Contractual incentives between the main contractor and third parties for better performance in a Bouwteam

by

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Preface

Before you lies the master thesis of contractual incentives between the main contractor and third parties for a better performance in a Bouwteam. This report is written as a result of a research conducted in seven months at Witteveen+Bos and marks the final of the Master programme: Construction Management and Engineering, with the specialization of projects and people.

During my study period, the interest in contracts within the construction industry has grown. Therefore, I have chosen conduct my thesis in Early Contractor Involvement.

I would like to thank my graduation committee from Delft university of technology, for their support during the graduation process. I would also like to thank Witteveen+Bos for granting me the opportunity to conduct a research within their organisation. A special thank you to my company supervisor Lonneke who provided me of helpful feedback during the graduation process. I would also like to thank Jaap, who included me in external events of the Early Contractor Involvement, from which I could draw inspiration in writing my thesis. A special thank you, to the thirteen interviewees and the four experts, who shared their knowledge with me.

Lastly, I would like to thank my family and friends in the Netherlands and Aruba for supporting me during the whole graduation process. Without their support, I would not be able to finalise the report that lies in front of you. With gratitude I close my learning period at Delft university of technology and I am preparing myself for the beautiful challenges that lies ahead of me.

Eljoenai Gumbs
Delft, May 2023

Executive summary

In the last decade, the Bouwteam concept has become increasingly popular in the construction industry. A Bouwteam agreement is a bilateral agreement between a client and a main contractor, in which the main contractor is involved at an early stage. In practice, both the client and the main contractor can employ third parties to transfer parts of their design responsibilities. In the recent Bouwteam models (DG2020 and BN2021), there is the possibility that a substantial part of the design responsibility is passed on to the main contractor and his third parties. These third parties have an increasing influence on the achievement of project goals, which are usually the design quality, design costs, design planning and client satisfaction. Hence, this research is focused on the implementation of contractual incentives for the designing third parties, who are employed by the main contractor in a Bouwteam. The contractual incentives are used to influence the performance of these third parties, in such a way that Bouwteam goals are achieved. The research question is:

"How can contractual incentives in the design phase of Bouwteam projects be employed by main contractors to influence the performance of their third parties in such a way that Bouwteam goals are met?"

A literature study was conducted and a theoretical framework was set up with the contractual incentives which can be used in an Early Contractor Involvement (ECI) project. An ECI is a project delivery method, the main contractor is involved in an early stage to offer input in the design phase. The Bouwteam agreement is a Dutch variant of an ECI project delivery method.

Contractual incentives can be divided in monetary incentives, which are based on the payment method and risk sharing. The literature shows that the cost reimbursable payment method is suitable for ECI projects, as these projects have a high level of uncertainty. A cost reimbursable payment is based on the actual expenses made in the design phase of an ECI project. The following variants of this payment method are suitable: Cost plus Award Fee (CPAF), Cost Plus Fixed Fee (CPFF) and Cost Plus incentive Fee (CPIF). Risks sharing can be divided in a risk pot, by implementing a Bonus Malus concept or to set up a target price.

Key Performance Indicators (KPI) are additional tools for project evaluation or they can be used in combination with an incentive fee. The following indicators can be used in the design phase of an ECI project: management costs, management time, design errors, risk management, constructability, manageability and innovation.

Contractual incentives also consist of non-monetary incentives. These incentives are based on contractual extension and network relations. The theoretical framework is used as a stepping stone for the empirical study. In the empirical study a multiple case study was set up. Four Bouwteam projects were selected for a document review and interviews. Thirteen interviews were conducted with practitioners from the client, main contractors organisation and third parties (hired by the main contractor). Research was done in which contractual incentives were used in the four Bouwteam projects. The monetary incentives consists of payment methods and mitigation tools. The following payment methods were used in the four Bouwteam projects:

- Cost reimbursable
- Lump sum

The following mitigation tools were used:

- **Task budget:** a target value during the Bouwteam phase that is based on function rates.
- **Price ceiling:** a hard budget that is set in the tender phase.
- **Milestones:** a payment arrangement based on the performance of the parties.

Furthermore, the following non-monetary incentives were used:

- **Direct vs indirect involvement:** there is direct communication between the client and third party. Or the main contractor functions as an intermediary.
- **Early vs In-time involvement:** the third party is involved in the tender phase. Or a third party is hired at the moment their activities are executed.

The case study results, show that the Bouwteam goals in terms of design costs is not achieved. Two reasons can be given for this. First, the designing third parties tend to carry out the design in as much detail as possible, even if this is not always necessary at this stage. Secondly, extra employees are deployed from the designing third parties to finish the design within the planning. This shows that the project control of larger Bouwteam projects become complex. Hence, several contractual incentives have been proposed, which can be used to influence the performance of designing third parties in such a way that Bouwteam goals are met (especially the design costs). The participants suggested the following mitigation tools:

- **Risk sharing:** the client and the main contractor are responsible for the costs, in case of a budget overrun.
- **Risk pot:** a joint risk pot between the client and the main contractor. The residual amount is divided between the parties.
- **Budget margin:** the actual costs in the design phase may remain within a specified margin. If the costs exceed the budget margin, the main contractor becomes responsible for the additional costs.
- **Incentive fee:** the incentives are based on the applied KPI's.

The following non-monetary incentives were suggested:

- **Bouwteam partners:** this is a combination of the direct involvement and early involvement of third parties. The main contractor forms a partnership with an engineering firm in the tender phase.
- **Third party defines the level of detail:** the third party defines the level of detail of the design and the main contractor gives an approval after the review is done.

It was also suggested to use KPI's for project evaluating, weekly project control and incentive fees. The important KPI's covers the following: quality, design time, design planning, satisfaction (client and main contractor), realisation requirements (risk management, constructability and maintainability) and the number of employees.

The majority of the monetary incentives in contracts between the main contractor and third parties have been taken over from the Bouwteam agreement. This form of contracting is called Back-to-Back contracting and is attractive to main contractors, as the risks in the Bouwteam phase can be transferred back to the client. Therefore, it is recommended that the client applies the suitable monetary incentives. After which, the main contractor evaluates which monetary incentives can be included in contracts towards his third parties.

Next, a preliminary framework was set up with the contractual incentives from the literature study and the case study. This preliminary framework was evaluated by four experts within Witteveen+Bos, after which, a final framework was set up which consists of three parts. Part I aims at the client to implement suitable monetary incentives in the Bouwteam agreement. Part II aims at the main contractor for the acquisition of monetary incentives and to implement suitable non-monetary incentives in contracts towards his third parties. The function of part III is to monitor incentives and to make adjustments if needed.

The use of contractual incentives is summarized in the final framework, presented in Figure 1.

Several recommendation are given:

- **Recommendations for practice:**
- **The client**
    - Remain responsible for applying the suitable monetary incentive, to regulate which monetary incentives are taken over by the main contractor.
- **Main contractor**
    - Use key performance indicators to improve project control and appoint a person from the main contractors organisation, to execute weekly project control.
    - The person responsible for project control, should guard scope change and evaluate how this would affect the third parties.
    - Share the responsibility for project control with the third party.
- **Third parties**
    - Use KPI's to improve project control
- **Recommendation for future research:**
    - Study the impact of a different Bouwteam composition on the performance. In this case, a Bouwteam agreement is formed between the client, main contractor and an engineering firm.
    - Study how strategic behaviour can be minimalized by change management in a Bouwteam collaboration. As it became clear that contractual incentives may stimulate strategic behaviour.
    - Study the impact of framework contracting on the performance of third parties in a Bouwteam.

Keywords: Bouwteam, contractual incentives, third parties, performance

Management samenvatting

In de afgelopen jaren is het Bouwteam concept steeds populairder geworden in de bouwwereld. Een Bouwteamovereenkomst is een bilaterale overeenkomst tussen een opdrachtgever en een hoofdaannemer, waarbij de hoofdaannemer in een vroeg stadium betrokken is om diens kennis van de uitvoering in te zetten in de ontwerpfase. In de praktijk kunnen zowel de opdrachtgever als de hoofdaannemer derde partijen in dienst nemen om gedeelten van hun ontwerpwerkzaamheden over te dragen. In de recentere Bouwteammodellen (DG2020 en BN2021), bestaat de mogelijkheid dat een substantieel gedeelte van de ontwerpverantwoordelijkheid, wordt doorgezet bij de hoofdaannemer en diens derde partijen. Waarbij deze derde partijen een steeds grotere invloed hebben op het behalen van de Bouwteamdoelstellingen, die vaak gericht zijn op de ontwerpkwaliteit, ontwerpkosten, ontwerpplanning en de tevredenheid van de opdrachtgever.

Dit onderzoek richt zich daarom op het doorzetten van contractuele prikkels naar de ontwerpende derde partijen, die in dienst zijn van de hoofdaannemer in een Bouwteam. De contractuele prikkels worden ingezet om de prestatie van deze derde partijen dusdanig te beïnvloeden, zodat de Bouwteamdoelstellingen worden bereikt. De onderzoeksvraag luidt:

Hoe kunnen hoofdaannemers contractuele prikkels inzetten in de ontwerpfase, om de prestatie van hun derde partijen dusdanig te beïnvloeden, zodat de Bouwteamdoelstellingen worden bereikt?

Een literatuuronderzoek en een theoretisch raamwerk is opgesteld met contractuele prikkels die gebruikt kunnen worden in een Early Contractor Involvement (ECI) project. Een ECI is een wijze van project oplevering, waarbij de hoofdaannemer in een vroeg stadium is betrokken om input te leveren in de ontwerpfase. Een Bouwteamovereenkomst is een Nederlandse variant van een ECI.

Contractuele prikkels zijn op te delen in monetaire prikkels, die bestaan uit betaalmethodes en risicoverdelingen. Uit de literatuur is gebleken, dat het betalen op regie de meest geschikte betaalmethode is voor een ECI project omdat deze projecten een hoge mate van onzekerheid hebben. Het betalen op regie is gebaseerd op de gemaakte kosten tijdens de ontwerpfase en heeft verschillende varianten: Cost plus Award Fee (CPAF), Cost Plus Fixed Fee (CPFF) en Cost Plus incentive Fee (CPIF). Verder kan het risico verdeeld worden door een gezamenlijke risicopot, het opstellen van een Bonus Malus concept of een streefprijs in te stellen.

