uncomfortable feelings (Interview 1D). This indicates that there was no real co-production and feeling of collective responsibility.
Substantial discretion, self management (Schillemans, 2007; Schillemans and Bjurstrøm, 2020)	Contract not perfectly detailed; open ended (Schillemans, 2013), social and psychological safety, trust	No.	Contract, especially the brief, was very detailed according to the contractor (Interview 1D). "The contract was monitored in a very traditional UAC-IC way by the client" (Interview 1B). "It was very much contractually driven [by the client]" (Interview 1B). Contractor said it could have been a normal integrated contract and it was handled like an integrated contract by the client (Interview 1B, 1D). Monitoring by the client on staying inside the task-based budget for the first phase took

			place based on design phases defined before the first phase (Integraal Plan van Aanpak Bouwteamfase; Interview 1A, 1B, 1C).
Immaterial rewards/professional rewards (Hernandez, 2012; Schillemans and Bjurstrøm, 2020)	Verbal praise, reputation (Schillemans and Bjurstrøm, 2020, p. 656), intrinsic benefit from working (Hernandez, 2012)	No.	No observed indications that this was clearly implemented or experienced in this way from any of the interviews. Project documents do not show real indications this was the case.
Internal control (Schillemans and Bjurstrøm, 2020)	Open access to documents, monitoring is quite lean and done within the relationship (Schillemans and Bjurstrøm, 2020)	Yes.	One shared sharepoint with open access (Interview 1A, 1B, 1D). Two joint working days a week on the same location (Interview 1B). The Contractor needed to provide an open budget for the definitive design (Bouwteamovereenkomst Appendix III)
Informal relationship management (Schillemans and Bjurstrøm, 2020)	Equivalence in the working relationship (Schillemans and Bjurstrøm, 2020), joint team, shared workplace	Somewhat observed.	The atmosphere was good (Interview 1A, 1B), informal relationship and discourse (Interview 1B), there was a (hybrid) integrated IPM team with the client supplying the managers (Bouwteamovereenkomst; Interview 1B, 1D). However, the client and contractor played traditional roles (Interview 1B) with the client's recollection of a mirrored IPM team (Interview 1A, 1C) reflecting this.The PM on the client side also remembers it taking time and real effort by him to transmit to the project people in the Bouwteam (or project team) to get into a more cooperative 'Bouwteam' mode of working together instead of the traditional way of working where the contractor carries the work more on their own (Interview 1A).

The findings show that markedly less characteristics of the stewardship theory model can be seen compared to the characteristics of the agency theory model. This suggests that the relationship between the client and contractor in the first phase of this project was more contractually based in the balance between the two. This does not mean however, that there was no cooperation or that the relationship was bad. Indeed, all interviewees agree that on the technical disciplines cooperation and exchange went really well and in general the atmosphere was good and informal (Interview 1A, 1B, 1C, 1D). However, the contractor feels like the relationship was traditionalist - like a classical integrated contract responsibility division - (Interview 1B, 1D) whilst the client feels like the contractor needed reminding of the different responsibility division a Bouwteam entails (1A). This does suggest that the working relationship on the project was more in line with the agency theory model than the stewardship theory model.

5.4.1.4 Risk allocation

The risk allocation for this project is based on the work packages and products of the Bouwteam agreement (Bouwteamovereenkomst). The liability for products have been assigned to either the client, the contractor or both. Design choices made within the Bouwteam are carried together (Interview 1A). Products which fully came from the contractor were fully their responsibility (Interview 1A). The choice for a Bouwteam from the client came from experience with integrated contracts for bridge projects where the scope turned out to be wrong and this led to increased costs and longer project durations (Interview 1A). In order to have more say in the matter a Bouwteam has been chosen. However, where the client saw this as taking on 50% of the responsibility, the market saw this more as being forced to take on 50% of the liability themselves (Interview 1A, 1D). This is backed up by the sentiments expressed in interview 1D which state they did not get full say on design choices but did have to carry the risks for them. Interview 1A confirms this somewhat by indicating that the ‘standard’ Model Agreement Bouwteam DC 2020 was seen as being a bit limitative by giving too little responsibility to the contractor and therefore the client opted to use the Model Agreement Bouwteam DC 2020 with a few project specific changes regarding liability. After the Bouwteam phase the contractor took over the design and the associated risks with bringing the design further and executing the work (Interview 1B) per the UAC-IC 2005 contract for the second phase.

5.4.1.5 Conclusions

The case findings of the Cruquiusbrug lead to the following conclusions. The Cruquiusbrug is an example of the two phase process project delivery method design opt in design II: Bouwteam 2.0. The first phase is a Bouwteam under the Model Agreement Bouwteam DC 2020 and the second phase is under UAC-IC 2005. The information risk was reduced over the course of the first phase through additional research and input from the contractor. The division into a Bouwteam phase with shared responsibility and then a take-over with the second phase under UAC-IC 2005 has led to some frustration on the contractors side with how the first phase has played out. This can be seen in the relationship and behaviour that has been observed. Elements of both agency and stewardship theory are present, however agency theory better fits the behaviour and relationship that has been observed. The atmosphere was good and informal, but the relationship was more traditionally contract driven than expected by the contractor under such a first phase design. Both parties exhibited traditionalist behaviour associated with more traditional project delivery methods and

contracts. The design risks for the definitive design of the first phase have been split between client and contractor. The risks for the further development of the design and execution in the second phase have been carried by the contractor.

In addition to these conclusions some interesting observations are made regarding the project delivery method design and the effects on the project process. Firstly, even though there was discussion on the take-over point, the first phase was completed in nine months. The project manager of the contractor does not see the way the first phase played out - traditional and with the contractor taking on most design duties - as caused by the contract but by the people that were on the project, both on the client side as well as on the contractor side (Interview 1B). In the eyes of the contractor the contract offered little room for changes to the requirements already set out or for choices which would affect only the second phase: the client strongly guarded the contract (Interview 1B, 1D). Secondly, both sides expressed how this type of project delivery method asks quite a lot from people and it is different from traditional contracts in terms of behaviour and relation to the other party. Thirdly, there is a big difference in perception between the client and the contractor. The contractor did not feel they did a full Bouwteam with room to explore the design. The client expresses how they took on liability whilst the contractor feels like they got handed liability without the room to make their own design choices. Finally then, it seems like a first phase with two stories, which was well controlled and completed, but handled in a more traditional way than the contractor had expected with this type of project delivery method.

5.4.2 Case 2: Renovatie A12 IJsselbruggen

In this section the findings of the case project Renovatie A12 IJsselbruggen are presented. These findings are the result of the study of tender documents as well as interviews with involved actors. No access was given to actual project documentation apart from publicly available documents such as the tender documents. This means that verification of the elaboration of the agreements has been gotten through interviews of the involved actors.

5.4.2.1 Two phase process project delivery method design

The choice for a deferred price setting project delivery method was the result of the amount of unknowns and uncertainty around the conditions of the project itself (Interview 2A, 2B, 2C) as well as the complexity of the project location in relation to the work that had to be carried out (Interview 2A). The client was not able to mitigate all unknowns and uncertainties up front themself (Interview 2B, 2C). To do this a contractor was involved for the necessary design and research steps needed (Interview 2A, 2B). This need for a market party (Interview 2A, 2B, 2C) combined with a want to gain experience with this type of contract (Interview 2A, 2C) was the reason to use this type of PDM for this project. The project is currently being realised and in the second phase. In Table 20 the findings on the project delivery method design of case 2 Renovatie A12 IJsselbruggen is presented.

Table 20

Renovatie A12 IJsselbruggen project delivery method design findings

Characteristic	**Observed.**	**Example / Explanation**

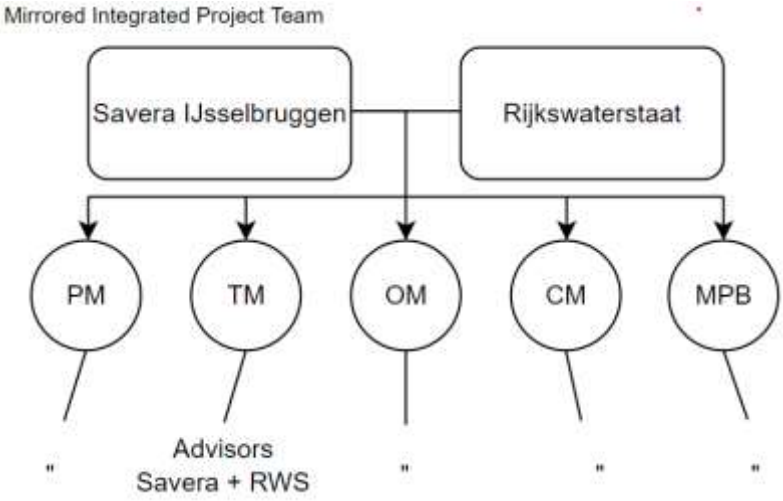
Existence of a suspensive or resolutive condition(s) for agreement second phase	Three suspensive conditions for the second phase agreement.	Three suspensive conditions (Interview 2A, 2B, 2C, 2D). These are: Rijkswaterstaat predicate green for the project estimate price (1), successful practical trial by the contractor (2) and guaranteed safety during second phase (3) (Interview 2A; Rijkswaterstaat 2020; Rijkswaterstaat PPO, 2020).
Service contract, integrated contract, Bouwteam, other	First phase is a cost-plus contract. Second phase integrated contract.	“The engineering for the first phase is on the basis of cost-plus” (Rijkswaterstaat PPO, 2020). The first phase can be seen as a cost-plus contract (Interview 2A). Differs from regular integrated contracts under UAC-IC 2005 which have a fixed price at award (Rijkswaterstaat PPO, 2020).
UAC 2012, UAC-IC 2005, TNR 2011, Model Agreement Bouwteam DC 2020, other	The agreement is under UAC-IC 2005. Both the first and second phase.	The UAC-IC 2005 has been used for both phases of the contract (Interview 2A, 2B, 2D; Rijkswaterstaat, 2020b; Rijkswaterstaat PPO, 2020). This means liability for design choices made in the first phase lies with the contractor, apart from when the client overrides the contractor (Rijkswaterstaat PPO, 2020).
Integrated IPM team, mirrored IPM team, other	A mirrored IPM team was used in the first phase.	The project used a mirrored IPM team (Interview 2A, 2B, 2C, 2D). Of note is that Rijkswaterstaat made known who would be in their IPM team before the award as part of the tender (Rijkswaterstaat PPO, 2020).

The suspensive condition relating to the total price estimate of the first and second phase combined provides a material incentive if the contractor is able to stay under budget. The cost-plus based first phase could possibly lead to the contractor wanting to keep engineering in order to further decrease the risks before starting execution as the costs they make in phase one are compensated. The Rijkswaterstaat predicate green for the project estimate price was a part of the agreement to keep this from happening.

In Figure 24 the IPM team as it was used for the first phase of the Renovatie A12 IJsselbruggen is shown. This illustration, based on a sketch from interview 2C, shows the mirrored team with the managerial roles filled by both sides. This team is called the project team or core team by interviewees. When use is made of the term project team this team is referred to. As mentioned above Rijkswaterstaat communicated the composition of their IPM team before the award (Rijkswaterstaat PPO, 2020).

Figure 24

Mirrored integrated project team of Renovatie A12 IJsselbruggen

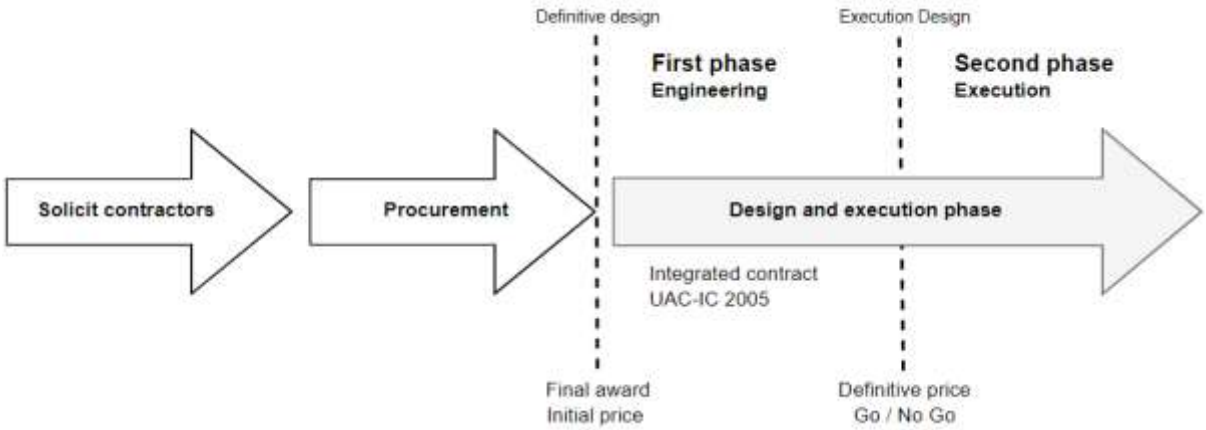


Note. Adapted from a sketch made by interviewee 2C. Important to note is that according to the award information the client also had a 'director asset management' (Rijkswaterstaat PPO, 2020) and the project manager of the contractor described that they added a role of a cost price manager on their side (Interview 2B). The sketch from interview 2C does not show these and therefore it has not been included in the figure.