Kritieke Prestatie Indicatoren (KPI), zijn een toegevoegde gereedschap voor projectevaluatie of kan gebruikt worden als beloningscriteria. De volgende KPI's kunnen tijdens de ontwerpfase van een ECI project van belang zijn: kosten, tijd, aantal ontwerpfouten, risicomanagement, uitvoerbaarheid, onderhoud en innovatie.

Contractuele prikkels bestaan ook uit niet-monetaire prikkels die gericht zijn op contractverlenging of netwerkrelaties. Het theoretisch raamwerk is gebruikt als basis voor de empirische onderzoeksfase.
De empirische onderzoeksfase bestond uit meerdere casusstudies. In de casusstudies zijn er vier Bouwteamprojecten geselecteerd voor een documentenonderzoek en het uitvoeren van interviews. In totaal zijn er dertien interviews uitgevoerd met deelnemers vanuit de opdrachtgever, aannemersorganisatie en derde partij (in dienst van de hoofdaannemer). Er is onderzoek gedaan naar welke contractuele prikkels er ingezet zijn in de vier Bouwteamprojecten. De monetaire prikkels bestaan uit de volgende betaalmethodes:

- Betalen op regie
- Vast bedrag

De risico's van de betaalmethodes werden gemitigeerd met de volgende hulpmiddelen:

- **Taakstellend budget:** een streefwaarde tijdens de Bouwteamfase die gebaseerd is op functietarieven.
- **Plafond bedrag:** een harde plafond dat ingesteld wordt in de aanbestedingsfase.
- **Mijlpalen:** een betalingsregeling die gebaseerd is op de geleverde prestatie van partijen.

Ook zijn de onderstaande niet-monetaire prikkels ingezet in de vier Bouwteamprojecten:

- **Directe of indirecte betrokkenheid:** er is directe communicatie tussen de opdrachtgever en derde partij (in dienst genomen door de hoofdaannemer). Of de hoofdaannemer functioneert als tussenpersoon.
- **Vroege inzet of latere inzet:** de derde partij (in dienst genomen door de hoofdaannemer) is reeds betrokken in de aanbestedingsfase. Of een derde partij wordt in dienst genomen op het moment dat zijn werkzaamheden aan bod komen.

Verder is gebleken dat de Bouwteamdoelstelling, voor wat betreft de ontwerpkosten vaak niet wordt bereikt. Hiervoor zijn twee oorzaken genoemd . Ten eerste blijkt dat de ontwerpende derde partijen de tendens hebben om het ontwerp zo gedetailleerd mogelijk uit te voeren, ook al is dit niet altijd noodzakelijk in dit stadium. Ten tweede worden vanuit de ontwerpende derde partijen extra werknemers ingezet om het ontwerp binnen de planning te beëindigen. Hieruit blijkt dat de projectbeheersing van grotere Bouwteamsamenstellingen ingewikkeld wordt. Op basis hiervan zijn er verscheidene contractuele prikkels voorgesteld die ingezet kunnen worden om de prestatie van derde partijen dusdanig te beïnvloeden, zodat Bouwteamdoelstellingen (met name de ontwerpkosten) worden behaald.

De deelnemers hebben tijdens het interview, de onderstaande suggesties gegeven voor het invoeren van hulpmiddelen:

- **Gezamenlijke risico verdeling:** waarbij de opdrachtgever en hoofdaannemer gezamenlijk de kosten dragen in geval van budgetoverschrijding.
- **Gezamenlijke risicopot:** een gezamenlijke risicopot tussen de opdrachtgever en hoofdaannemer. Het resterende bedrag wordt opgedeeld tussen de partijen.
- **Budgetmarge:** waarbij de werkelijke kosten in de ontwerpfase binnen een bepaalde marge mogen blijven. Indien de kosten boven de budgetmarge oplopen, wordt de hoofdaannemer verantwoordelijk gesteld voor de resterende kosten.
- **Aanmoedigingsvergoeding**: deze vergoeding is gebaseerd op de KPI's die gehanteerd kunnen worden.

Verder hebben de deelnemers de volgende niet-monetaire prikkels voorgesteld:

- **Bouwteampartners:** dit is een combinatie van een directe-en-vroege betrokkenheid van derde partijen waarbij de hoofdaannemer een partnerschap vormt met een ontwerpende partij in de aanbestedingsfase.
- **Derde partijen definiëren het detailleerniveau:** de derde partijen definiëren het detailleerniveau van het ontwerp en de hoofdaannemer geeft goedkeuring na controle.

Ook is er voorgesteld, KPI's breder in te zetten voor projectevaluatie in combinatie met een bonus of voor een wekelijkse projectbeheersing. Hier wordt geadviseerd één persoon verantwoordelijk te stellen voor de projectbeheersing van de projectscope van diens derde partijen, de kosten en de planning. De voorgedragen KPI's zijn: kwaliteit, ontwerptijd, ontwerpkosten, tevredenheid (opdrachtgever en hoofd aannemers), realisatie eisen (risicobeheersing, onderhoud en bouwbaarheid) en de aantal medewerkers.

De meeste monetaire prikkels in contracten tussen de hoofdaannemer en derde partijen zijn overgenomen uit de Bouwteamovereenkomst. Het door-contracteren van prikkels wordt Back-to-Back contracteren genoemd en is aantrekkelijk voor hoofdaannemers, omdat de risico's in de Bouwteamfase doorgezet kunnen worden bij de opdrachtgever. Hierbij wordt geadviseerd de opdrachtgever de verantwoordelijkheid te laten dragen voor het selecteren van de juiste monetaire prikkels. Hierna evalueert de hoofdaannemer welke prikkels door-gecontracteerd kunnen worden naar hun derde partijen.

Met de verkregen contractuele prikkels vanuit de literatuur en de empirische studie is er een conceptueel raamwerk opgesteld die geëvalueerd is door vier experts binnen Witteveen+Bos. Waarna een definitief raamwerk is opgesteld dat bestaat uit drie delen. Deel I van het raamwerk is gericht op de opdrachtgever om de juiste monetaire prikkels te implementeren in de Bouwteamovereenkomst. Deel II is gericht op de hoofdaannemer voor de overname van monetaire prikkels in contracten met hun derde partijen en het inzetten van niet-monetaire prikkels. De functie van deel III is om prikkels te monitoren en wijzigingen te brengen, indien dit nodig is. De inzet van contractuele prikkels zijn samengevat in een raamwerk en zijn weergegeven in Figure 1.

Verder zijn er aanbevelingen aangegeven:
Aanbevelingen voor de praktijk

- **De opdrachtgever**
    - De opdrachtgever moet verantwoordelijk blijven bij het implementeren van monetaire prikkels
    - Het raamwerk kan ook gebruikt worden voor derde partijen die in dienst zijn genomen door de opdrachtgever.
- **Hoofd aannemers**
    - Gebruik de KPI's voor een verbeterde projectbeheersing. Eén persoon vanuit de aannemersorganisatie moet verantwoordelijk zijn voor de wekelijkse projectbeheersing.
    - De projectbeheerder moet ook de project scope van de derde partijen bewaken.
    - Het is aanbevolen om een deel van de verantwoordelijkheid in project beheersing over te dragen aan het ontwerpende derde partij
- **Derde partijen**
    - Gebruik KPI's als richtlijn voor een verbeterde project beheersing

Aanbevelingen voor toekomstig onderzoek

- Onderzoek hoe een andere Bouwteamsamenstelling invloed kan hebben op prestatie. Er wordt verwezen naar een Bouwteamovereenkomst tussen een opdrachtgever, hoofdaannemer en een ingenieursbureau.
- Onderzoek doen hoe strategisch gedrag binnen een Bouwteam verminderd kan worden door veranderkunde. Uit de expert meetings is geconcludeerd dat contractuele prikkels strategisch gedrag kunnen bevorderen in een Bouwteam.
- Onderzoek hoe raamwerkcontracten de presentie van derde partijen kan beïnvloeden in een Bouwteam.