In Figure 25 the project delivery method design observed in Renovatie A12 IJsselbruggen is shown. Clear are the suspensive conditions for the second phase agreement, with the first phase more focused on the engineering work and the second phase more focused on the execution work (Rijkswaterstaat, 2020b). "The client is intended to award the realisation to the contractor based on the tender bid, with the second phase awarded under a suspensive condition" (Rijkswaterstaat, 2020b, p. 4). Even though use is made of suspensive conditions for the second phase, because of the fact that the first and second phase are awarded in one agreement and an exit possibility is built in it is an opt out design. More specifically it falls under the opt out design I: Two phase after final award.

Figure 25

Schematic representation of the PDM of Renovatie A12 IJsselbruggen



Note. The design falls under the classification opt out Design I: Two phase after final award. Based on information from Rijkswaterstaat (2020b) and Rijkswaterstaat PPO (2021).

5.4.2.2 Information risk

In this section the findings on information risk in the first phase of the Renovatie A12 IJsselbruggen project is shown, see Table 21 below.

Table 21

Renovatie A12 IJsselbruggen information risk findings

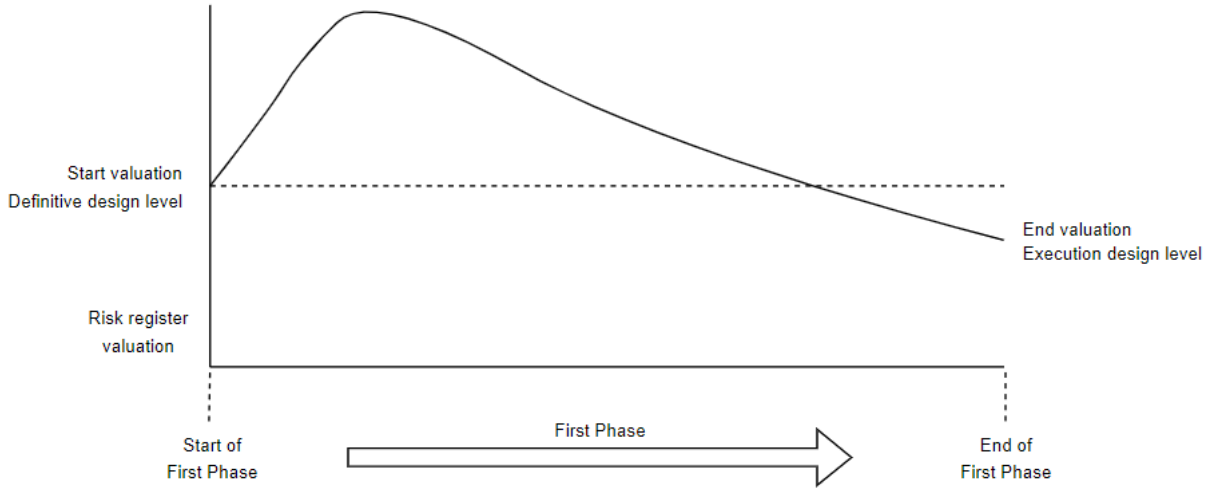
Information	**Indicator / Source**	**Observed**	**Example / Explanation**
Known unknowns and known knowns	(additional) Research into project specific conditions	Yes.	Additional research has been done in order to get the design further along and because conditions were uncertain (Interview 2A, 2B, 2C). Additional research was done into delamination of the steel (Interview 2C, 2D).
	Change in risks identified at the start and at the end of the first phase e.g. a change in risk register.	Yes.	Early in the first phase the amount of risks in and the total price of the risk register increased due to expertise of the contractor, at the end of the first phase the price was lower than the initial risk register value (Interview 2A). “Almost doubled, and afterwards it more than halved, so in the end the first phase helped both in identifying more risks and in better mapping the effects of risks” (Interview 2A). The risk of delamination was re-valued at least thirty times higher due to joint additional research done in the first phase (Interview 2C).
Design level before and after the first phase	Brief, Preliminary design, Definitive design, Execution design, Technical Specifications	From definitive design to execution design.	Design level after the first phase was not a suspensive condition on its own, but it was guaranteed to be sufficiently detailed by the Rijkswaterstaat predicate green (Interview 2A, 2B, 2C, 2D) which had a variance of 10% on the price estimate (Interview 2A; Rijkswaterstaat PPO, 2020). In

			practice this corresponded to an execution design level (Interview 2A, 2B, 2C, 2D).
Transition to second phase	Content of resolutive or suspensive condition(s)	Suspensive conditions were observed.	Three suspensive conditions (Interview 2A, 2B, 2C, 2D). These are: Rijkswaterstaat predicate green for the project estimate price (1), successful practical trial by the contractor (2) and guaranteed safety during second phase (3) (Interview 2A; Rijkswaterstaat 2020; Rijkswaterstaat PPO, 2020). When to transition was the result of talks and jointly figuring out when the project estimate was certain enough (Interview 2B, 2C). There existed a grey area around this (Interview 2C). “The good cooperation supported successfully working towards the phase transition” (Interview 2B).

It is clear that during the first phase the information risk was reduced by involving the contractor with their expertise and knowledge as well as the research into project conditions that has been carried out. A clear indicator of this fact is given in Interview 2A where the project manager explains how the value of the risk register changed over the course of the first phase. This is shown visually in Figure 26.

Figure 26

Conceptual sketch of the Renovatie A12 IJsselbruggen risk profile



Note. Based on Interview 2A. The figure shows a sharp rise at the start of the first phase, where the valuation “nearly doubled” (Interview 2A), after which it “more than halved” (Interview 2A) towards the end of the first phase. The figure is provided as a visualisation of

this information and does not portray an accurate representation of the evolution in risk valuation throughout the first phase.

As shown in the figure first the value increases sharply due to an increase in the amount of risks identified as well as a higher valuation of risks that have been identified already in the definitive design (Interview 2A, 2C). At the end of the first phase however, the value is lower than at the start (Interview 2A), showing that the first phase both made more risks known and made them more controlled.

5.4.2.3 Division of responsibilities

In this section the findings on the division of responsibilities and relationship between the client and contractor in the Renovatie A12 IJsselbruggen are presented and discussed. See Table 22 for the agency theory findings and Table 23 for the findings regarding stewardship theory.

Table 22

Renovatie A12 IJsselbruggen agency theory findings

Element	Indicator	Observed	Example / Explanation
Goal conflict (Eisenhardt, 1989a; Panda & Leepsa, 2017; Schillemans and Bjurstrøm, 2020)	Differing goals between principal and agent	No.	No clear indications from the interviews held.
Information asymmetry (Eisenhardt, 1989a)	Agent has more information than principal (Arrow, 1985; Eisenhardt, 1989a; Chrisidu-Budnik and Przedańska, 2017)	Yes.	The client needed the contractor and especially the knowledge on the execution phase in order to complete the design (Interview 2A, 2B, 2C).
	Principal has more information than agent (Arrow, 1985)	Yes.	The contractor had to learn the definitive design which was made by an engineering firm and the client (Interview 2B, 2D).
	Hidden information (Arrow, 1985)	No.	No indications from the interviews held. All indications point to everything being shared between the parties: definitive design was verified by the contractor at the start (Interview 2D), meetings were open and risk management was done jointly (Interview 2A, 2C, 2D). The

			culture did have to grow during the first phase (Interview 2B, 2C).
Strategic behaviour (Eisenhardt, 1989a)	Interplay of information and incentives; information is held back or provided in order to gain something by one of the parties	Not between client and main contractor. Somewhat in the sub-contractors.	In answering questions and explaining how the culture is open and built on trust, multiple interviewees mention the sub-contractors as not being part of this culture and exhibiting 'traditional' strategic behaviour (Interview 2C, 2D). In times of crises you saw that people (project team) revert back to traditionalist behaviour really quickly but thanks to the PM's explaining how this is a different project the culture was kept (Interview 2D).
Opportunism (Eisenhardt, 1989a; Herandez, 2012)	Response to events unfolding that benefits one party; self-serving (Hernandez, 2012).	No.	On the contrary, a risk that surfaced which under the agreement would be a client risk was taken on by the contractor (Interview 2D).
Detailed boundary conditions (Schillemans and Bjurstrøm, 2020)	Accountability on following procedure is high and relationship is contract driven; 'hard' contracting (Greve, 2000; Schillemans and Bjurstrøm, 2020)	No.	"The parent assignment is guiding and we will use our requirements to this end" (Interview 2A). "The framework was there, but there is no … there is quite some room to concretise yourself" (Interview 2B).
Formal relationship management (Schillemans and Bjurstrøm, 2020)	Hierarchical relationship; minimisation of informal contacts in extreme cases (Schillemans and Bjurstrøm, 2020)	No.	Relationship management was informal. "The notion that you have to formally arrange some things, has nothing to do with how you communicate and interact and cooperate with each other" (Interview 2A). The project control managers chaired meetings together and filled in for one another, even going so far as doing each other's one-on-ones with team members (Interview 2C, 2D). Informal contacts happen with happenings with each other on both sides (Interview 2B).
Outcome-based contract (Eisenhardt, 1989a)	Compensation is based on the final product, not the process or behaviour.	No.	The first phase contract is a cost-plus contract, meaning that the actual costs made are reimbursed (Rijkswaterstaat PPO, 2020; Interview 2A).

	Material incentives (Shillemans and Bjurstrøm, 2020).		
Agent's behaviour is monitored (Eisenhardt, 1989a)	Monitoring and verification of agent behaviour (Schillemans and Bjurstrøm, 2020). Verification reduces the possibility of opportunism (Eisenhardt, 1989a)	Somewhat observed. No external monitoring.	Monitoring through access to meetings and project documents. There were joint project environments: one Relatics, one Sharepoint (Interview 2B, 2D). There was a shared working place, which was used (Interview 2A, 2B, 2C, 2D). There were single, shared minutes, one project report with both sides giving their perspectives (Interview 2B).

The findings show that the agency theory model does not seem to capture the behaviour exhibited in the first phase of the project. The parties have not been observed to act (only) in rational self-interest as defined by agency theory.

Table 23

Renovatie A12 IJsselbruggen stewardship theory findings

Characteristic	**Indicator**	**Observed**	**Example / Explanation**
Shared leadership practices (Hernandez, 2012)	Joint project team, jointly chaired meetings, shared workplace, cooperation 'rules'	Yes.	The project team is a mirrored team with a shared workplace (Interview 2A, 2B, 2C, 2D) and weekly meetings with everyone (Interview 2C). "You do not really feel who is who [which side]" (Interview 2C). Both parties involved two "cooperation coaches" which jointly coach the project team and help them cooperate (Interview 2A, 2B, 2C, 2D). Project control managers chaired their meetings together and did each other's one-on-ones (Interview 2C, 2D).
Feeling of ownership and responsibility (Donaldson, 2008; Hernandez, 2012)	Joint project team, do involved actors feel the project and process is 'theirs': mutual social exchange (Hernandez, 2012).	Yes.	Everyone interviewed felt that the project was a joint effort and felt connected to it and the outcome (Interview 2A, 2B, 2C, 2D).

Alignment of goals / shared interest (Davis et al., 1997; Schillemans and Bjurstrøm, 2020)	In contrast to agency theory: overlapping goals. Do the client and contractor want the same thing for/in the first phase?	Yes.	The client project manager feels like everyone on the project wanted and wants it to succeed and do good (Interview 2A). “I also want to do everything I can to make this a success” (Interview 2D). “We also expressed to each other that we want to make this project succeed in every way” (Interview 2D).
Collective responsibility for work outcomes, co-production (Hernandez, 2012; Schillemans and Bjurstrøm, 2020)	Feeling of cooperation, joint project team, shared workplace, shared responsibility in contract and practice.	Yes.	Everyone interviewed felt that the project was co-owned and felt connected to it and the outcome (Interview 2A, 2B, 2C, 2D). “That we do that which helps the project go forward and not because one side decided that those requirements would be good” (Interview 2B). “You do not notice who is from the client or who is from the contractor” (Interview 2C).
Substantial discretion, self management (Schillemans, 2007; Schillemans and Bjurstrøm, 2020)	Contract not perfectly detailed/open ended (Schillemans, 2013), social and psychological safety, trust	Yes.	“The parent assignment is guiding and we will use our requirements to this end” (Interview 2A). “The framework was there, but there is no … there is quite some room to concretise yourself” (Interview 2B). This indicates that there was ‘wiggle room’ and the contract was not detailed and followed to a t. Safety is also observed in the quarterly project team meetings with the cooperation coaches (Interview 2B, 2C, 2D) where tough conversations are had and sometimes tears are shed (Interview 2D). These retreats are good for renewed team energy (Interview 2D).