Trefwoorden: Bouwteam, contractuele prikkels, derde partijen, prestatie

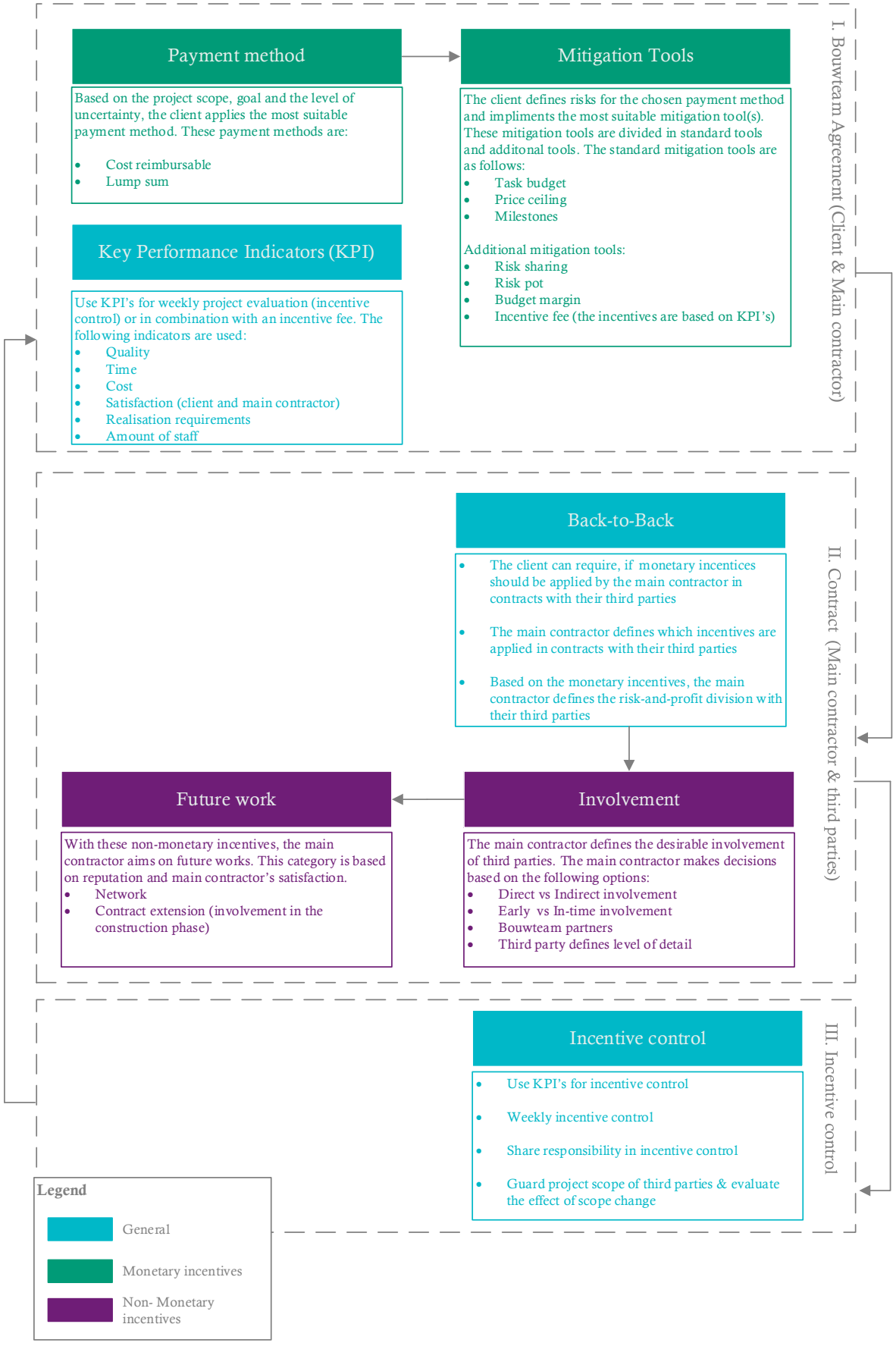

Figure 1 Final framework for contractual incentive between main contractors and their third parties

Terminology & List of Abbreviations

Terminology	Definition
Back-to-Back contracting	A form of contracting when a party assigns rights and obligations from the client to another party. In this study, the main contractor assigns rights and obligations to the third parties to execute a part of his work.
Bilateral agreement	A contractual agreement between two parties
Bouwteam agreement	A temporary collaboration between the client and the main contractor in the design phase of a construction project. The Dutch variant of an Early Contractor Involvement project delivery method.
Contractual incentives	Driving forces or key performance measures used to motivate a party or individual to achieve a service or value
Design phase	The phase within a construction project, in which the design of a construction is made. Also known as the Bouwteam phase.
Design team	A temporary and equal partnership between different representatives in the construction industry. The participants of the team perform tasks and give advice in a coordinated manner.
Early Contractor Involvement (or ECI)	In this Project Delivery Model, the main contractor shares insights from the construction phase. These insights are useful in the design phase of a construction project.
Iron Triangle	Three constraints in which project managers work to define project success. The iron triangle refers to quality, time and costs of a construction project
Project Delivery Method (PDM)	System used by construction firms for organizing, operating, constructing, financing and maintaining a structure
Product performance	Performance of the delivered work
Target Costs	Estimated costs
Task budget	A provisional budget determined by the client in the tender phase to execute different activities in the construction project.
Third parties	All parties (in)directly involved in the Bouwteam agreement other than the client and main contractor. Third parties such as specialized contractors, consultants, architects (or designers), construction engineer, mechanical engineer, electrical engineer, etc.
Traditional contracting	Design-Bid-Build. In this contract form, the main contractor is solely involved during the construction phase.

Abbreviations	Definition
BN2021	Bouwend Nederland 2021
C	Client
CPAF	Cost Plus Award Fee
CPFF	Cost Plus Fixed Fee
CPPF	Cost Plus Percentage Fee
CPIF	Cost Plus Incentive Fee
CPPF	Cost Plus Percentage Fee
CP GMSS	Cost Plus Guaranteed Maximum Shared Savings
DD	Detailed Design
DG2020	Duurzaam Gebouwd 2020
ECI	Early Contractor Involvement
FD	Final Design
KPI	Key Performance Indicators
LP +IF	Lump Sum Plus Incentive Fee
MC	Main contractor
MEAT	Most Economic Advantageous Tender
NEC	New Engineering Contract
OAN	Onderaannemer. Code used during the interviews to indicate the third party. The English code “TP”, is used in the report.
OG	Opdrachtgever. Code used during the interviews to indicate the client. The English code “C”, is used in the report.
ON	Opdrachtnemer. Code used during the interviews to indicate the main contractor. the English code “MC”, is used in the report
PD	Preliminary Design
TNR 2011 or DNR 2011	The New Rules 2011 or De Nieuwe Regeling 2011
TP	Third party
UAC (in Dutch UAV)	Uniform Administrative Conditions or in Dutch Uniforme Administratie Voorwaarden
UAC- IC (In Dutch UAV-GC)	Uniform Administrative Conditions for Integrated Contracts or in Dutch Uniforme Administratie Voorwaarden voor Geintegreerde Contracten
SD	Structural Design
W+B	Witteveen+Bos
VGB1992	VG Bouw 1992

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Chapter 1 Introduction to the research

Nowadays the complexity and size of construction projects continues to grow. Leading to more risks, bigger cash flows and the need for more involvement of specialized professionals in the design phase of construction projects (Nikolić & Cerić, 2022). This ensures that the traditional form of contracting is no longer sufficient. In the traditional form of contracting (design bid build or DBB), the design and construction are separated. Creating the necessity to transition to a contracting form that facilitates the complexity of construction projects. Hence, the Early Contractor Involvement (ECI) becomes more popular in the construction industry.

This chapter first presents the background information on the ECI project delivery method and the Bouwteam agreement in section 1.1. Next, the contractual relations in a Bouwteam is explained in section 1.2. The problem definition of this research is formulated in section 1.3, followed by the research gap presented in section 1.4. The research questions are presented in section 1.5 and a research scope is set up to demarcate the area of research, this is covered in section 1.6. Lastly, the research methodology is presented in section 1.7.

1.1 Early Contractor Involvement (ECI) vs Bouwteam agreement

An ECI is a Project Delivery Method (PDM) with a temporary collaboration between the client, designing parties (architect, consulting engineer, etc.) and parties involved in the construction phase (the contractor, installation engineer, etc.). These parties work on equal footing, to develop a design and detailed project plan (Chao-Duivis et al., 2018). As the name implies, the main contractor is involved at an earlier stage, when compared with the traditional form of contracting (DBB). An elaborate explanation of the ECI project delivery method is given in appendix I.

The ECI project delivery method is imbedded in contractual models originated from the Netherlands, Portugal, New Zealand, United States, Norway, Sweden and the United Kingdom (Rahmani et al., 2013; Scheepbouwer & Humphries, 2011). These contracts differ in the procurement method, selection process and structure of the construction project. This research focuses on the Dutch version of the ECI project delivery method (the Bouwteam agreement).

The Bouwteam agreement was first introduced in the 1950's and was massively used during the housing shortage after the second world war (de Koning & Weyne, 2022). Due to the construction fraud in 2012, the use of Bouwteam agreements was minimalized for a limited period of time. However, for the past decade the popularity of the Bouwteam principle is on the rise, especially in the infrastructural industry (de Koning, 2020). A Bouwteam agreement is a bilateral agreement between the client and main contractor. Both the client and the main contractor can employ third parties to execute parts of the design work. The involvement of these third parties in the Bouwteam is based on their expertise. The Bouwteam agreement creates the possibility for the main contractor to manage his risks, contribute to the design and to manage execution processes in an early stage (de Koning & Weyne, 2022). At the end of the Bouwteam phase, the main contractor is privileged to negotiate as the first and only bidder, to execute the construction phase. If no agreement can be made, other contractors may bid on work in the construction phase (Scheepbouwer & Humphries, 2011).

Figure 2 shows a schematic overview of the Bouwteam composition. The solid lines indicate the contractual relation between the parties. In general, a coordination agreement is signed by the parties in the design phase (Chao et al., 2020). This Bouwteam creates more job opportunity for the main contractor and increases his chance to be awarded for the construction phase (Chao-Duivis, 2012, p. 402; Scheepbouwer & Humphries, 2011).

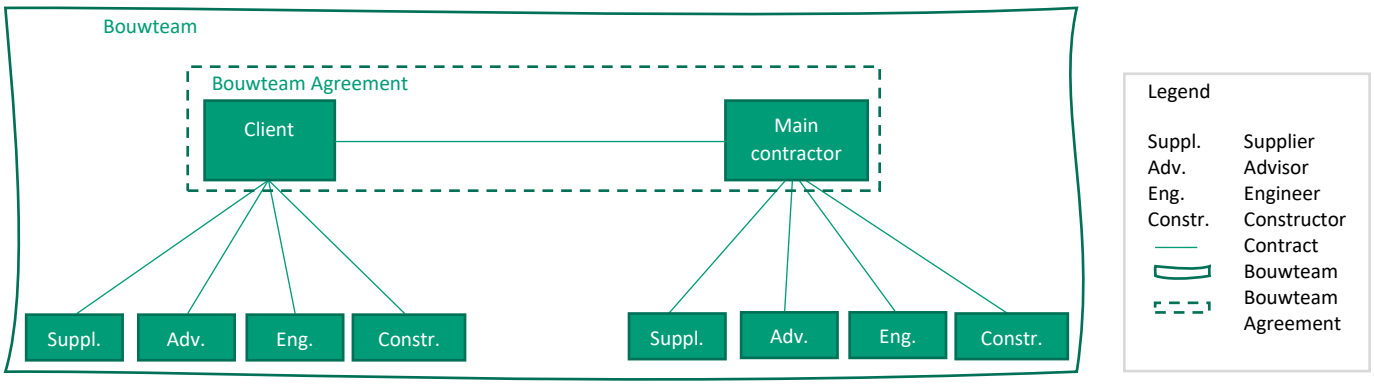


Figure 2 Schematic view of an Bouwteam (Chao et al., 2020)

1.2 Back-to-Back contracting

As it is mentioned in the previous section, both the client and the main contractor can hire third parties to complete parts of their tasks in the Bouwteam. The arrangement between the main contractor and his third parties is called Back-to-Back contracting. In Back-to- Back contracting, a main contractor forms an agreement with a client and outsources parts of the work to his third parties. The main contractor enters a separate agreement with these third parties, and obligations and rights from the initial agreement are passed on (Boogaart & Dröge, 2015). However, the main contractor remains the head responsible for the work delivered by his third parties. In the Back-to-Back agreement, the main contractor can make separate agreements with his third parties which may differ from the initial agreement between the client and main contractor. For instance the client can pay the main contractor on a cost reimbursable basis, whilst the main contractor pays his third parties on a lump sum basis.

Another aspect is that the main contractor pays his third parties after he is paid by the client (paid-when-paid) (Assaad, Elsayegh, Ali, Nabi, et al., 2020). The timeliness of payments can form a general point of friction between the main contractor and third parties. The main contractor does not guarantee when the third party is paid. These decisions are made to protect the main contractor, if they are not paid by the client (Assaad, Elsayegh, Ali, Abdul Nabi, et al., 2020). Other than the friction in payment, different conflicts may occur which affect the performance between the main contractor and third parties. Figure 3, presents the principle idea of Back-to-Back contracting.

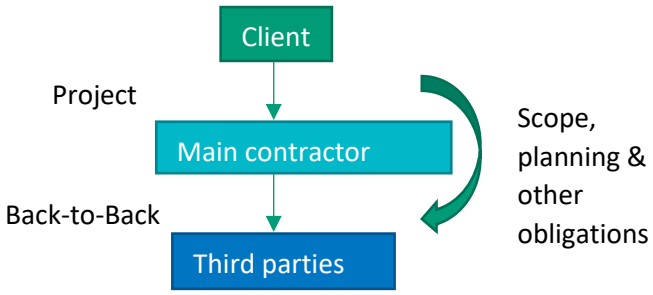


Figure 3 Principle of Back-to-Back contracting (de Leede, n.a.)

1.3 Problem Definition

Nowadays, more design responsibility is shifted towards the main contractor (Grooters, 2018). The work that is delivered by the main contractor and his third parties, has a substantial influence on the Bouwteam goals, this is presented in Figure 4 (Grooters, 2018). This study will focus on how contractual incentives between the main contractor and third parties can be used to influence the performance of these third parties.

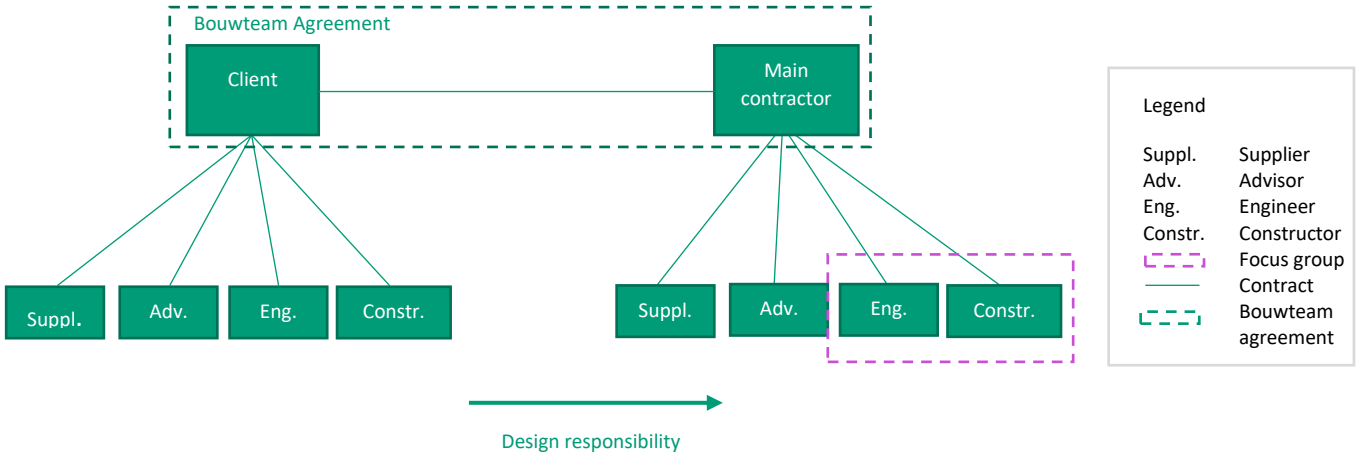


Figure 4 Overview problem definition based on Chao et al. (2020)

1.4 Research Gap

Several studies investigated the collaboration between the client and the contractor in a Bouwteam (de Hoog, 2020; Dhonré, 2021; van de Hoef, 2020). The study of Dhonré (2021) focused on the transition from the design phase to the construction phase. van Riggelen (2019) focused on the relationship between the client, contractor and consultants during the tender phase all through the construction phase. Three other studies compared the Bouwteam collaboration with international integrated contracts (Nader, 2019; Nielen, 2010; Varanasi, 2021). Correa-Galdeano (2022) did his research on risk allocation and control strategies in Bouwteam projects. Lastly, three studies did research on the price formation in Bouwteam projects (Lagemaat, 2015; Uzun, 2022; van der Pas, 2021). Much research has been done in the field of Bouwteam agreements. However, previous studies only covered the following topics; collaboration between client and contractor, price formation, risk allocation and the comparison with other contractual types. This concludes that no research is done how contractual incentives can influence the performance of third parties hired by a main contractor in a Bouwteam. The goal of this study is to create an understanding of how contractual incentives can be implemented in contracts between the main contractor and his third parties, to influence the performance of third parties in such a way that Bouwteam goals are met.

1.5 Research Questions

The following main research question is formulated:

How can contractual incentives in the design phase of Bouwteam projects be employed by main contractors to influence the performance of their third parties in such a way that Bouwteam goals are met?

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

1. Which contractual incentives can be used during the design phase of an ECI project?
2. Which contractual incentives are currently used in practice in the design phase of Bouwteam projects?
3. How can contractual incentives affect the performance of third parties in a Bouwteam?
4. How can the main contractor incorporate contractual incentives in contracts with their third parties?

1.6 Research Scope

This study focuses on contractual incentives which can be applied to influence the performance of third parties in such a way that Bouwteam goals are met. This study solely focuses on the performance of third parties to deliver design products which meet the Bouwteam goals. The target audience of this research is the main contractor and his employed third parties in a Bouwteam. However, the clients view on contractual incentives is also taken into account as a comparison for contractual incentives implemented in Bouwteam agreements and contractual incentives in contracts between the main contractor and his third parties. The third parties employed by the client are out of scope. Furthermore, in practice third parties can outsource the work (originated from the main contractor) to other parties (this creates a contractors chain on the main contractors side), due to time constraints this will not be taken into account. Parties such as interest groups and stakeholders are not included in this research. Lastly, this research focussed on Bouwteam projects with public clients. See Figure 5 for the research scope.

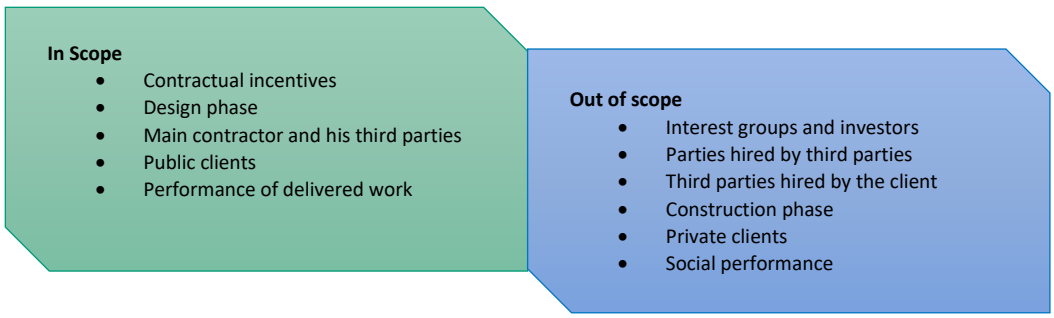


Figure 5 Research Scope

1.7 Research Methodology

This thesis is divided into the following four phases; exploratory study, empirical study and the evaluation& final study. In Chapter 2, a literature study is conducted to provide a theoretical framework on contractual incentives imposed in contracts between the main contractor and his third parties. The literature study first provides information on associated topics such as the definition of a Bouwteam, contractual incentives in ECI projects, the definition of performance and project success. The outcome of this literature study tackles sub question 1; "*Which contractual incentives can be used during the design phase of an ECI project?*". Furthermore, a theoretical framework is constructed and is used as a stepping stone for the empirical study.
The resources used for this literature study mainly consist of academic papers, master theses, legal documents, lecture slides and books. These references are derived from the repository of TU Delft, google scholar, research gate and web of science.

The nature of this research requires a qualitative study, to provide a better understanding of how the contractual incentives can be implemented in contracts between the main contractor and his third parties in a Bouwteam. Due to the performance based nature of this research, a multiple case study is conducted. The case study method provides an understanding on the detailed viewpoint of the client, main contractor and third parties in a Bouwteam (Tellis, 1997). Furthermore, the case study approach is used for explanatory questions (Crowe et al., 2011; Rowley, 2002).

Four Bouwteam projects are used in the multiple case study. The literal replication of four cases is needed to investigate predictions made in the theoretical framework on the contractual incentives in a Bouwteam (Yin, 2009). The case study consists of a document research and interviews. In the document research the case description, used contractual incentives, duration and composition of the Bouwteam are reviewed. After the document research is finalized, interviews are conducted with the client, main contractor and his third parties. The results of the multiple case study provide insight on the following aspects; contractual incentives used in practice, the influence of contractual incentives on performance and the implementation of contractual incentives in contracts between the main contractor and his third parties. The case study method is presented in Chapter 3. The case study results are covered in Chapter 4 of this thesis and sub question 2 is answered.

After the case study is finalised, the data is analysed through a comparison of cases, to investigate the relation between the contractual incentives and the performance of third parties in Bouwteam projects. After the comparison of cases is finalised, sub question 3 is answered and the preliminary framework is constructed. The comparison of cases is presented in Chapter 5. Followed by the framework development, presented in Chapter 6.