Immaterial rewards/professional rewards (Hernandez, 2012; Schillemans and Bjurstrøm, 2020)	Verbal praise, reputation (Schillemans and Bjurstrøm, 2020, p. 656), intrinsic benefit from working (Hernandez, 2012)	Yes.	Immaterial or professional rewards have not been clearly observed. However, interviewee 2D describes how much more he likes working on this project than other projects he has done and how this makes him want to do everything he can to make it succeed (Interview 2D). This is a clear example of self-actualisation because of the culture present. Multiple interviewees describe the atmosphere as good (Interview 2B, 2C, 2D) and giving joy (Interview 2C, 2D). This is an indication of intrinsic benefit from work.
Internal control (Schillemans and Bjurstrøm, 2020)	Open access to documents, monitoring is quite lean and done within the relationship (Schillemans and Bjurstrøm, 2020)	Yes.	Monitoring through access to meetings and project documents. There were joint project environments: one Relatics, one Sharepoint (Interview 2B, 2D). There was a shared working place, which was used (Interview 2A, 2B, 2C, 2D). There were single, shared minutes, one project report with both sides giving their perspectives (Interview 2B).
Informal relationship management (Schillemans and Bjurstrøm, 2020)	Equivalence in the working relationship (Schillemans and Bjurstrøm, 2020), joint team, shared workplace	Yes.	Relationship management was informal. “The notion that you have to formally arrange some things, has nothing to do with how you communicate and interact and cooperate with each other” (Interview 2A). The project control managers chaired meetings together and filled in for one another, even going so far as doing each other’s one-on-ones with team members (Interview 2C, 2D). The first phase was done jointly (Interview 2A, 2B, 2C, 2D), with certain disciplines like project control management and technical management especially close (Interview 2B, 2C).

The behaviour observed follows the stewardship theory model well. As the client’s project manager noted: “Do you make the requirements in your contract guiding and possibly not fulfil your assignment, or do you say the parent assignment is guiding and we will use our requirements to this end” (Interview 2A). This culture seems to have been maintained the

second phase, with the project control managers still chairing eachothers meetings and doing one-on-ones of the other managers team members (Interview 2C, 2D) and the contractor even taking on a risk which was designated to be a client risk because they felt it not fitting for the client to carry it: “obviously a contractor risk” (Interview 2D).

The interviewees are clear that the culture of openness and working with the ‘other side’ does not work for everyone however: “And the conclusion is that that [working together more closely with another organisational culture] does not work and succeed for everyone” (Interview 2B). “You ask something totally different from quite a lot of different people. And some people, they do struggle with that” (Interview 2A). As put in Interview 2C: “[it does come more natural for some to relate] to the contractor, let go and view them as your colleagues”. In other words, someone has to match with the two phase project delivery method: “If I would ever do another two phase project for which I would have to select people I would look at if someone is fit for the way of working together before looking at their specific knowledge to be able to do project control” (Interview 2D). Furthermore, the look inside each other’s kitchen through working together has helped in understanding where both parties come from (Interview 2D).

5.4.2.4 Risk allocation

All risks for the second phase have been allocated to either one of the parties or both (Interview 2A, 2B). This has been done in three risk sessions and has been done risk per risk (Interview 2A, 2B, 2C, 2D). Rijkswaterstaat started with a risk register at the definitive design stage and this was expanded upon in cooperation with the contractor. Risks have been allocated on the basis of whether it was an endogen or exogen risk and which party could best control it and where the risk came from (Interview 2B, 2C). Risks were either fully a risk for the client, a risk for the client with control measures for the contractor or fully a risk for the contractor (Interview 2C). Contractor risks have been priced in the final agreement based on what control measures the contractor will have to take. If the risks cost more than this price, then the contractor bears the costs (Interview 2C). Finally, limited risks are contractor risks up to a certain cost / amount and once they go beyond that they become client risks, for which the client has a risk reservation (Interview 2C). Unidentified risks that occur in the second phase are allocated as being risks for the client (Interview 2D), however in practice certain risks turned out to be clear contractor risks and these have been taken on by the contractor with “minimal discussion” (Interview 2D). An example of a risk that under the agreement would have been a client risk but which the contractor took on is welders leaving due to the repetitive nature of the welding work on the bridge. According to Interview 2D this came up unexpectedly during the second phase - so it should have been a client risk - but it was taken on by the contractor because it was “100% for the contractor of course”. Even though this is from the second phase it is an example which supports the open and joint culture that has been observed in the first phase.

5.4.2.5 Conclusions

From the case findings of the Renovatie A12 IJsselbruggen some conclusions can be drawn. First of all, the project delivery method design. The interviews and project documents show that it is a type of two phase which classifies as an opt out design even though it makes use of suspensive conditions. By having three suspensive conditions for the agreement for the second phase but the award being for both the first and second phase under UAC-IC 2005 it falls under opt out design II: two phase after final award by het Instituut voor Bouwrecht (2022). Second, the information risk was reduced and controlled during the first phase. More risks

became known and at the end of the first phase they could also be controlled better. Both are indications of transfers from unknown unknowns into known unknowns and also to known knowns. Both sides acknowledge that this is the result of cooperation and was not possible without the expertise of the contractor. Third, the stewardship theory model fits the behaviour exhibited well. Open and joint behaviour has been observed, where the goal of realising the project successfully was shared between both parties. On the other hand few indicators of behaviour described by agency theory have been observed and therefore agency theory seems to fit less well. Finally, risks have not been allocated completely in the way as one would expect under the UAC-IC 2005. Risks have jointly been allocated to who can best carry them. The public client has taken on more risks than they would have under a traditional integrated contract.

Some interesting observations can be made in addition to the conclusions regarding the four sub research questions. The Renovatie A12 IJsselbruggen is observed to have a culture of openness and togetherness. Whether this is a result of the framework or of the people involved is not clear and interviewees cannot say (Interview 2D). Cooperation and working together has been a focus, both in implementation through meetings and coaching as well as through the efforts of the two project managers (Interview 2A, 2B, 2C, 2D). The interviewees note that this type of contract and cooperation asks a lot from people. It is new, it is uncertain and some even say it is not for everyone. However, they are convinced it leads to a more controlled project with higher quality (Interview 2A, 2C). This makes sense as the parties get to know each other and the project during the first phase already.

6. Expert interviews

In this chapter the expert interviews that have been held are presented and discussed. First the expert interview selection is given and then the findings from these interviews are shown.

6.1 Expert interview selection

The expert selection is instrumental for the expert interviews to be of added value to the research and the data gathered reliable. After all, if the experts aren't actually experts in fields relevant to this study their input is not worth much. The relevant expertise, as described in section 2.5, of the experts has been guiding in their selection for an interview. Besides the relevant expertise, multiple interviews have been held in order to include different perspectives from different backgrounds. Furthermore, both experts are and have not been directly involved in the two case projects. In Table 24 below the expert interview selection is presented.

Table 24

Expert interview selection

Interview	**Actor**	**Relevant expertise**
AA	Rijkswaterstaat	Involved in evaluations of two phase projects and part of the two phase task force of Rijkswaterstaat (Interview AA). Experience and expertise is all from Rijkswaterstaat, originally a lawyer.
AB	AT Osborne	Involved in multiple evaluation rounds of a Rijkswaterstaat two phase project. This evaluation looks at if contract mechanisms that have been implemented work as intended (Interview AB). Involved in writing the 'Handreiking toepassing 2-fasen aanpak bij Rijkswaterstaat projecten'. Done research on the cooperation in a water board two phase project and a Bouwteam project (Interview AB). "Done various things [relating to two phase projects] and expertise is more on cooperation" (Interview AB).

The expert interview selection includes two people. One works for Rijkswaterstaat, a public client, and one for AT Osborne, a consultancy for public clients (AT Osborne, 2023). These experts have been asked to answer questions about the variables that have been researched and afterwards to respond to the results and early conclusions from this study. For the expert interview procedure that has been used see Appendix D. The transcriptions from the expert

interviews are not included in the public thesis as no permission to publish these has been received from the interviewees. The findings from the interviews are presented in section 6.2.

6.2 Expert interview findings

In this section the findings from the expert interviews are presented. The expert interview findings are presented in four parts, corresponding to the main areas of focus. At the end of the section conclusions are drawn.

6.2.1 Two phase process project delivery method design

With regards to the two phase process project delivery method the experts highlighted different aspects of two phase projects. One expert notes that there are differing project delivery method designs based on the size and challenge of the projects (Interview AA). The suspensive conditions are quite similar across the different projects however (Interview AA). Both experts note that the first phase of two phase projects costs a lot of time, effort and money (Interview AA, AB). This is because the parties have to get to know each other and merge their expectations (Interview AB). The expert from interview AA agrees with the conclusion that the incentive to end the first phase through the total project cost evaluation in Renovatie A12 IJsselbruggen is a lesser incentive than that of a task-based budget as implemented in the Cruquiusbrug. This expert also suggests that for instance a risk assessment is made before the first phase together with an inclination on how much it will be reduced during the first phase as a way to end the phase (Interview AA).

6.2.2 Information risk

Both experts agree that more information is gained and risks are identified in the first phase (Interview AA, AB). The joint first phase leads to a more controlled project (Interview AB). However, there needs to be a balance between more controllability and the duration of the first phase (Interview AA). Expert AA agrees with the findings of the grey area that exists around what constitutes a certain design level and the transition towards the second phase (Interview AA). Additionally, there might not be enough incentive in the agreements to end the first phase in case of UAC-IC 2005 as there is an incentive for both parties, but especially the contractor, to design further and take on less and more controlled risks in the second phase (Interview AA). Expert AB notes that the market party and their expertise is not necessarily needed on all aspects to achieve the first phase end product and that not all benefits of their involvement are visible in the first phase product. Their involvement in the first phase however, increases the controllability and the quality of the second phase because the parties know each other and the agreements with other parties (Interview AB). This is in line with the results of this research. Interestingly, the other expert notes that the necessity of involving another party should be an important reason to use the two phase process project delivery method over other project delivery methods (Interview AA).

6.2.3 Division of responsibilities

With regards to the relationship and division of responsibilities between client and contractor, experts note that they observe that cooperation in two phase projects goes well (Interview AA, AB). The good intentions, especially at the start, are truly different to traditional contracts (Interview AB). Bouwteam first phases are usually more open and have one integrated team with more intensive cooperation than other two phase process project delivery method designs

which have a bit more distance between client and contractor, however this cooperation is still more intense and the relationship closer than in other project delivery methods (Interview AB). Interestingly, in the cases researched the Bouwteam was not necessarily more open and did not have a 'closer' relationship between the client and contractor compared to the relationship observed in the case using a different two phase PDM.

Both experts agree that the people on the project team are crucially important to how the relationship and cooperation plays out (Interview AA, AB). People need to have inner will and be open to cooperating with the other party (Interview AA). Therefore, they agree that people who do not fit the project, culturally and/or competency wise, should be able to leave or go to a role where they are less directly involved with the other party (Interview AA, AB). The expert from interview AA notes that the contract does not decide how well cooperation takes place, but it does make it easier or harder (Interview AA). "It is of course harder when you have a very tight contract, it does not make everything easier" (Interview AA). The expert from interview AB had a similar opinion, noting that the people on a project matter but that the mechanisms and contract framework which make the cooperative relationship possible should not be discounted (Interview AB). With regards to the division of responsibilities the expert from interview AA remarks that expectation management around how the first phase will actually play out before and at the start of the first phase is an area where progress can be made (Interview AA). This was also mentioned in interview AB, with the expert saying that the first phase of the Renovation A12 IJsselbruggen also went well because the client communicated what they were going to do and what they wanted with the first phase, not just because of the people (Interview AB). This is important, especially as the room to deviate from the contract after the start of the first phase is limited (Interview AA).

In conclusion the experts agree that the people, their attitude and competencies, inform what the cooperation and relationship on the project is like, whilst the contract and built in mechanisms play an important part in making the cooperation possible and shaping how it comes to be.

6.2.4 Risk allocation

The experts note that risk allocation differs per project (Interview AA, AB). The expert from interview AA stated that larger projects are different, with it being impossible to allocate on a per risk basis as with the Renovation A12 IJsselbruggen and risks instead coming in packages (Interview AA). The risk allocation in two phase projects usually happens at the end of the first phase with the discussions then becoming more tense (Interview AB). The expert from interview AA thinks that risk allocation discussions can be easier in two phase projects compared to other PDMs due to having more jointly done the first phase (Interview AA). The continued feeling of responsibility for each other's risks in the second phase, which has also been observed in the Renovatie A12 IJsselbruggen, is something which the expert from interview AB recognizes from other two phase projects (Interview AB).

6.2.5 Conclusions

The expert interview findings confirm certain conclusions from the case findings and provide some interesting insights. The experts confirm that the information risk is reduced during the first phase. They agree that the end of the first phase and transition towards the second phase can be a grey area, both in terms of design level as well as in the role the parties have.