In the final phase, the preliminary framework is evaluated by experts who had no contribution to the empirical study. It is required that the experts have experience in fulfilling the role as a third party (specialised in design or engineering). The expert evaluation is discussed in Chapter 6 of the thesis. The final framework will help answering sub question 4. Finally the discussion is presented in Chapter 7 and the conclusion and recommendations for practice and future research are given in Chapter 8.

A schematic review of the methodology is shown in Figure 6.

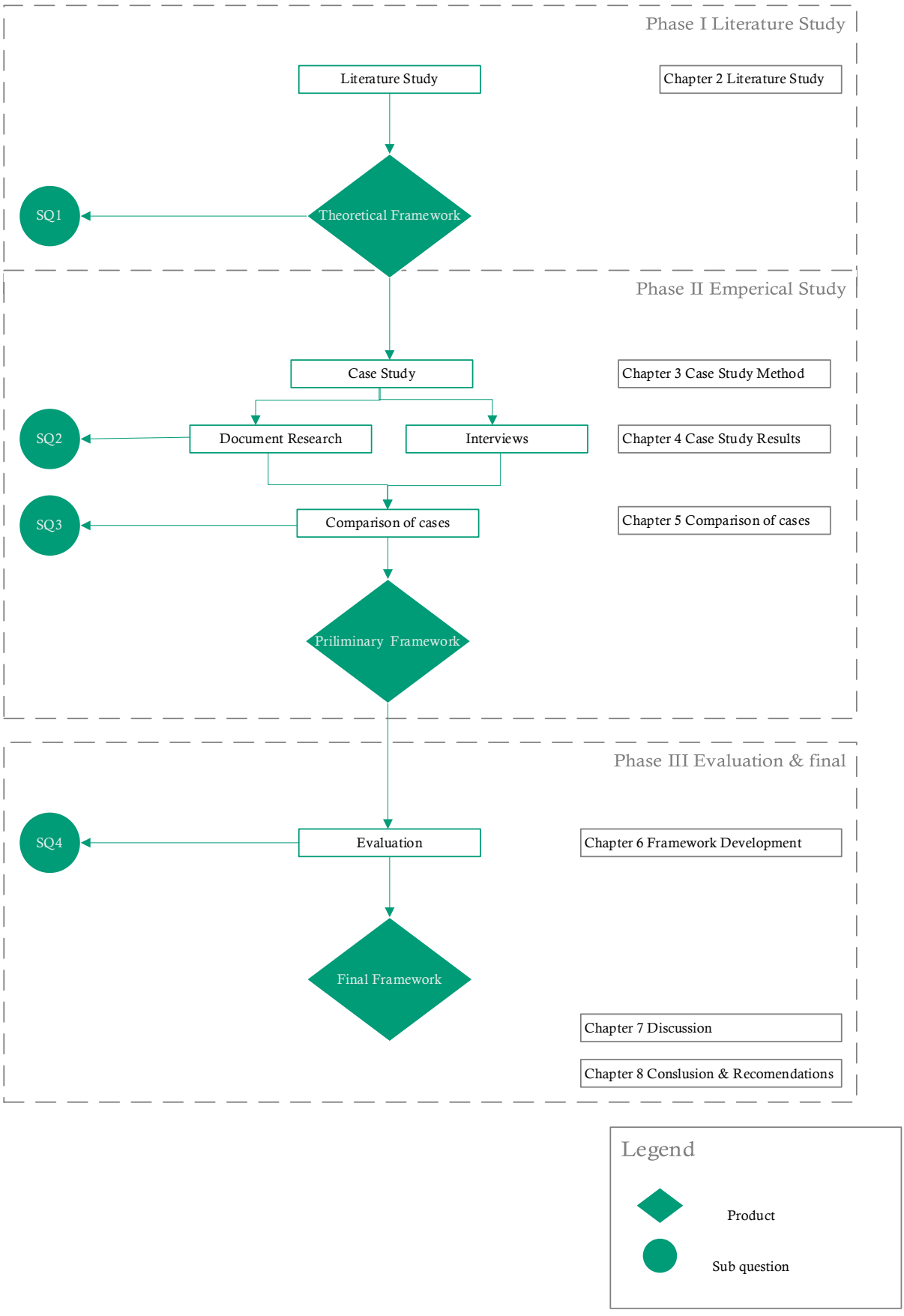
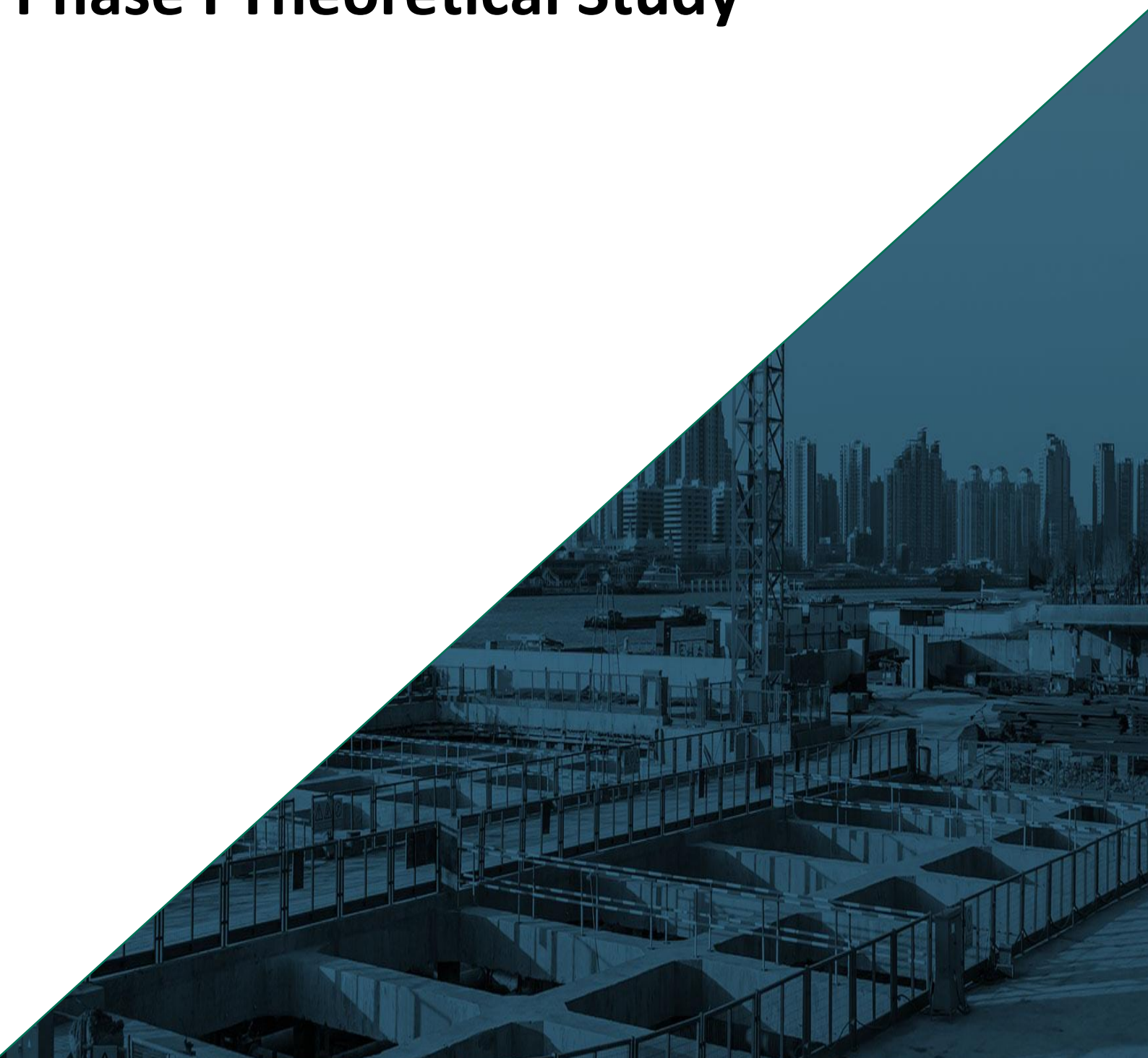


Figure 6 Flowchart research methodology

Phase I Theoretical Study



Chapter 2 Literature Study

This chapter presents the results of the exploratory literature study on the Bouwteam and contractual incentives which can affect the performance of parties in the design phase. This literature study is divided into several sections. First, the definition and general information is given on Bouwteam agreements in section 2.1. Section 2.2 focuses on the contractual incentives which can be applied in the design phase of an ECI project delivery. This chapter explores the contractual incentives implemented by both the client and the main contractor to improve the performance of parties involved in the design phase of an ECI project delivery. These incentives are divided in monetary incentives and non-monetary incentives. In section 2.4 sub question 1 is answered: "*Which contractual incentives can be used during the design phase of an ECI project?"*. Lastly, section 2.4 presents the theoretical framework which will be used as a stepping stone in the empirical study.

2.1 The Bouwteam

This section covers the general aspects of Bouwteam projects. First, the different Bouwteam phases are explained in sub section 2.1.1. The difference between the Bouwteam models (VGB1992, DG2020 and BN2021) are elaborated 2.1.2. The role, expectations and responsibility of the parties involved in a Bouwteam are addressed in sub section 2.1.3. Lastly, the liability and insurance of these parties are covered in sub section 2.1.4.

2.1.1 The phases of a Bouwteam

The Bouwteam consists of four phases; the tender, Bouwteam phase (or design phase), pricing and construction phase. Sewalt (2019) explains the differences between the different phases in the Bouwteam:

1. **Tender phase:** A phase in which, the client conducts a search for suitable partners (including a main contractor).
2. **Bouwteam phase (or design phase):** the start of the Bouwteam agreement. In this phase the client and main contractor start working together. The start of the Bouwteam phase is unique for each Bouwteam project. The Bouwteam phase can start in the following design phases: structured design (SD), preliminary design (PD), final design (FD) or detailed design (DD). This is presented in Figure 7. The expertise of the main contractor in the construction phase, is used to give advice on risk mitigation, constructability of the design, etc.
3. **Pricing phase:** A price determination is made at the end of the design phase. The characteristic of the Bouwteam is that the main contractor becomes the first advantageous bidder to submit a price for the construction phase.
4. **Construction phase:** In this phase the detailed design is finalised and the physical realization of the design takes place. The client and the contractor enter this phase under a different contract. Such as the Uniform Administrative Conditions (UAC) or Uniform Administrative Conditions for Integrated Contracts (UAC-IC). See appendix I for a more elaborate explanation on UAC and UAC-IC contracts.