Furthermore, the experts state that the contract has to provide room for the cooperation to work well. It affirms the notion that it is the people that have to make the mechanisms in the contract work, without the right people - in both competency as well as will - it will not work. Additionally, expectation management around what the first phase is going to be and the role the parties are going to play, before and at the start of the first phase is important for the cooperation. Interestingly, both experts underscore that there is good cooperation in the first phase of two phase projects. The starting point is different to traditional contracts. Finally, risk allocation can differ a lot between projects, but discussions around it can become easier due to the parties having gone through the first phase with each other.

7. Conclusions

This research has tried to gain knowledge on and insight into how the joint first phase, with a collaborative relationship between client and contractor, observed in two phase process project delivery methods in the Netherlands affects the information risk, division of responsibilities and risk allocation in projects. To do this the effects of different two phase process project delivery method designs on the information risk, division of responsibilities and risk allocation between client and contractor have been researched. This has been done by looking at different projects that employ the two phase process project delivery method. The use of the two phase project delivery method makes these projects interesting to research for this purpose. The following research question has been formulated:

How does the two phase project delivery method design affect the information risk in the first phase and the division of responsibilities and risk allocation between client and contractor?

To help answer the main research question four sub questions have been researched and answered.

RQ1: *Which two phase process project delivery method designs are used for the first phase?*

Different two phase process project delivery method designs have been defined with the literature and observed in the researched cases. All two phase project delivery method designs share a form of deferred price setting with a go / no go moment after the first phase in which plan development takes place with or by the contractor and the client. The end (product) of the first phase and its associated conditional obligations have been observed to entail a grey area as it is always possible to keep developing further. Additionally, when the second phase is contracted under UAC-IC 2005 the possible incentive to keep developing further by the contractor in order to reduce the possible uncertainties and risks they have to take on for the second phase has been observed.

RQ2: *Is the information risk reduced during the first phase and, if so, how?*

The research shows that the information risk is reduced during the first phase. During the first phase in the two phase project delivery method uncertainties are mapped and risks identified. The public client lacks the knowledge on construction execution to come to a complete assessment up front and needs the expertise of the contractor to do so and develop the plan further. The first phase manages to reduce the unknown unknowns before starting the second phase, in part as a result of cooperation between the client and the contractor.

RQ3: *What does the client-contractor relationship look like in practice?*

The relationship between client and contractor varies per project. Differences between the written down relationship and the relationship in practice during the first phase have been observed. The differences lie in the division of responsibility for tasks and first phase products. The two phase project delivery method design sets the framework within which the people on the projects shape what the relationship is like and becomes. The contract itself does not decide what the relationship is like but rather it sets the boundaries which make good cooperation easier or more difficult. The right people therefore make the difference but the contract makes it possible.

RQ4: *How are risks allocated between client and contractor?*

Risks are shared more between client and contractor in two phase projects than in traditional integrated contract project delivery methods. The joint first phase in which client and contractor get to know each other and the project plan can create a feeling of joint responsibility for the risks of the project and make risk allocation more straightforward. This is due to the parties both knowing the project, the risks and each other well after the first phase. Risks do not necessarily get allocated fully accordingly to the contract conditions.

Finally, the conclusions to the sub questions lead to the following conclusions regarding the main research question:

The first phase of the two phase process project delivery method reduces the information risk, can make good cooperation between client and contractor possible and may help risk allocation between client and contractor. However, it cannot be said to definitely and automatically do these things better than other project delivery methods based on this research. The two phase project delivery method design determines the room which the people on the project have for the implementation of collaboration within the contract.

In the following chapter, chapter 8 the discussion, the limitations and implications of this research and its conclusions are discussed and elaborated on further. Afterwards, recommendations for practice and future research are presented.

8. Discussion

In this section the results of the research are discussed. The results are interpreted and the limitations considered. Afterwards a reflection on the theories used is given. Following this the implications are presented and finally practical recommendations and recommendations for future research are offered.

8.1 Interpretation of research findings

To start it is important to reflect on the generalisability of the results found in this study. Case study research in this regard is a double edged sword. It incorporates the context which gives credence to the results but this also affects the generalisability. This is because case studies are used because the research object is context dependent. This is also the case with the case projects used for this research as contextual factors such as culture, openness and access to information influence the results, more on this in section 8.2 and 8.3. This issue has been addressed through the case selection criteria, the use of expert interviews and is further mitigated by the nature of this research. This research is exploratory in nature and as such only tries to gain insight into how the first phase of two phase process project delivery method designs affect the information risk, client-contractor relationship and risk allocation through studying the effects in case projects. It does not try to prove hypotheses or causal relationships between variables. The insights from the research are therefore of interest both to the stated objective of this research as well as a jumping off point for further research. The exploratory nature of this research combined with the limited number of possible projects is also the reason why no cross case analysis has been done. This way there was room for exploration. Whilst it was not possible to analyse very similar projects as needed for cross-case analysis (Seawright & Gerring, 2008), sufficiently different cases improve the generalisability of the results as Shavelson and Towne (2002) note.

This research' findings show that the first phase of the two phase process project delivery method reduces the information risk, can make good cooperation between client and contractor possible and may help the risk allocation between client and contractor. In the remainder of this section some interesting findings are discussed and compared to expectations from the literature.

8.1.1 The two phase process project delivery method design

An interesting finding relating to the design of the first phase is that a Bouwteam, with an integrated project management team, would be expected to be relatively more closely collaborative than other two phase processes who work with mirrored integrated project teams. This view is expressed both in case interviews (Interview 1B, 1C) as well as by experts (Interview AB) and also noted by Wermer (2018). However, in the researched projects this was not the case. The collaboration was relatively more close in case 2, a Two phase after final award, and less close in case 1, Bouwteam with UAC-IC 2005. This is an interesting finding and can provide some insight into what other factors possibly influence the cooperation other than the project delivery method design.

The findings and expert interviews seem to indicate that expectations that parties have about the client-contractor relationship during the first phase at the start of the first phase are important to how it plays out and is perceived. The contractor in case 1 Cruquiusbrug felt the

first phase was not very Bouwteam like and differed from what was agreed (Interview 1B), whereas the client thought they were giving room for innovation and cooperation with the contractor (Interview 1A). This is a mismatch in expectations and perceptions of how the first phase played out. In case 2 Renovatie A12 IJsselbruggen the communication up front about and plans for the first phase were clear and this was important to creating the culture seen there (Interview AB). Words should be accompanied by actions and expectation management is important. This is echoed by the report of Significant Synergy (2023) which states this type of project delivery method has clear added value if it is well and carefully considered.

Finally, it should be noted that both of the case projects have had substantial budget increases. Some of this can be explained through inflation and external factors (Provincie Noord-Holland, 2022). However, the two phase PDM being expensive does seem to be a theme and is noted in the evaluation by the Economisch Instituut voor de Bouw (2023) and was mentioned by both experts (Interview AA, AB). Possible reasons provided by expert AA are that there is further detailing than needed, a part of it is honest price for honest work and that there is less competition on price (Expert AA) The question therefore rises, what the right balance between project control and costs is. After two phase projects have completed the second phase, these could be researched in order to see whether total project costs are indeed higher compared to non two phase projects and what possible reasons for this are.

8.1.2 Information risk

Regarding the information risk it is clear that the information risk is reduced during the first phase. This is the goal of the first phase defined by Jansen (2021). However, another result of the first phase might be a more controlled overall project (Interview 2A, 2C, AB). The reduction in information risk and steps made through further research and increased expertise are not only felt during the first phase, but could also come to the fore during the second phase in how the second phase is executed and controlled. The parties know the project as well as each other better after the first phase (Interview 1A, 2D). The identification of more risks that has been observed in the two phase projects is also a finding in the Significant Synergy report (2023) and agreed upon by the experts (Interview AA, AB).

8.1.3 Client-contractor relationship

The first phase can help make good cooperation possible whilst the people on the project themselves are really important to the actual collaborative relationship that forms. The feeling of ownership and shared interest from stewardship theory can be seen in case 2 Renovatie A12 IJsselbruggen. These characteristics have also been observed and linked to good cooperation in water board two phase projects: “Positive cooperation … is explained by shared interest and feelings of ownership in the project” (Significant Synergy, 2023, p. 11). How important the people are to the collaboration on projects in the first phase was something that came up in almost all interviews held, with the clients, with the contractors and with experts. It is possible that there is bias towards these types of observations, both from the researcher or the participants, but as everyone mentioned this it is important to keep this observation in mind.

Another interesting observation from the case study research, which was also reported by the expert in expert interview AB, is that the relationship built in the first phase seems to, at least sometimes and somewhat, transfer to the second phase. Additional research on the client-

contractor relationship during the second phase of projects will be needed once projects have completed in order to make more definitive statements on this possible observation.

8.1.4 Risk allocation

This study shows that the two phase process can make risk allocation discussions easier than the norm. The conclusions on risk allocation are in line with the first conclusions on two phase projects in the monitor report of the Economisch Instituut voor de Bouw (2023) which notes that two phase projects have “risks better identified and allocated” (p. 41). It is important to note that the two phase process project delivery method is not a guarantee for easier risk allocation. However, the combination of a joint first phase in which client and contractor form a relationship, (often) with open bookkeeping, with the knowledge both sides have of the project and the associated risks provides a good starting point for discussions around the allocation. The Significant Synergy report (2023) also identifies the handling with exogen events, whether already identified as risks or not, as going smoother in two phase projects because the water board and contractor have closer ties. However, as the case findings show and Abrahamson (1984) already noted, one should not live by the contract.

8.2 Reflection on agency and stewardship theory

Agency theory and stewardship theory have been used to investigate the client-contractor relationship. The choice for these theories was in part based on Ceric (2012) who used the principal-agent paradigm to investigate communication risk in construction projects and Schillemans and Bjurstrøm (2020) who used both these theories to investigate and analyse Dutch autonomous agencies, such as public clients. As these two theoretical models have been used it is important to reflect on their use and usefulness in this study. Interestingly, both these models fit one of the case projects better than the other, with both cases exhibiting characteristics of both theories. This is in line with Schillemans and Bjurstrøm (2020) who found that the actual governing models displayed elements from both theories (p. 669). The conclusion they draw is to employ a combination of both theories: verification and trust.

Regarding this conclusion there is a nuance to be made based on this research for the use in two phase contracts. The findings of this research suggest a tendency in the behaviour exhibited by both parties to revert to more traditional behaviour, in this case agency-like behaviour. This tendency in behaviour was observed in the first phase of case 1 Cruquiusbrug where both parties soon more closely followed their traditional roles than was agreed upon and in moments of crises in case 2 Renovatie A12 IJsselbruggen this tendency was only averted due to the intervening of both project managers (Interview 2D). As Davis et al. (1997) note there is a form of prisoner's dilemma present in steering, which can be observed in these cases. Demonstrating either agency or stewardship behaviour only works well and pays off when the other party matches this behaviour. Acting as a steward whilst the other takes an agency approach leaves open the possibility of shirking. Whilst acting in a principal-agent manner whilst the other acts more in a steward manner can reduce their desire to act as a steward (Davis et al., 1997). A focus on carrots and sticks can even reduce intrinsic motivation (Frey & Jegen, 2001) and in doing so breed self-serving behaviour. Therefore, as indications in the case findings show, parties could very well be prone to reverting to traditionalist, more agency-like behaviour once a possible mismatch is perceived by one of the parties.

Another interesting reflection herein lies in one of the propositions put forward by Davis et al. (1997): *People in a low power distance culture are more likely to develop principal-steward relationships than are people who are in a high power distance culture.* The Netherlands is a low power distance culture (Hofstede et al., 2010; Hofstede-Insights, 2023), reflected in, among other things: relative equivalence, accessible managers, hierarchy for convenience only, informal attitude towards managers, coaching leaders and dislike of control (Hofstede et al., 2010; Hofstede-Insights, 2023). Therefore, the Netherlands would seem to be a good place and culture for the type of collaborative and stewardship-like relationship that the two phase process strives towards. It is in line with the results seen in case 2 Renovatie A12 IJsselbruggen and backed up by both experts (Interview AA, AB). However, as case 1 Cruquiusbrug shows and interviewees from both cases mention (Interview 1A, 1B, 2A, 2D), within the infrastructure sector exists the baggage of everything that has come before and the tendency to revert to traditional roles, agency behaviour and a traditionally contractually driven relationship that has to be overcome, which asks quite a lot from people. The conclusion of trust and verification of Schillemans and Bjurstrøm (2020) then, is shared by this study, with the emphasis on trust.

8.3 Limitations of this research

In this section the limitations of this research are discussed. The act of researching itself results in limitations. Limitations have been addressed throughout the thesis report. Here the most important limitations are presented, discussed and weighed.

8.3.1 Scope and design

An obvious but important external limitation of this research comes from the fact that no two phase projects have been fully completed. This is reflected in the scope of the research in which only the first phase has been researched. Therefore the conclusions of this research are limited to this first phase.

Another limitation lies in the cases that have been researched. These are different in terms of public client and PDM but similar in object. The challenges of these bridges are similar but not the same as one is a renewal and the other project is a completely new bridge. It is important to note that bridges are a specific type of infrastructure and not the most complex works out there. This could have an effect on the results obtained from these cases, as mentioned in section 6.2.4 that risk allocation is not possible in the same way on all projects (Interview AA). The amount of cases has also been limited due to the time available and researchability of the cases. Two cases is not a large amount and when using case study research to build theory, according to Eisenhardt (1989b), preferably at least four cases are studied to assure empirical grounding. When the goal of the study is not to build theory, but to explore a phenomenon, this matters less and other criteria start to matter more. The depth of the research has increased due to the limitation of the amount of cases.

The interview selection also needs to be mentioned. Almost no people from design teams or outside the project teams have been interviewed. Most interviews have been with managers on these projects. This choice has been made in order to gain as much information as possible within a limited time and limited amount of interviews, see section 5.2. Ideally however, one would also interview people from outside the managerial roles in order to research the client-

contractor relationship, which has only happened with one participant who at the time of the case project had a consulting role.

Lastly, the literature regarding early contractor involvement has been kept out of the research. This is because early contractor involvement has not been part of the scope. This has been a deliberate choice in order to not overcomplicate the research. The two phase process project delivery method is a form of early contractor involvement however. Therefore, it is possible that certain relevant information from other research on early contractor involvement has not been used in this research.

8.3.2 Data gathering

A limitation regarding the data collection through interviews is that all interviews have been done after the first phase has been completed. This means that all interviews have been recollections of the first phase. This is not a solvable issue when doing research after the fact but it does impact the information gotten from the interviews. It makes the methods of triangulation through multiple interviews as well as project documents all the more important. The amount of interviews is another limitation regarding the data collection and it impacts the triangulation of the research. The amount of interviews held has been sufficient to have enough observations and multiple viewpoints per client or contractor. In this way, together with project documents, triangulation has been possible in most cases. However, ideally one would have had second interviews with some participants in order to further clarify certain information and opinions as well as confront them with the results. This has been done in a different manner through expert interviews in order to get broader opinions from outside of the case projects as well, however second interviews could have possibly achieved some additional interesting results. It is also important to note that although some elements or characteristics have not been observed in the case studies that does not necessarily mean that the behaviour was not present.

Additionally it has not always been possible to view project documents. They were not always available before interviews, apart from two interviews (1C, 1D), or even at all. This means that the interviews were fact finding driven in order to gather information on the agreements made and how the project was set up. This means that there was less room for the opinion and feelings of the participants. These dimensions are therefore possibly underrepresented in this research, even though efforts have been made in the interviews to shed light on those as well.

8.3.3 Data analysis and biases

Selection bias is always present when conducting case study research. It has been addressed through the case selection criteria. However, projects had to be researchable in order to be selected as a case. This means that possibly only projects which were successful enough, or projects where the relationship between client and contractor went well have been studied. One of the projects which is not part of the research but which was approached was a project in which the relationship between client and contractor was strained and the client involved pulled out of this research. This is a possible indication of selection bias. This bias can then impact the generalisability of the results. However, the fact that the projects that have been researched had actors which were willing to cooperate with the study does not mean that the results are not of interest. Contrarily, these projects contain a lot of information on what made the relationship not fall apart. Just as a lot can be learned from ‘unsuccessful’ projects.

Supporting this view is the fact that case information has been gathered which does not necessarily paint a flattering picture and interviewees have reported on difficulties in the relationships between parties.

In addition to the selection bias, researcher bias also had to be mentioned. The bias of the researcher cannot fully be eliminated in qualitative research as there is always an interpretation of data from human participants by a human researcher. This bias is also needed in order to get the most out of semi-structured interviews which have to be done flexibly as Flick (2022) notes. The bias has been mitigated through triangulation and the use of multiple interviews per project per side. Finally, expert interviews have been used to look at the results. These experts have been selected based on their relevant expertise to the research. However, both experts work for or consult for public clients. Therefore their views on the subject could be somewhat coloured with regards to the client-contractor relationship. Again, the possible impact this can have has been reduced by having multiple expert interviews from different organisations.

8.4 Implications of this research

Some of the implications regarding agency theory and stewardship theory have been alluded to and discussed already in section 8.2. In addition to these reflections there are more implications that stem from this study.

An implication of this study is that there exists a spectrum of knowledge within the status of knowledge introduced in section 3.2 on information risk. In relation to two phase projects the question on the information risk becomes one of balance: how ‘known’ do unknowns have to be for a sufficiently sure risk register at the end of the first phase in order to control and allocate risks for the second phase. Is there a difference in the types of information and how known they need to be and where does this difference come from? Of course, information risk can never fully be taken away, but it does not need to be for a more controlled project as the cases and interviews show.

The classification of knowledge into various states also begets the question if practical use is to be gotten from this classification or whether its use is limited to a mostly theoretical one. A theoretical use it has for certain, in helping to grasp what the gathering of information and researching means. The division of risks into known knowns, known unknowns and unknown unknowns is one that is used in other risk management models as well (Jorion, 2009). Looking at these models their use is also in classifying risks based on how much is known about the probability of the events occurring as well as their effects. This is then used to determine how much attention these risks should get. However, the question of what knowing what you do not know means for how one should best proceed is not ‘solved’ and remains one that is tackled through best practices and experience. Thus the practical use seems to remain limited.

Another implication lies in that this research suggests that a collaborative project delivery method, like the two phase process, asks quite a lot from people and is different to what they traditionally know from other projects. This could imply that the act of doing more of these projects, gaining experience in these relationships and the passing of time in itself will help people with what it takes to do these projects. Especially, as interviewees have noted that they got to know more about how the other side (client or contractor) works and functions over the

course of the first phase of these projects (Interview 1A, 2D). At the same time a clear indication from this research is that the contract and how it is managed has to provide room for the cooperation and relationship to be able to grow. As such it remains a question if time and experience alone are enough to reduce the effort needed to create such a collaborative relationship.

Finally, the divergence of knowledge share as seen in case 2 Renovatie A12 IJsselbruggen where the amount of known unknowns grows in the beginning of the first phase, with convergence towards known knowns at the end could mean that it is important to have a risk assessment in the run up towards the first phase. Similarly, the research shows that the expertise and know-how of the execution by the contractor is needed to be able to bring the risk register further along. Involvement of people who have experience and knowledge in/on the execution stage of projects is therefore of added value in the process.

8.5 Recommendations for practice

Recommendations for practice with regards to the two phase process project delivery method design are presented in this section.

The first recommendation is to manage expectations up front by having thought out the first phase as a public client. The choice made for the two phase process project delivery method design should be made once it is carefully considered and the client knows what it wants to do and how. This helps in managing the expectation, on the side of the client but also in relation to the contractor. A well thought out approach to the first phase has been observed in case 2 Renovatie A12 IJsselbruggen where the client presented which people would be on their IPM team for the first phase, already during the procurement phase for the contractors to see. This helped with the contractor being able to mirror the expectations according to one expert (Interview AB). As this type of cooperation is new, thinking out the first phase gives the start of the relationship a good foundation to grow from and it is tied together with a few other recommendations.

Second, provide room in the contract. It is difficult to keep changing your agreement, especially if it is under the UAC-IC 2005. Therefore, it is important to have room built into the contract to deviate from the path set out and explore and research additional conditions and possibilities. The great possible benefit of having a contractor onboard during the first phase lies there. A possibility is a 1% innovation budget reservation as was implemented in case 2 (Interview AA). This provides the opportunity to harness the added expertise of the contractor.

Third, build in a mechanism to end the first phase and transition towards the second phase. This could be a literal deadline but also a set percentage reduction in risk valuation or a budget for the first phase for instance. It is important that the mechanism is followed and enforced. This study found that a design level definition entails a grey area which breeds possible discussion and can also lead to the end of the first phase being pushed back which increases the costs.

Fourth, decide if you have the people, competency and culture wise, to do a two phase project and which design. The first phase is collaborative in nature, can last quite some time and is taxing on the people who do the project. For the client this means that the role they play is

(should be) bigger than they are used to from traditional contracts and for contractors this means that they should let employees be able say no to doing such a project.

Finally, continuity of the people on the project should be aimed for during the first phase, especially if the cooperation is good. This is important because the first phase asks quite a lot from people and it takes time for the cooperation and relationship between client and contractor to grow. There should not necessarily be continuity across different phases. This is due to the difference in experience and competence of different people with different phases of the construction process, as noted in Interview 2B and 2D.

8.6 Recommendations for research

The recommendations for future research presented are based on interesting implications of this research as well as limitations that constrained this research.

Following the implication for information risk from 8.4 and the recommendation to build in a mechanism from 8.5 to end the first phase it is interesting to research when and how much the information risk is reduced and what the effect of this reduction is on the second phase and project execution. This might make it possible to make a more informed decision on the use of the two phase process and how far the first phase should go in researching project conditions and unknowns. Possibly a balance between the increase in project control and the costs of the first phase can be found.

The second recommendation for future research is to include the people working for managers of the client and contractor and for subcontractors in research on the client-contractor relationship. This could give new insights and provide a more complete picture on what the relationship between organisations and disciplines is like on the ground level.

Future research could look into the competencies of people, both in terms of hard and soft skills as well as openness and culture, which are needed for a good collaborative relationship in the first phase. People are important to the success of the first phase collaboration on a project and the atmosphere on the project. Multiple interviewees note that one should choose a project delivery method and contract which suits the people available or pick people that can be made available. Furthermore, as this notion is supported by both experts as well it would be interesting for future research to look into which people are needed to get the desired result out of the first phase, be this more maximalist or minimalist in terms of collaboration. A start in this field of research has been made by Van Limbergen (2020). However, his research looked into only clients and their evaluation of contractors' collaborative behaviour during the tender phase of projects.

This research has used agency theory and stewardship theory in a descriptive manner. Agency theory and stewardship theory can also be and have been used in a prescriptive manner (Schillemans & Bjurstrøm (2020). Future research could use agency and stewardship theory in this way in order to try and create a model for how public clients and/or contractors should try and steer the first phase to get the results they desire.

In this research the first phase has been somewhat cut apart from the procurement phase and the second phase. Future research could look at the entire project delivery method design,

from start to finish, once two phase projects have been completed. This would make it possible to better investigate the possible benefits from a joint first phase that come to the fore in the second phase. These possible benefits have been mentioned by multiple interviewees as well as in the expert interviews, but this has not been researched in this study. Furthermore, the possible higher costs associated with this PDM, as alluded to by one expert (Interview AA), could then be investigated, as this is only possible once projects have finished and the actual costs are known.

Finally, this research seems to suggest that the contract is important but that the type of contract and two phase process project delivery method design does not matter as much as the way it is implemented by the people on the project. Future research could look further into how to build room into contracts to help a good collaborative relationship develop.

Bibliography

Abrahamson, M. W. (1984). Risk Management. *The International Construction Law Review*, *1,* 241-264. http://alliancecontractingelectroniclawjournal.com/abrahamson-m-1984-risk-management/

AMS Advocaten. (2023). *Regiebasis*. Retrieved from https://www.amsadvocaten.nl/woordenboek/bouwrecht/regiebasis/

Arrow, K. J. (1984). *The Economics of Agency* (No. ADA151436). Institute for Mathematical Studies in the Social Sciences. Stanford, CA: Stanford University. https://apps.dtic.mil/sti/citations/ADA151436

AT Osborne. (2023, April 19). *AT Osborne | Consultants en managers met hart voor vernieuwing*. Retrieved from https://atosborne.nl/

Bryde, D. J., Unterhitzenberger, C., & Joby, R. (2019). Resolving agency issues in client–contractor relationships to deliver project success. *Production Planning & Control*, *30*(13), 1049–1063. https://doi.org/10.1080/09537287.2018.1557757

Cambridge University Press & Assessment. (2023a). *Liability*. Retrieved from https://dictionary.cambridge.org/dictionary/english/liability

Cambridge University Press & Assessment. (2023b). *Risk*. Retrieved from https://dictionary.cambridge.org/dictionary/english/risk

Corbetta, G., & Salvato, C. (2004). Self–Serving or Self–Actualizing? Models of Man and Agency Costs in Different Types of Family Firms: A Commentary on “Comparing the Agency Costs of Family and Non–family Firms: Conceptual Issues and Exploratory Evidence.” *Entrepreneurship Theory and Practice*, *28*(4), 355–362. https://doi.org/10.1111/j.1540-6520.2004.00050.x

Ceric, A. (2012). Communication risk in construction projects: Application of principal-agent theory. *Organization, Technology and Management in Construction: An international journal (4)*2, 522-533. https://doi.org/10.5592/otmcj.2012.2.8

Chao-Duivis, M. A. B. (2019). *De zaak van de smeltende dinosaurus: Overpeinzingen bij 22 jaar werken in de wereld van het bouwrecht* (1st ed.). ‘s-Gravenhage, The Netherlands: Instituut Voor Bouwrecht.