As mentioned before, this research will solely focus on the Bouwteam phase (or design phase) of a construction project. The four phases of a Bouwteam agreement are presented in Figure 7. The Bouwteam (or design phase) consists of the structural design (SD), preliminary design (PD), final design (FD) and the detailed design (DD). It depends on the agreement, if the main contractor enters the Bouwteam before or after the completion of the SD.

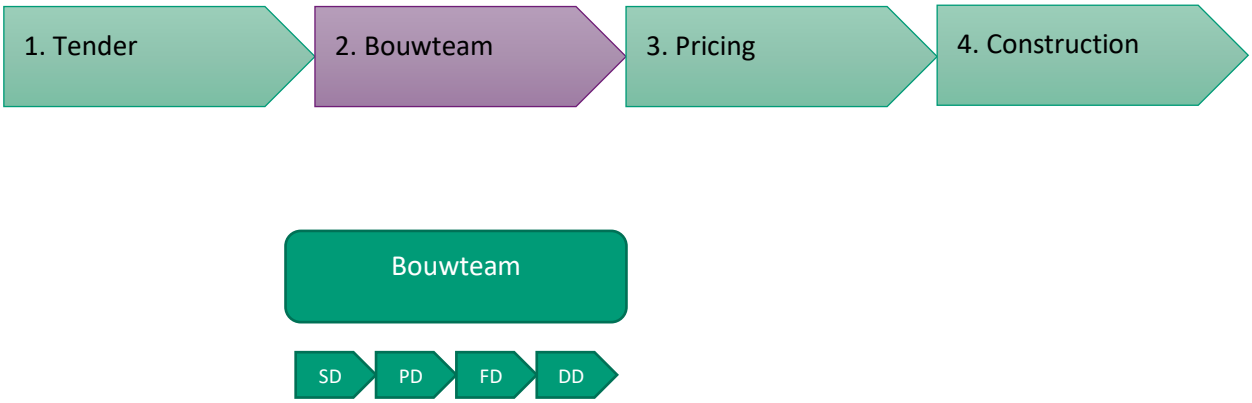


Figure 7 The Bouwteam phases based on (Sewalt, 2019)

2.1.2 Bouwteam models

The Bouwteam consists of a Bouwteam agreement which is a bilateral agreement between the client and main contractor. Prior to the start of a Bouwteam, the client can choose between three Bouwteam models (the VGB1992, DG2020 and BN2021) or adjust one model according to their wishes. The key differences between these three models are elaborated bellow.

In practice both the client and the main contractor can employ third parties to execute parts of the design. The New Rules 2011 (TNR 2011 or in Dutch DNR 2011) is applied. The TNR is an agreement for designers, consultants and engineers.

The VGB1992 model is the oldest Bouwteam model and was set up in 1992 by VG Bouw. In this model, the main contractor is hired based on the UAC contract. The main contractor enters the Bouwteam based on his expertise on the cost indication and execution plans in the construction phase. In this case, it is common that the main contractor enters the Bouwteam when the design is partially completed by the consultant of the client(after SD or PD). Due to the later inclusion of the main contractor, it becomes more difficult to judge if the design is buildable (Laan, 2020; Lindeboom et al., 2021). Furthermore, the VGB1992 model is mainly focused on delivering a complete design (preliminary design, final design and building specification) at the end of the Bouwteam agreement. Due to a rising demand for change in this Bouwteam model, the new models; DG2020 and BN2021 were published as an improvement of the VGB1992 model (Laan, 2020).

The DG2020 model is published by Duurzaam Gebouwd in 2020, a Dutch knowledge platform for the construction and real estate. This model defines the Bouwteam Agreement as a bilateral collaboration in a design phase between the client and the main contractor. The main difference between the DG2020 and the VGB1992 model, is that the DG2020 model can be combined with an UAC or UAC-IC contract for the construction phase. A substantial part of the design responsibility can be shifted towards the main contractor, in case of a DG2020 in combination with a UAC-IC contract. An advantage is, that risks can be mitigated in the design phase. The main contractor can enter the Bouwteam in a much earlier stage of the design (see appendix I for an elaborate explanation on UAC and UAC-IC contracts). Furthermore, the DG2020 model creates the flexibility to choose the degree of detail and completeness of the design (FD or DD) and to include risks management and other construction plans. In this model, the client can be engaged in other bilateral agreements with other parties (such as; a designer, cost specialist, supplier consultants, construction engineers, etc). The main contractor is allowed to hire his own third parties, which are (in) directly involved in the Bouwteam. Lastly, the DG2020 model also protects the property rights and confidentiality of the work delivered by the main contractor in the Bouwteam (Küçük & van Schouwenburg, 2021).

The BN2021 model is published in 2021 by Bouwend Nederland, a Dutch association for construction and infrastructural companies. The BN2021 model also defines the Bouwteam agreement as a bilateral agreement between the client and the main contractor. Furthermore, this model creates the option to work with the UAC or UAC-IC contract. The client and the main contractor can separately hire third parties, which are (in) directly involved in the Bouwteam (Lindeboom et al., 2021). The biggest difference with the DG2020 model is that, the tasks for the different parties are not defined into detail. The aim was to create the freedom within each Bouwteam project, to define their own requirements to the design.

2.1.3 Objectives of the parties

This section covers the role, expectations, responsibility, liability, level of involvement and obligations of the different parties involved in the Bouwteam. The target audience in this section is the client, main contractor and the third parties hired by the main contractor. By defining and setting clear objectives at the beginning of the contractual agreement, the client and subsequently the main contractor are enabled to steer the performance of the work delivered by third parties.

The Client his role in a Bouwteam agreement differs from his traditional role in Design Bid Build (DBB) contracts. The precise role of the client differs for each Bouwteam project. However, it is stated that a Bouwteam succeeds, if the client remains accountable for the final design. The client (or his representative) is the leader of the Bouwteam (Chao-Duivis, 2012; de Koning, 2012; Sewalt, 2019; van Riggelen, 2019). The general role of the client is to coordinate, communicate, regulate and designate tasks properly. The client coordinates Bouwteam meetings and the working process. As communication is key in Bouwteam agreements, the client is required to be transparent with the main contractor and third parties. In a Bouwteam agreement, it is expected that the client will inform the main contractor and third parties (on the clients side) properly about wishes, requirements and the project scope. The client is also expected to give timely feedback on the deliverables submitted by the main contractor and third parties. Furthermore, the client will assign parties to execute certain responsibilities, such as the design, planning, note taking, the safety management and the structural management (Chao et al., 2020; Sewalt, 2019). The previously mentioned obligations for the client are solely towards the main contractor and third parties hired by the client.

The Main Contractor is expected to have sufficient knowledge and experience with the specific construction project to be involved in the Bouwteam (Bellens, 2016). The general tasks of a main contractor in the VGB1992 model, was to advice and give feedback on the design. But nowadays, more design responsibility is transferred towards the main contractor and his third parties. Furthermore, the main contractor is the end responsible for the work delivered by his third parties. Therefore, the main contractor will coordinate and ensure that the suitable third parties are contracted in time. As the end responsible, the main contractor will guard and regulate the project scope and is responsible for project control (Chao et al., 2020; The New Rules 2011, 2013).

The Third Parties are specialized in design, planning and technical requirements and are hired by the client or the main contractor to fill in the specialization gap. However this research solely focuses on the third parties hired by the main contractor. These third parties can be consultants, architectures, construction engineer, structural engineer, mechanical engineer, energy engineer, etc. (Stroe, 2013). The exact role of the third parties is defined by the project goals and their expertise (Sewalt, 2019). In general the third parties are expected to execute the work assigned to them. Their involvement in the Bouwteam depends on their specialization. The third parties which are directly involved in the Bouwteam are expected to be present in the Bouwteam meetings. Furthermore, they should act in the best of their ability to; assess the accuracy and completeness of information documents, deliverables, safety and risk documents. The third parties have the duty to warn for any risks in their own area of specialization (Bellens, 2016; Chao et al., 2020).

2.1.4 Liability & Insurance

In a Bouwteam the following takes place; consultation, advice , integration of partial designs into the main design and alternative proposals (Sewalt, 2019). Because of the joint collaboration and liability of the different parties, the Bouwteam becomes complex. The liability of the parties differ in the Bouwteam models. In this sub section the liability of the different parties are covered. Followed by an elaboration of the insurances within a Bouwteam project.

Liability

The VGB1992 model, addresses the liability of the main contractor in the design phase in article 11 – 13. Article 11 explains that the main contractor should handle the work in the Bouwteam to the best of his ability (VGBouw, 1992). Article 12 describes the leading decision making in liability and states the following: "*Responsibility for advice and designs lies with the person whose specific field in the Bouwteam the advice and designs relate to, provided that the person has accepted and adopted the advice and designs*" (VGBouw, 1992). If the main contractor is liable for defects in the design and advice, this will be covered by a fixed sum as explained in article 16, clause 4 of the RVOI 1987. The VGB1992 model does not elaborate on the liability of the client and any of the third parties.

The DG2020 model addresses the liability of the different parties in article 11, clause 1 through 6 (Chao et al., 2020). The main contractor is not liable for the following statements (discussed in clause 1, 3, 4, 5 and 6):

- Claims from third parties hired by the client
- Suggestions given on work outside their expertise, as long as these suggestions are not taken over by the third parties hired by the main contractor
- Decisions made by the Bouwteam

Furthermore, the DG2020 model works with TNR2011, as a contractual agreement with their third parties. TNR2011 is a standard legal document with regulations and agreements for architects, construction engineers and consultants (different expertise of third parties). The liability of the consultant is explained in article 13 through 15 (The New Rules 2011, 2013). The consultant is liable towards the client if there is culpable fault on his behalf or his third parties. Hereby, the client has to put a warning into writing and give the consultant sufficient time to rectify his faults. The consultant is held liable if he fails to rectify the warning given by the client. Furthermore, the TNR 2011 sets several limitations for the liability towards the consultant. First, the liability is limited to direct damage, for instance if time delay occurs due to design errors. The additional costs are appointed to the consultant, but their accountability has a ceiling for maximum compensation of damage (Chao-Duivis et al., 2018). This maximum compensation is limited to one or three times the consultancy costs, with a maximum of € 1.000.000- € 2.500.000 (The New Rules 2011, 2013).

The BN2021 model shares the same regulations concerning the liability written in article 12 of the VGB1992 model (VGBouw, 1992). However, this model adds the duty to warn each party in the Bouwteam. The model further explains that the main contractor is responsible for the third parties hired by him. This model also works with the TNR 2021 concerning the liability of third parties (BouwendNederland, 2021, p. 6).

Insurance

There is no tailored made insurance for the parties involved in a Bouwteam project. However, the Bouwteam works with profession indemnities insurance which covers the whole lifecycle of a construction project (Bellens, 2016). The profession indemnity insurance is required for architects/designers in a Bouwteam. This insurance covers up until € 500.000 for material and immaterial damage, the coverage for design errors is maximum € 1.000.000. The main contractor and other consultants are not required to take the profession indemnities insurance, but are highly recommended to do so. For the main contractor and third parties, the professional indemnities solely covers claims outside of their contracts. For example this insurance covers damage done by the main contractor to a party to whom he has no contractual relation with but is affected by his defect.

Bellens (2016) further explains that there are two types of policies for the designers/ architects in a Bouwteam; the subscription and police recruitment. Depending on the project scope and the type of client, the designer can choose which policy to join. The abonnement policy is an individual policy, which only covers the work of the policy taker. In this case, all the designers in the Bouwteam will join a separate abonnement policy. The insurance coverage can vary throughout the duration of the project. For instance if there is overdue in policy payment. Because, team members solely have insight on their own policy and have no insight on the policy coverage of other team members, this can lead to high risks during claims in the design phase. The designer has another option to join a polis werf insurance. This insurance covers the whole design team. In this case, the main designer (if there are more designers in the Bouwteam one designer will be appointed as main designer) joins the insurance with other designers. The main designer is the only policy taker and have insight on the insurance coverage, the remaining designers have no insight to this policy (Bellens, 2016).

2.2 Contractual Incentive

This section covers the contractual incentives which can be implemented by both the client and the main contractor in the design phase of an ECI project delivery. Stukhart (1984) states the following: *"Incentives are used in construction contracting to reduce overall contract cost, to control time and to increase support of specific performance goals such as productivity, quality, safety, technological progress, innovation and management".* The contractual incentives can be divided into monetary incentives and non-monetary incentives. The monetary incentives are addressed in sub section 2.2.1 and the non- monetary incentives are elaborated in sub section 2.2.2.

2.2.1 Monetary Incentives

The majority of contractual incentives taken during a construction project are based on the financial aspects, referring to rewards in the form of money (Saka et al., 2021). Money is a powerful tool to motivate individuals to improve their performance. This sub section will elaborate more on the incentives in payment methods and risk sharing.

Payment Methods

There are several payment methods in the construction industry, which can be divided into two categories. The lump sum (or fixed price) and the cost reimbursable payment method (or Cost Plus). The ECI project delivery does not define a specific payment method to be used. Therefore, several methods are listed below (Bakker et al., 2014; Leijten, 2020).

Lump Sum (or Fixed Price) is a single fixed payment, and is used when the scope of the project is complete and the degree of uncertainties and risks are low. The client is required to specify the project scope, time schedule, the design and other specification. A schematic representation is given in appendix III, Figure 17a. A great risk is pushed towards the contractors, as they become responsible for cost underruns and cost overruns. Cost underrun occur when the total project costs are lower than initially planned. Cost overrun occur when the project costs are higher than initially planned, in this case additional costs are covered by the main contractor. This payment method is generally used during the construction phase (Bakker et al., 2014; Leijten, 2020). Due to the high uncertainties during the design phase of an ECI project delivery, this payment method will not be considered as a potential contractual incentive.

Lump Sum Plus Incentive Fee (or LS+ Incentive fee) is a variant of the Lump Sum payment method. The single fixed payment is reimbursed with an incentive for higher performance and for spending less money. A price ceiling is set for the construction project, if the actual costs exceeds the price ceiling, the contractor is held responsible for the additional costs (Thronæs, 2018, p. 26). See appendix III Figure 17b, for a schematic representation of the Lump Sum Plus Incentive Fee (Leijten, 2020).

Cost Reimbursable (or Cost Plus), is a payment method, where the main contractor is paid for all his expenses for his services. The price of the project is determined at the end of the project or at a final date. The cost reimbursement method is mostly used in projects with a high level of complexity, high level of uncertainty and where little is known about the project scope. This payment method can work disadvantageous for the client when parties have different interests. The reimbursed parties can purposely create additional work, to create a greater revenue. A second disadvantage is the division of actual costs and profits, this requires specific financial competencies (Bakker et al., 2014). Different variants are considered in the cost reimbursable payment method to incentivize the performance of the paid party, these methods are; Cost Plus Fixed Fee, Cost Plus Award Fee, Cost Plus Incentive Fee and Guaranteed Maximum Shared Savings.

Cost Plus Fixed Fee (or CPFF), is a reimbursable payment method. The fee does not vary with the actual costs, but may be adjusted if the project scope changes (Leijten, 2020). This reimbursable payment method is implemented when project scope is partially defined and the degree of uncertainty and risks are moderate. Meaning that if the main contractor spends more service hours on a project, the profit decreases. The profit percentage is determined by dividing the fee with the costs for total service hours. This demotivates the contractor to create additional work (Bakker et al., 2014). The schematic representation is given in appendix III Figure 17c .Formula (1) and (2) indicate how the contract value is calculated. The fixed percentage is negotiated in the tender phase.

$$Contract\ Value = Actual\ costs + Fixed\ Fee \quad (1)$$

$$Fixed\ Fee = \% * Actual\ costs \quad (2)$$

Cost Plus Award Fee (CPAF), a payment method, based on the actual costs. The fee is based on the client's satisfaction (Stukhart, 1984). Previous study showed that this concept can be implemented by defining the award criteria in the tender phase of the project. The award criteria should include the following; compliance of the budget, planning, safety and client satisfaction. (Ndihokubwayo et al., 2014; Thronæs, 2018, p. 30).

Cost Plus Incentive Fee (CPIF) is a cost reimbursable payment method where the fee is based on certain the performance (Kwawu & Laryea, 1980). There can be difficulties in defining criteria and performance target on which the contractor receives his fees. Therefore, these target goals can be based on Key Performance Indicators (KPI). More information on these KPI's are given in sub section 2.2.3. Next, to the incentive fee, the main contractor receives a percentage of the savings, if the actual costs are lower than the estimated costs (Bakker et al., 2014; Leijten, 2020; Ndihokubwayo et al., 2014). The lower the actual costs, the higher the fees. A visual representation of the CPIF is given in appendix III Figure 17d. Formula (3) and (4) indicate how the contract value is calculated. The percentage is negotiated in the tender phase of the project.

$$Contract\ Value = Actual\ costs + incentive\ fee + \% * Savings \quad (3)$$

$$Savings = Estimated\ costs - Actual\ costs \quad (4)$$

Guaranteed Maximum Shared Savings (GMSS) is a combination of Lump Sum and Cost Plus Fixed Fee with a ceiling cost. The client compensates the contractor for their direct costs and pays a fixed amount for overhead costs and fees up to a certain amount (Leijten, 2020). The payment incentivize the quality performance and is based on final outcomes, such as achieving certain expected standards. In such an payment method, the contractor focuses on the long-term needs of the end user (Meng & Gallagher, 2012). A schematic representation is given in appendix III Figure 17e.

As it is already stated, each payment method can form a risk for the contractor or the client. In Lump Sum payment method, the risk shifts towards the contracting party as cost overruns are covered by the contractor. Whilst, in cost reimbursable payment methods, the risks are shifted towards the client. The nature of cost reimbursable payment method is that the contractor is paid for expenses made, in such a case it is possible that the contractor purposely seeks for additional work to increase their revenue. Resulting that the work is done inefficient. Figure 8, shows how the risks of payment methods are shifted towards the client or contractor.

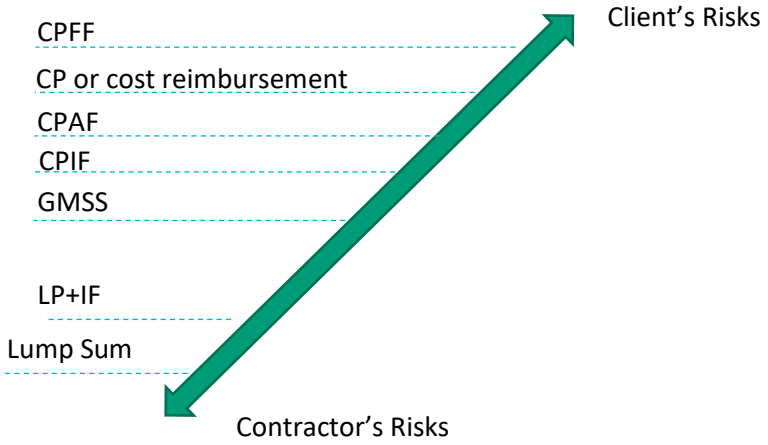


Figure 8 Payment method and risks based on (David King, 2015, p. 10)

Risk Sharing

Risk management is another powerful factor which affects the performance of parties in a construction project. The research of Rose and Manley (2010), appoints risk adverse behaviour as a common problem. They used a case study to substantiate this point of view. In this specific case, the contractor was unwilling to strive for higher performance as it was uncertain that they would reach their goal and receive a reward. The research further explains that better performance and a reduction in risk premium is reached when a risk division of (un) foreseen risks is made in the initial (design) phase of a project. There are various contractual incentives which can be taken to mitigate risks during the design phase of a construction project. In the New Engineering Contract (NEC) and Alliance contract, the gain-and-pain sharing mechanism, is used as a key driver to align risks between different parties (Hughes et al., 2007). This mechanism can be used as a possible solution for influencing the performance. Three concepts are shared in the master thesis of Ooms (2021), which can be used as potential contractual incentives. These concepts within the gain-and-pain mechanism are; the Bonus- Malus, Risk Pot and Target Pricing concepts.