Chao-Duivis, M. A. B., Koning, A. Z. R., Ubink, A. M., & Bruggeman, E. M. (2018). *A Practical Guide to Dutch Building Contracts* (4th ed.). ‘s-Gravenhage, The Netherlands: Instituut voor Bouwrecht.

Chrisidu-Budnik, A., & Przedańska, J. (2017). The Agency Theory Approach to the Public Procurement System. *Wroclaw Review of Law, Administration and Economics*, *7*(1), 154–165. https://doi.org/10.1515/wrlae-2015-0059

Czarniawska, B. (2014). *Social Science Research: From Field to Desk*. Thousand Oaks, CA: SAGE Publishing.

Davis, J., Schoorman, F. D., & Donaldson, L. (1997). Toward a Stewardship Theory of Management. *Academy of Management Review*, *22*(1), 20-47. https://doi.org/10.2307/259223

Deane, P. (2021, March). *Unknowns: three kinds*. Australian National University: Integration & Implementation Sciences. https://i2s.anu.edu.au/resources/three-kinds-of-unknowns

Degn Eskesen, S., Tengborg, P., Kampmann, J., & Holst Veicherts, T. (2004). Guidelines for tunnelling risk management: International Tunnelling Association, Working Group No. 2. *Tunnelling and Underground Space Technology*, *19*(3), 217–237. https://doi.org/10.1016/j.tust.2004.01.001

De Ruijter, A., & Guldenmund, F. W. (2016). The bowtie method: A review. *Safety Science*, *88*, 211–218. https://doi.org/10.1016/j.ssci.2016.03.001

Donaldson, L. (2008). Ethics Problems and Problems with Ethics: Toward a Pro-Management Theory. *Journal of Business Ethics*, *78*(3), 299–311. https://doi.org/10.1007/s10551-006-9336-6

Duurzaam Gebouwd. (2021, September 30). *Nieuwe modelovereenkomst voor bouwteam*. Zwolle, The Netherlands: Duurzaam Gebouwd.

https://www.duurzaamgebouwd.nl/artikel/20200514-nieuwe-modelovereenkomst-voor-bouwteam

Economisch Instituut voor de Bouw. (2023). *Transitieopgave 'Naar een vitale infrasector' - Transitiemonitor 2022*. Amsterdam, The Netherlands: Author. https://www.vitaleinfrasector.nl/nieuws/2483985.aspx

Eisenhardt, K. M. (1989a). Agency Theory: An Assessment and Review. *Academy of Management Review*, *14*(1), 57–74. https://doi.org/10.5465/amr.1989.4279003

Eisenhardt, K. M. (1989b). Building Theories from Case Study Research. *Academy of Management Review*, *14*(4), 532-550. https://doi.org/10.2307/258557

Ellis, D. (1993). Modeling the information-seeking patterns of academic researchers: A grounded theory approach. *The Library Quarterly, 63*(4), 469-486.

Engebø, A., Lædre, O., Young, B., Larssen, P. F., Lohne, J., & Klakegg, O. J. (2020). Collaborative Project Delivery Methods: A Scoping Review. *Journal of Civil Engineering and Management*, *26*(3), 278–303. https://.doi.org/10.3846/jcem.2020.12186

Fijneman, J. (2020). *Handreiking 'Aanbesteden van twee fasen contracten.'.* Ede, The Netherlands: CROW. https://www.crow.nl/publicaties/handreiking-aanbesteden-van-twee-fasen-contracten

Flick, U. (2022). *An Introduction to Qualitative Research*. Thousand Oaks, CA: SAGE Publications.

Frey, B. S., & Jegen, R. (2001). Motivation Crowding Theory. *Journal of Economic Surveys*, *15*(5), 589–611. https://doi.org/10.1111/1467-6419.00150

Greve, C. (2000). Exploring Contracts as Reinvented Institutions in the Danish Public Sector. *Public Administration*, *78*(1), 153–164. https://doi.org/10.1111/1467-9299.00197

Hernandez, M. (2012). Toward an Understanding of the Psychology of Stewardship. *Academy of Management Review*, *37*(2), 172–193. https://doi.org/10.5465/amr.2010.0363

Hofstede, G., Hofstede, G. J., & Minkov, M. (2010). *Cultures and Organizations, Software of the mind. Intercultural Cooperation and Its Importance for survival* (3d ed.). New York City, NY: McGraw-Hill.

Hofstede-Insights. (2023). *Country comparison tool - Netherlands*. Retrieved from https://www.hofstede-insights.com/country-comparison-tool?countries=netherlands

Huith, G. J. (2021). Eerlijk werk voor eerlijk geld? Enkele beschouwingen over het twee-fasen proces en daarbij behorende kritische succesfactoren. *Tijdschrift Voor Bouwrecht, 14*(8)*,* 724-743.

HWBP. (2022b, November 18). *Wie we zijn en wat we doen*. *Over HWBP | Hoogwaterbeschermingsprogramma.* Retrieved from https://www.hwbp.nl/over-hwbp/wie-we-zijn-en-wat-we-doen

Instituut voor Bouwrecht. (2022). *Vormen van UPB.* [Slide show; PowerPoint].

Instituut voor Bouwrecht. (2023). *Home - Instituut voor Bouwrecht (IBR)*. *Het Instituut voor Bouwrecht.* Retrieved from https://www.ibr.nl/

ISO (2018). *ISO 31000:2018 Risk management - Guidelines (2nd ed.).* Vernier, Switzerland: International Organization for Standardization.

Jansen, C. E. C. (2021). Over 'twee-fasen-proces', 'bouwteam met UAV-GC' en 'alliantie': mogelijke oplossingen voor een verbeterde beheersing van het informatierisico bij de aanbesteding en realisatie van geïntegreerde projecten. *Tijdschrift Voor Bouwrecht*, *14*(8), 692–710.

Janssen, V., Van der Mark, R., Metzlar, W., Mulder, V., & Overgaauw, N. (2021, September). *Onderzoek naar budgetverhogingen bij grote infrastructurele projecten van de Provincie Limburg*. Maastricht, Netherlands: Gedeputeerde Staten. Retrieved from https://limburg.bestuurlijkeinformatie.nl/Document/View/6ab67059-9958-40fb-a6d5-03a4bd6e961f

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, *3*(4), 305–360. https://doi.org/10.1016/0304-405x(76)90026-x

Jorion, P. (2009). Risk Management Lessons from the Credit Crisis. *European Financial Management*, *15*(5), 923–933. https://doi.org/10.1111/j.1468-036x.2009.00507.x

Kent, D. C., & Becerik-Gerber, B. (2010). Understanding Construction Industry Experience and Attitudes toward Integrated Project Delivery. *Journal of the Construction Division and Management*, *136*(8), 815–825. https://doi.org/10.1061/(asce)co.1943-7862.0000188

Leloup, V. (2016). Risk management under standard forms of construction contracts. *Exequatur.* Retrieved from https://exequatur.pro/risk-management-under-standard-forms-of-construction-contract/

LexisNexis (2023a). *Resolutive condition*. Retrieved from https://www.lexisnexis.co.uk/legal/glossary/resolutive-condition

LexisNexis (2023b). *Suspensive condition*. Retrieved from https://www.lexisnexis.co.uk/legal/glossary/suspensive-condition

Management Yogi. (2019, September 16). *Risk Classification: Known-Knowns, Known-Unknowns, Unknown-Knowns and Unknown-Unknowns*. Retrieved from https://www.managementyogi.com/2019/09/risk-classification-known-knowns-known-unknowns-unknown-knowns-and-unknown-unknowns.html

Maslow, A. H. (1943). A theory of human motivation. *Psychological Review*, *50*(4), 370–396. https://doi.org/10.1037/h0054346

Ministerie van Infrastructuur en Waterstaat. (2023, February 20). *Integraal projectmanagement*. Retrieved from https://www.rijkswaterstaat.nl/zakelijk/zakendoen-met-rijkswaterstaat/werkwijzen/werkwijze-in-gww/werken-in-projecten/integraal-projectmanagement

Mintzberg, H. (1983). *Structures in Fives: Designing effective organisations.* Hoboken, NJ: Prentice Hall

Nagelkerke, M., & van Dijke, J. (2020). *Evaluatie 2-fasen proces (inventarisatiefase).* 's-Gravenhage, The Netherlands: Rijkswaterstaat, afdeling Inkoopcentrum GWW (ICG).

Oakland, J. S., & Marosszeky, M. (2017). *Total Construction Management* (1st ed.). London, United Kingdom: Routledge. https://doi.org/10.4324/9781315694351

Panda, B., & Leepsa, N. M. (2017). Agency theory: Review of Theory and Evidence on Problems and Perspectives. *Indian Journal of Corporate Governance*, *10*(1), 74–95. https://doi.org/10.1177/0974686217701467

Project DOEN. (2022). *Home – Project DOEN.* Retrieved from https://projectdoen.nu/

Projectteam DOEN & Rijkswaterstaat. (2016). *Aanbestedingsleidraad Project DOEN*. Utrecht, The Netherlands: Rijkswaterstaat.

Provincie Noord-Holland. (2021). *TN245030 - SF03 Aankondiging van een gegunde opdracht.* Den Haag, The Netherlands: Tenderned. https://tenderned.nl

Provincie Noord-Holland. (2022). *Integraal MeerjarenProgramma infrastructuur 2023-2030.* Haarlem, The Netherlands: Author

Provincie Noord-Holland, Witteveen+Bos, & Copper8. (2022). *Inzichten en tips n.a.v. aanbesteding van de Cruquiusbrug*. Haarlem: The Netherlands: Provincie Noord-Holland

Rijksoverheid. (2023a, January 23). *Ministerie van Infrastructuur en Waterstaat (IenW).* Retrieved from https://www.rijksoverheid.nl/contact/contactgids/ministerie-van-infrastructuur-en-waterstaat

Rijksoverheid. (2023b, April 26). *Klimaatbeleid.* Retrieved from https://www.rijksoverheid.nl/onderwerpen/klimaatverandering/klimaatbeleid

Rijkswaterstaat. (2019). *Toekomstige Opgave Rijkswaterstaat: Perspectief op de uitdagingen en verbetermogelijkheden in de GWW-sector*. 's-Gravenhage, The Netherlands: Ministerie van Infrastructuur en Waterstaat.

Rijkswaterstaat. (2020a). *Op weg naar een vitale infrasector - Plan van aanpak en aanzet tot een gezamenlijk transitieproces*. Utrecht, The Netherlands: Author. Retrieved from https://vitaleinfrastector.nl

Rijkswaterstaat. (2020b). *Basisovereenkomst - Het engineeren en uitvoeren van de renovatie A12 IJsselbruggen*. Den Haag, The Netherlands: Tenderned. https://tenderned.nl

Rijkswaterstaat PPO. (2020) *De Bijsluiter Renovatie A12 IJsselbruggen - zaaknummer 31146554.* Den Haag, The Netherlands: Tenderned. https://tenderned.nl

Rijkswaterstaat PPO. (2021). *TN278436 – SF03 Aankondiging van een gegunde opdracht.* Den Haag, The Netherlands: Tenderned. https://tenderned.nl

Rijkswaterstaat PPO. (2022). *TN278436 – SF20 Aankondiging van een wijziging.* Den Haag, The Netherlands: Tenderned. https://tenderned.nl

Rijkswaterstaat PPO. (2023). *TN278436 – SF20 Aankondiging van een wijziging.* Den Haag, The Netherlands: Tenderned. https://tenderned.nl

Rumsfeld, D. H. (2002). *DoD News Briefing - Secretary Rumsfeld and Gen. Myers*. Arlington County, VA: United States Department of Defense

Schillemans, T. (2013). Moving Beyond The Clash of Interests: On stewardship theory and the relationships between central government departments and public agencies. *Public Management Review*, *15*(4), 541–562. https://doi.org/10.1080/14719037.2012.691008

Schillemans, T., & Bjurstrøm, K. H. (2020). Trust and verification: balancing agency and stewardship theory in the governance of agencies. *International Public Management Journal*, *23*(5), 650–676. https://doi.org/10.1080/10967494.2018.1553807

Seawright, J., & Gerring, J. (2008). Case Selection Techniques in Case Study Research. *Political Research Quarterly, 61*(2), 294–308. https://doi.org/10.1177/1065912907313077

Shapiro, S. P. (2005). Agency Theory. *Annual Review of Sociology*, *31*(1), 263–284. https://doi.org/10.1146/annurev.soc.31.041304.122159

Shavelson, R. J., & Towne, L. (2002). *Scientific Research in Education*. Washington, DC: National Academies Press eBooks. https://doi.org/10.17226/10236

Significant Synergy. (2023). *Leerervaringen vroege marktbenadering Hoogwaterbeschermingsprogramma*. Utrecht, The Netherlands: Hoogwaterbeschermingsprogramma. https://www.hwbp.nl/documenten/rapporten/2023/03/28/leerervaringen-vroege-marktbenadering

Stewart, D. W., & Kamins, M. A. (1993). *Secondary Research: Information Sources and Methods*. Thousand Oaks, CA: SAGE Publications.

Tansey, O. (2007) Process Tracing and Elite Interviewing: A Case for Non-probability Sampling. *Political Science & Politics, 40*(4), 765-772. https://doi.org/10.1017/S1049096507071211

Van Limbergen, K. (2020). Assessing collaborative behaviour as partner selection mechanism: An explorative study into team assessments used in the tender process of infrastructure projects. *Delft University of Technology Repository.* [MSc thesis] https://repository.tudelft.nl/islandora/object/uuid%3Af6a24890-0972-40ac-b489-7ed90c3a5ebb?collection=education

Werkgroep 2-fasen aanpak. (2023). *Handreiking toepassing 2-fasen aanpak bij Rijkswaterstaat projecten*. ‘s-Gravenhage, The Netherlands: Ministerie van Infrastructuur en Waterstaat, Rijkswaterstaat. https://www.vitaleinfrasector.nl/nieuws/2475305.aspx?t=Handreiking-tweefasenaanpak-bij-Rijkswaterstaat-projecten-beschikbaar

Wermer, F. (2018). *De kracht van een driehoek: Praktijkervaringen met Integraal Projectmanagement (IPM).* Den Haag, The Netherlands: Neerlands diep. https://neerlandsdiep.nl/openacademy/kracht-van-een-driehoek-freek-wermer/

Wondimu, P. A., Hailemichael, E., Hosseini, A., Lohne, J., Torp, O., & Lædre, O. (2016). Success Factors for Early Contractor Involvement (ECI) in Public Infrastructure Projects. *Energy Procedia*, *96*, 845–854. https://doi.org/10.1016/j.egypro.2016.09.146

Yin, R. K. (2009). *Case Study Research.* Thousand Oaks, CA: Sage Publications

Yin, R. K. (2012). Case Study Methods. In *Handbook of Complementary Methods in Education Research*. Oxfordshire, United Kingdom: Routledge. https://doi.org/10.4324/9780203874769-8

Zainal, Z. (2007). Case study as a research method. *Jurnal Kemanusiaan*, *5*(1). Retrieved from https://jurnalkemanusiaan.utm.my/index.php/kemanusiaan/article/view/165

Appendix A: Interview procedure

Below the interview procedure is presented. Please note that the interviews were in Dutch as is the procedure. The questions seen here are indicative and the planned procedure, not all questions have been asked in exactly this phrasing. Also this procedure is not limitative, meaning that more questions have been asked during interviews than shown.

Introductie
Nogmaals enorm bedankt voor uw deelname aan dit onderzoek.

Door te kijken naar twee fasen projecten van verschillende publieke opdrachtgevers hoop ik te weten te komen hoe de eerste fase wordt ingevuld en hoe in die verschillende projecten risico's zijn ontdekt en verdeeld. Hiervoor wil ik per project enkele mensen spreken aan de kant van de opdrachtgever en aan de kant van de aannemer. Het **[project]** is in dit licht erg interessant en ik ben benieuwd naar uw ervaringen en kennis.

Ik wil een open interview met u houden waarin ik een aantal dingen zeker de revue wil laten passeren. Er zijn drie thema's/variabelen waar ik naar wil vragen. Dat zijn het informatierisico en de planuitwerking in de eerste fase, de rolverdeling en samenwerking tussen OG en ON, en hoe de risico's zijn verdeeld.

Dan zou ik nu uw toestemming willen vragen om het interview op te nemen en te gebruiken via het toestemmingsformulier, de opname starten en beginnen met het interview. Als eerste zou ik graag van u horen over het project zelf.

1. Begin - het project

1. Kunt u mij wat meer vertellen over het project?
    a. Waarom is er gekozen voor een twee-fasen aanpak?
    b. Waarom is er gekozen voor specifiek deze twee-fasen aanpak (UPB vorm)?

2. Hoe was de eerste fase van het project georganiseerd?
    a. Welke rollen, wat voor teams, wie beslist

2. Informatierisico en onbekendheden

1. Is er (verder) onderzoek gedaan naar **[projectomgeving]** in de eerste fase?
    a. Ingegeven door de samenwerking tussen OG en ON?
    b. Wat is hierdoor ontdekt?

2. Zijn er nieuwe risico's ontdekt tijdens de eerste fase?
    a. Door de samenwerking in de eerste fase?

    Zijn onbekendheden ontdekt en/of beter (specifieker) duidelijk geworden in de eerste fase?
    b. Waren die hierdoor (beter) te beprijzen?

3. Wanneer was er genoeg bekend (over risico's, prijs) om over te gaan naar fase twee?
    a. Lag dit voor aanvang van de eerste fase vast?
        i. Zo nee: hoe en door wie werd dit bepaald?

4. Tot welk detailniveau was het ontwerp uitgewerkt aan het eind van de eerste fase?

5. Waaruit bestaat de ontbindende/opschortende voorwaarde voor fase 2?

3. Rolverdeling tussen OG en ON

1. Wat was de rolverdeling tussen OG en ON in de eerste fase?

a. Wie had welke verantwoordelijkheden?
b. Wie had welke taken?

2. Wie had/nam de leiding in de eerste fase, de OG of de ON?

3. Had de OG de ON nodig om de eerste fase te kunnen doorlopen?
    a. Waren er kennis en vaardigheden nodig die de OG zelf niet heeft of kon inzetten?

4. Hoe formeel was de relatie en het contact tussen OG en ON in de eerste fase?
    a. Ingebouwde overlegmomenten?
    b. Inzage in elkaars stukken?
    c. Rapportage over en weer (naar OG vanaf ON en vice versa)?
        i. bv Open book accounting/open book management?
        ii. bv Gezamenlijke werkplek?

5. Hoe was de sfeer op het project en tussen werknemers van OG en ON?

6. Waren er afspraken over de samenwerkingsrelatie? over hoe die zou moeten zijn?
    a. Zo ja: mondeling, ongeschreven, vastgelegd?

7. Hoe werd de ON gecontroleerd?
    a. Middels contract? via 3e partij zoals ingenieursbureau?

4. Risico's en risicoverdeling

1. Hoe zijn risico's voor fase twee verdeeld tussen OG en ON?
    a. Per risico?
    b. Deel onbestemd?

2. En de ontwerprisico's?

3. Lag de risicoverdeling voor fase twee al vast voor aanvang fase een?
    a. Zo ja: Is hier iets aan veranderd gedurende fase een?
    b. Zo nee: wat lag er wel vast over de risico aanpak voor aanvang fase een?

5. Einde

- Wat zijn (voor u) de belangrijkste uitkomsten van de eerste fase mbt het ontwerp, de samenwerking tussen OG en ON, en risico identificatie/beheersing?

Graag wil ik u enorm bedanken voor uw tijd en medewerking. Ik zal het interview gaan transcriberen en verwerken. Hierbij streef ik ernaar om binnen twee weken het interview en de resultaten naar u terug te koppelen zodat u desgewenst kan reviseren.

Zijn er nog zaken waar ik vergeten ben naar te vragen volgens u, of die u mij graag wilt vertellen?

Appendix B: Informed consent form

Toestemmingsformulier interview

Onderzoek: MSc thesis Construction Management and Engineering

Instituut: Technische Universiteit Delft

Interviewer: Peer van Esch

Gelieve aan te kruisen wat van toepassing is

Deelname aan het onderzoek	**Ja**	**Nee**
1. Ik heb het toestemmingsformulier en informatie over het onderzoek gelezen. Ik heb de mogelijkheid gehad om vragen te stellen over het onderzoek en mijn vragen zijn naar tevredenheid beantwoord.	☐	☐
2. Ik stem er vrijwillig mee in om deel te nemen aan dit onderzoek en begrijp dat ik kan weigeren vragen te beantwoorden en dat ik me op elk moment kan terugtrekken uit het onderzoek, zonder het opgeven van een reden.	☐	☐
3. Ik begrijp dat mijn deelname aan het onderzoek een audio-opgenomen interview inhoudt dat zal worden getranscribeerd en ter goedkeuring naar mij zal worden verzonden.	☐	☐
Gebruik data tijdens het onderzoek		
4. Ik begrijp dat de informatie die ik verstrek gebruikt zal worden voor het schrijven van een scriptie voor de MSc Construction Management and Engineering aan de TU Delft.	☐	☐
5. Ik begrijp dat persoonlijke informatie die over mij verzameld wordt en mij kan identificeren, zoals mijn naam en functie, niet gedeeld wordt buiten het onderzoeksteam.	☐	☐
6. Ik geef toestemming om mijn antwoorden, ideeën of andere bijdragen autoniem/anoniem (*doorstrepen wat niet van toepassing is)* te citeren in resulterende onderzoeksproducten.	☐	☐
Toekomstig gebruik en publicatie		
7. Ik geef toestemming om deze masterscriptie – met daarin de informatie die ik verstrek – te publiceren op de research repository van de TU Delft opdat deze gebruikt kan worden voor toekomstig onderzoek en onderwijs.	☐	☐

Handtekening deelnemer

Naam deelnemer	Handtekening	Datum

Voor vragen neem contact op via [verwijderd]

Informatie interview

Onderzoek: MSc thesis – Phasing the Market?
Instituut: Technische Universiteit Delft
Onderzoeker: Peer Marie (P.M.) van Esch

U wordt uitgenodigd om deel te nemen aan een afstudeeronderzoek genaamd *Phasing the Market?* Dit onderzoek wordt uitgevoerd door Peer van Esch als onderdeel van de MSc Construction Management and Engineering aan de Technische Universiteit Delft.

Deelname aan het onderzoek
Het doel van dit onderzoek is om inzicht te krijgen in hoe de eerste fase van twee-fasen-projecten effect heeft op het informatierisico, de rolverdeling en de risicoverdeling in de onderzochte projecten. Door deel te nemen aan dit onderzoek draagt u, met gegevens, ervaringen en kennis, bij aan kennisverwerving over hoe de invulling van de eerste fase in twee-fasen-projecten effect heeft op de risico- en rolverdeling tussen opdrachtgever en -nemer.

Uw deelname aan dit onderzoek is volledig vrijwillig, en u kunt zich elk moment terugtrekken zonder een reden op te geven. U bent vrij om vragen niet te beantwoorden. In het geval van terugtrekking, neem dan alstublieft contact op via de gegevens onderaan dit formulier.

Gebruik data tijdens het onderzoek
Van dit interview wordt een audio-opname gemaakt. Deze opname wordt na het interview getranscribeerd. De verzamelde gegevens zullen gebruikt worden voor het verkrijgen van informatie omtrent het project, welke vervolgens zal worden gebruikt in een case study en meegenomen in de conclusies van dit onderzoek. Dit onderzoek vormt de afrondende thesis voor de MSc Construction Management and Engineering en zal worden gepubliceerd op de education repository van de Technische Universiteit Delft.

Persoonlijke gegevens die u zouden kunnen identificeren worden niet gedeeld buiten het onderzoeksteam. Het onderzoeksteam bestaat uit Peer van Esch en mijn TU Delft begeleiders Prof.dr. G.P. van Wee, Dr.ir. A. Straub, en Prof.mr.dr. E.M. Bruggeman. In de onderzoeksproducten worden persoonlijke gegevens geanonimiseerd: u bent niet identificeerbaar. U heeft het recht van toegang tot en rectificatie of verwijdering van gegevens.

Toekomstig gebruik en publicatie
Na afsluiting van het onderzoek worden de audio-opnamen en persoonlijke gegevens verwijderd. De onderzoeksthesis wordt gepubliceerd op de Education Repository van de Technische Universiteit Delft, een opslagplaats van alle wetenschappelijke documenten die zijn geproduceerd door onderzoekers van de TU Delft. Op de repository is de afstudeerscriptie te vinden zodat deze gebruikt kan worden voor toekomstig onderzoek en onderwijs.

Enorm bedankt voor uw medewerking aan dit onderzoek! Voor verdere vragen kunt u altijd contact opnemen via onderstaande gegevens.

Met vriendelijke groet,

Peer van Esch

Appendix C: Data management plan

Plan Overview
A Data Management Plan created using DMPonline

Title: Phasing the market?

Creator: Peer van Esch

Principal Investigator: Peer van Esch

Affiliation: Delft University of Technology

Template: TU Delft Data Management Plan template (2021)

Project abstract:
Research on the effects of the first phase design on information risks and responsibilities in Dutch large complex two phase infrastructure projects. Case studies will be carried out accompanied by interviews to gain further knowledge and insight on the cases beyond project documents.

ID: 115739

Start date: 16-01-2023

End date: 28-06-2023

Last modified: 31-03-2023

Phasing the market?

0. Administrative questions

1. Name of data management support staff consulted during the preparation of this plan.

My faculty data steward, Xinyan Fan, has reviewed this DMP on 29-03-2023

2. Date of consultation with support staff.

2023-01-30

I. Data description and collection or re-use of existing data

3. Provide a general description of the type of data you will be working with, including any re-used data:

Type of data	File format(s)	How will data be collected (for re-used data: source and terms of use)?	Purpose of processing	Storage location	Who will have access to the data
Recordings of the interviews	MP4	Phone audio recorder, Teams recorder	Provide information on cases	Recording device hard drive	Myself
Email addresses	.docx file	Data received from third parties, either through project documents or information from supervisors. This information is available under the graduation agreement.	To contact possible interviewees	AT Osborne OneDrive	AT Osborne, Myself
Personally identifiable information, like project role	.docx file	From project documents and interviews	To help investigate the design of the first phase	Google drive	Myself
Informed consent forms	physical file, .docx file	From interviewees, physical or digital signature	Permission to use (certain) data gathered from interviews	Locker at TU Delft or AT Osborne, AT Osborne OneDrive	Myself
Transcribed recordings of interviews	.docx file	From interviews	Have interviews in writing as reference.	AT Osborne OneDrive, Google Drive	PI of TU Delft, AT Osborne, Interviewee, Myself
Anonymised data	.docx file	From project documents, interviews, third parties. Made available by interviewees.	To have as reference in thesis	AT Osborne onedrive, Google Drive	PI of TU Delft, AT Osborne, myself
Project documents like	.docx file, pdf	From project documents, interviews, third parties. Made	To have as reference in thesis as well as results	AT Osborne OneDrive,	PI of TU Delft, AT Osborne, myself

contracts, project plans	available by interviewees.	Google Drive

4. How much data storage will you require during the project lifetime?

- < 250 GB

II. Documentation and data quality

5. What documentation will accompany data?

- Other - explain below
- Methodology of data collection

The data gathered will accompany my thesis in the appendix. The data itself will not be shared as such on a repository.

III. Storage and backup during research process

6. Where will the data (and code, if applicable) be stored and backed-up during the project lifetime?

- OneDrive

The AT Osborne OneDrive

IV. Legal and ethical requirements, codes of conduct

7. Does your research involve human subjects or 3rd party datasets collected from human participants?

- Yes

8A. Will you work with personal data? (information about an identified or identifiable natural person)

If you are not sure which option to select, ask your Faculty Data Steward ***for advice. You can also check with the*** privacy website ***or contact the privacy team: privacy-tud@tudelft.nl***

- Yes

Persons could be identified based on the information that will be gathered.

8B. Will you work with any other types of confidential or classified data or code as listed below? (tick all that apply)

If you are not sure which option to select, ask your** Faculty Data Steward **for advice.

- Yes, confidential data received from commercial, or other external partners

There is data that will not be used directly which is or could still be confidential.

9. How will ownership of the data and intellectual property rights to the data be managed?

For projects involving commercially-sensitive research or research involving third parties, seek advice of your** Faculty Contract Manager **when answering this question. If this is not the case, you can use the example below.

The graduation agreement between the TU Delft and a Company (CME-2 Form) has been signed by all parties. The personal data is only known to myself and only non-personal and anonymized data will be shared. This anonymized data will be shared with the PI from the TU Delft and the supervisors from AT Osborne. It will also be part of the thesis which will be uploaded to a repository, if consent is provided.

10. Which personal data will you process? Tick all that apply

- Signed consent forms
- Data collected in Informed Consent form (names and email addresses)
- Names and addresses
- Email addresses and/or other addresses for digital communication
- Telephone numbers

11. Please list the categories of data subjects

People involved in different ways in the first phase of selected two phase projects, either on the client or contractor side. This could be for instance a manager, project manager, contract manager, stakeholder manager or a designer etc.

12. Will you be sharing personal data with individuals/organisations outside of the EEA (European Economic Area)?

- No

15. What is the legal ground for personal data processing?

- Informed consent

16. Please describe the informed consent procedure you will follow:

All study participants will be asked for their written consent for taking part in the study and for data processing before the start of the interview.

17. Where will you store the signed consent forms?

- Other - please explain below

When hard copies are used, stored in a locked box at the TU or AT Osborne. If the interview is done digitally and a digital form is used, this will be stored on the AT Osborne OneDrive.

18. Does the processing of the personal data result in a high risk to the data subjects?

If the processing of the personal data results in a high risk to the data subjects, it is required to perform a Data Protection Impact Assessment (DPIA). In order to determine if there is a high risk for the data subjects, please check if any of the options below that are applicable to the processing of the personal data during your research (check all that apply).
If two or more of the options listed below apply, you will have to complete the DPIA. Please get in touch with the privacy team: privacy-tud@tudelft.nl to receive support with DPIA.
If you have any additional comments, please add them in the box below.

- None of the above applies

22. What will happen with personal research data after the end of the research project?

- Personal research data will be destroyed after the end of the research project
- Anonymised or aggregated data will be shared with others

23. How long will (pseudonymised) personal data be stored for?

- Other - please state the duration and explain the rationale below

The expectation is that the personal data can be destroyed after analysis. However, it is possible that it is of interest to keep the data and/or use in the thesis. Therefore, in the informed consent form explicit consent is asked for this use with accompanying upload to the research repository of the TU Delft.

24. What is the purpose of sharing personal data?

- For research purposes, which are in-line with the original research purpose for which data have been collected

To help with research purposes. It will only be anonymised data and only with informed consent from the interviewee/participant. Otherwise the data will be left out.

25. Will your study participants be asked for their consent for data sharing?

- Yes, in consent form - please explain below what you will do with data from participants who did not consent to data sharing

Participants who do not consent will either be completely left out of the study, their input only used indirectly/contextually. Data gathered will always be checked with the participant again before being used.

V. Data sharing and long-term preservation

27. Apart from personal data mentioned in question 22, will any other data be publicly shared?

- All other non-personal data (and code) produced in the project

29. How will you share research data (and code), including the one mentioned in question 22?

- My data will be shared in a different way - please explain below

The data from interviews and project document, ie the data gathered, will possibly accompany my thesis. It is therefore shared only as an appendix/appendices to the thesis and will not be shared on a repository on its own.

30. How much of your data will be shared in a research data repository?

- < 100 GB

31. When will the data (or code) be shared?

- As soon as corresponding results (papers, theses, reports) are published

32. Under what licence will be the data/code released?

- Other - Please explain

The data from interviews and project document, i.e. the data gathered, will possibly accompany my thesis. It is therefore shared only as an appendix/appendices to the thesis and will not be shared on a repository on its own.

VI. Data management responsibilities and resources

33. Is TU Delft the lead institution for this project?

- Yes, leading the collaboration - please provide details of the type of collaboration and the involved parties below

The study is carried out as part of a graduation internship at the company AT Osborne. The graduation agreement between TU Delft and AT Osborne has been signed (CME-2 form).

34. If you leave TU Delft (or are unavailable), who is going to be responsible for the data resulting from this project?

Thesis supervisor: Ad Straub
a.straub@tudelft.nl

35. What resources (for example financial and time) will be dedicated to data management and ensuring that data will be FAIR (Findable, Accessible, Interoperable, Re-usable)?

TU Delft provides 5TB of storage to researchers, this is more than enough to store the data.

Appendix D: Expert interview procedure

Below the expert interview procedure is presented. Important to note is that some conclusions have been accentuated in order to get the most out of the responses from the experts.

Graag spreek ik u om u te vragen naar uw ervaringen met en inzichten in de twee-fasen aanpak. Daarnaast leg ik u graag mijn voorlopige resultaten en eerste conclusies voor om uw mening daarover te horen.

Korte introductie. Mijn onderzoek gaat over de twee-fasen aanpak en in het specifiek de eerste fase. De focus ligt op de effecten die de contractvorm heeft op het in kaart brengen van onbekendheden, de rolverdeling tussen OG-ON en de risicoallocatie, eigenlijk het verloop van de eerste fase.

1. Welke ervaring en expertise heeft u op het vlak van de twee-fasen aanpak?

2. Welke inzichten en overdenkingen heeft u over het gebruik van de twee-fasen aanpak?
    i. En in het bijzonder de eerste fase?

3. Wat ziet u in/m.b.t. het verloop van de eerste fase?
    i. Het in kaart brengen van onbekendheden en uitwisselen van kennis?
        1. Is het vroeg aan boord brengen van de ON nodig?
    ii. De rolverdeling tussen OG en ON?
        1. Contractueel?
        2. Praktijk: sfeer?
    iii. De risicoallocatie in deze projecten?
        1. Hoe ziet die er uit?
        2. Wanneer is dit in het proces afgesproken?

4. Wat zijn uw ideeën over de relatie tussen de gekozen contractvorm (binnen twee fasen) en het verloop van de eerste fase?

Mijn resultaten

Variabele	**Casus 1**	**Casus 2**	**Observatie / Conclusie**
Informatierisico	Er lag een haalbaar ontwerp, maar om meer eruit te halen qua innovatie en ambitie was marktpartij nodig	ON was nodig en de samenwerking heeft onbekendheden verkleint	- Twee fasen helpt bij het in kaart brengen van onzekerheden, OG mist uitvoeringskennis om aan de voorkant tot goede inschatting te komen. - De eerste fase slaagt erin de risico's te verkleinen alvorens te starten met de uitvoering.

Rolverdeling	- Bouwteam met werkpakketten. PM OG is eindbeslisser, ON ontwerpt en is in de lead (praktijk vs papier) - Keuze voor Bouwteam onder Duurzaam Gebouwd ipv onder UAV-GC zoals RWS om niet te veel af te hoeven wijken van de UAV-GC: aansprakelijkheid tijdens bouwteam fase is expres niet gebaseerd op DNR 2011 - Geintegreegd IPM team -> rolverdeling was meer alsof het gespiegeld was, traditionele rollen ingenomen - Samenwerkingsafspraken opgesteld, zaken werden gezamenlijk besproken en gedaan.	- UAV-GC, eigenlijk eerste fase een werk op regie. Alles in gezamenlijkheid besloten - Gespiegeld IPM, geen dubbeling van taken -> verdeling tussen rollen - Sfeer enorm informeel en goed, gezamenlijk gedragen project.	Uiteindelijk gaat het om de invulling binnen de contractvorm en de mensen die er op het project zitten. De contractvorm zelf is dan van minder belang, behalve in zoverre dat de kaders van het contract een goede invulling mogelijk maken alsmede de goede mensen de kans biedt boven te komen drijven. Hierin kunnen een aantal trekkers dit qua cultuur voor elkaar krijgen. - De keuze voor twee-fasen zou moeten afhangen van (het type) mensen dat je beschikbaar hebt, niet van de risico's van het project. - Continuïteit van mensen op het project is belangrijk voor de cultuur en gedragenheid
Risicoallocatie	- Executiefase is UAV-GC, overname bij DO - Gezamenlijke werkpakketten, of werkpakketten die de opdrachtnemer heeft afgetekend 50/50 risicoprofiel	- Hele risicodossier een voor een verdeelt. - voorziene risico's: OG, ON, of ON tot een bepaalde waarde - onvoorziene risico's: op papier voor OG, in praktijk pakt ON sommige -> niet puur gevaren op contract	- Worden in deze vormen gezamenlijker gedragen dan in een klassiek geïntegreerd contract, minder puur voor de markt - Het gezamenlijk doorlopen van de eerste fase kan het verdelen van risico's makkelijker/minder heikel punt maken - Er kan ruimte zijn om af te wijken van de gemaakte plannen en verdelingen in de contracten vanuit de OGs.
Procesinrichting	- Bouwteamfase eindigde bij een DO en prijsovereenstemming, opschortende voorwaarde	3 opschortende voorwaarden voor komen tot overeenkomst. Veiligheid	- Het is lastig om te bepalen wanneer een ontwerp ver genoeg is uitgewerkt om fase een te beëindigen; er zit een

	- Minimumvereisten aan de producten: taakstellend budget voor bouwteamfase (moest ON binnen blijven met uren) en taakstellend budget voor de aanbieding voor executiefase (anders geen gunning fase 2)	Lasproeven Kostenpooltoets RWS	groot grijs gebied en het is een definitiekwestie - Bij fase twee in UAV-GC vorm kan er prikkel liggen voor ON om zo lang mogelijk door te ontwerpen om de risico's/onzekerheid over risico's die hij moet overnemen te verkleinen

Hierbij lijken/zijn de volgende mechanismen van werking:
Iets zeggen over contractvorm en hoe het relateert aan invulling.
Taakstellend budget tegenover kostenpooltoets.

Mogelijke vragen:

1. Wat zijn uw eerste gedachten als u dit zo hoort?
2. Zijn er zaken die er voor u uitspringen?
3. Zijn er dingen die u herkent?
4. Zijn er zaken die u verbazen?
5. Ligt het in de lijn der verwachting?