In a Bonus Malus concept, common goals are established by a bonus or malus for every team member of the design team. The client creates a Bonus Malus scheme in the initial phase of a project, with clear indicators to measure the performance of the contractor. The goal of the Bonus Malus concept, is to shift the goal of the contractor to increase the probability for better performance (Schol, 2008). "Good" performance will be rewarded with a bonus. The decrease of performance is mitigated with a malus (or sanctions). The contractor receives a penalty if they failed to meet the contract requirements (Hughes et al., 2007). However, Girth (2017) states that the penalties and sanctions are limited to the liability of the contracting party. Figure 9 gives a visual representation of the Bonus-Malus scheme. If the performance of the contractor meets the requirements of the client, the contractor receives a bonus. In contrary, if the performance of the contractor is not sufficient according to the client, the contractor will not receive a bonus.

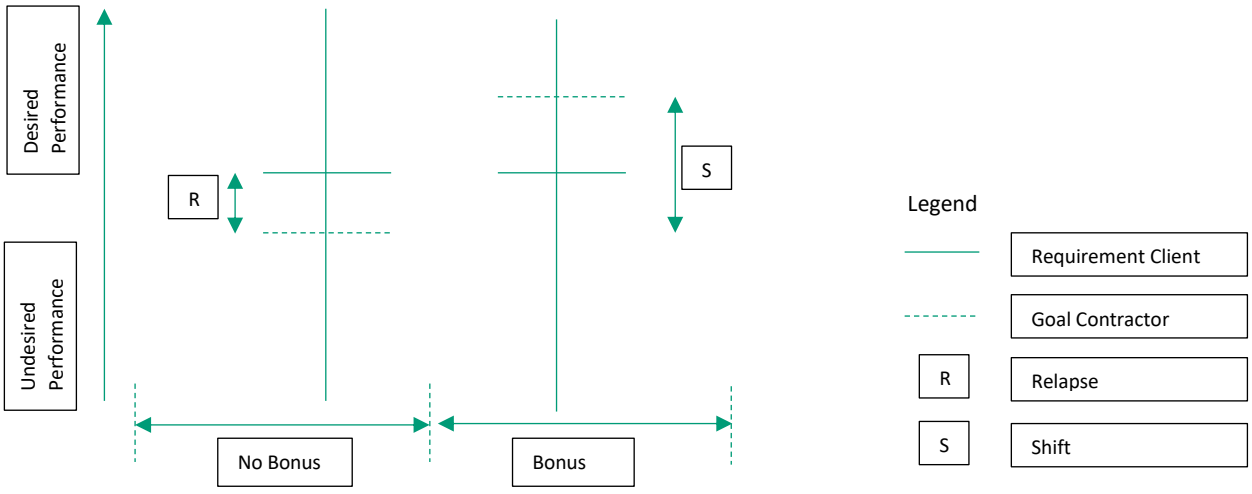


Figure 9 Bonus Malus Scheme based on (Schol, 2008)

The Risk Pot entails that the costs for risks are jointly managed by different parties. These parties decide beforehand which risks are shared and which are the responsibility of the individual party. The additional costs for risk assessment is paid from a joint risk pot. If the risk pot is empty, the client and the contractor will pay for the additional costs. The parties will perform to manage and mitigate their risks properly, because the remaining money of such a risk pot is divided between the parties (Ooms, 2021).

Target Pricing consists of total project costs (or target costs), which are estimated in the tender phase of a construction project. These costs include the costs made in the design and construction phase. Including costs such as land acquisition, reimbursement of third parties and consultancy fees (Molenaar et al., 2007). The target pricing concept is a combination between a lump sum and cost reimbursable payment method. The contractor invoice their expenses based on an "open book" method (Ooms, 2021). If the total expenses of the project exceeds the target costs, both the client and the contractor will cover the additional costs. This also applies for cost underruns, in this case the remaining finances are shared. The risk sharing ratio between the client and main contractor can differ. For example the risk sharing costs can be 50-50, 60-40, etc. A visual representation of the target costs is given in appendix III Figure 17f.

2.2.2 Non- Monetary Incentives

Non- monetary incentives do not involve direct cash flows to influence the performance of parties in the design phase. The non-monetary incentives are mainly focused on promoting future work opportunities. Rose and Manley (2010), state that future work occurs when the client is satisfied with the performance of the contractor. The research further explains that the contractor is motivated to achieve high performance, as it is their desire to maintain or improve their reputation in the competitive market (Rose & Manley, 2010). This research covers three non-monetary incentives, which are; early involvement, contract extension and network.

Early involvement is an incentive on what the ECI project delivery method is based on. As previously mentioned, the contractor is involved in the design phase of the construction project. The main contractor is able to contribute to the design, by giving advice on risk management, cost indication and time schedule. This early involvement is advantageous for the main contractor as, risks are mitigated from an early stage. Furthermore, the early involvement creates a level of responsibility.

Contract Extension can be used to motivate parties within the design phase of a construction project. In the case of an ECI project this is incentivized by giving the main contractor the privilege to be the first and only party to negotiate on a price for the construction phase. This contractual extension can also be taken for third parties.

Other than the incentive to provide work in the construction phase, one can also decide to apply Framework contracting in the ECI project delivery. A framework contract is an arrangement between one or more parties, these parties enter in several contracts (a bundle of work) during the period in which the framework contract applies (Hughes et al., 2007; Molenaar et al., 2007; Tennant & Fernie, 2010). In the case of a Bouwteam agreement, the client sets up a bundle of work and combines it with one or several Bouwteam projects. An example of such a Bouwteam in combination with framework contracting, is the renovation of pumping stations and weirs in the area of Assen, Deventer, Kampen and Hoogeveen. In this project, the client decided to set up several Bouwteam projects within a framework contract of four years, approximately four contractors are involved (WDOdelta, 2022). If the performance of the main contractor satisfies the requirements of the client, the contractor is granted another project within this framework contract. However, the framework contracts are only feasible in repetitive work. In this research Bouwteam projects in combination with framework agreements are excluded. The goal of this study is to set up a framework which can be applied for the general Bouwteam project.

Network entails, that a client or main contractor works with a limited group of third parties to realize works. The client or main contractor can maintain a report on the performance of the parties involved and use this for future tender selection processes (Rose & Manley, 2010). Networking can incentivize the performance of parties, as they wish to have a "good" reputation in the competitive market. Networking is also advantageous for the client as this reduces transactional costs (selection, bargaining and monitoring) (Klok, 2020, p. 4). However, there is a tender obligation for public clients in the Netherlands, the public client is required to use a public tender for construction works that are higher than the European threshold amount (Pianoo, n.d.-a). The European threshold amount for public works is € 5.382.000,- (Pianoo, n.d.-b).

2.2.3 Additional tools

Key Performance Indicators (KPI), are quantifiable measurements in which the performance can be compared. In this research scope, KPI's can be used as a reward criteria in the design phase. The KPI can be used as an additional incentive for payment methods (cost reimbursable payment method) and for risk sharing concepts (the target pricing and Bonus Malus concept). This scoring system is used by the client to provide transparency and avoid favouritism. Several indicators are selected from previous studies (Chan, 2012; Haponava & Al-Jibouri, 2009; Swan, 2004). The following indicators are suitable for the design phase of an ECI project:

- Cost management
- Time management
- Quality (Number of defects in the design)
- Satisfaction (client, main contractor)
- Risk management
- Constructability
- Maintainability
- Innovation

In Appendix IV, Table 7 and Table 8, two tables of KPI's are included from previous studies. Furthermore, the research of Swan (2004) advised to limit the amount of indicators which apply to a specific project, they suggested to use 8-12 indicators. According to Swan (2004), the application of more indicators can create a complex system.

2.3 Performance

Performance is the action or behaviour of an individual or party in the best of their ability to contribute to project success. The study of Shenhar et al. (2001) explains that the project success can be divided into short-term results and long-term results. In terms of the different phases in a construction project, the short-term results are associated with the outcomes of the design phase. The long-term results are associated with the outcomes of the construction phase, maintenance etc. Previous studies concluded that "good" performance can be assessed by the following project successes: the iron triangle (quality, cost and time) and stakeholder satisfaction (Molaei et al., 2021; Rose & Manley, 2010; Shenhar et al., 2001; Yan et al., 2019). The iron triangle is the most common used criteria, in which the project success is measured and is used to asses project performance (Pollack et al., 2018). According to Yan et al. (2019), stakeholders satisfaction refers to the satisfaction of the client, design team, suppliers and the improved relationship between parties.

This research solely evaluates the performance in the design phase of a construction project. Therefore, quality, time, costs and client/ main contractor's satisfaction, are considered during this research.

2.4 Conclusion

The references used in the literature study are presented in Table 9 of appendix V. Several contractual incentives can be taken into account to affect the performance of third parties in the design phase of an ECI project. These contractual incentives are divided into monetary and non- monetary incentives. Monetary incentives are financial tools which are induced into contracts to encourage the performance of third parties. The monetary incentives are mainly focused on the payment method and the risk sharing concepts. The following payment methods are suitable for an ECI project: Cost Plus Fixed Fee (CPFF), Cost Plus Award Fee (CPAF), Cost Plus Incentive Fee (CPIF). Due to the high uncertainties in ECI project delivery methods, it is assumed that the lump sum payment method is less suitable.

The risk division has a significant impact on the performance of different parties (Stukhart, 1984). Therefore, several concepts of the gain-and-pain mechanism from the NEC and alliance contracts are introduced as potential contractual incentives to mitigate risks. The following concepts of the gain and pain mechanism are used: Bonus Malus, risk pot and the target pricing.

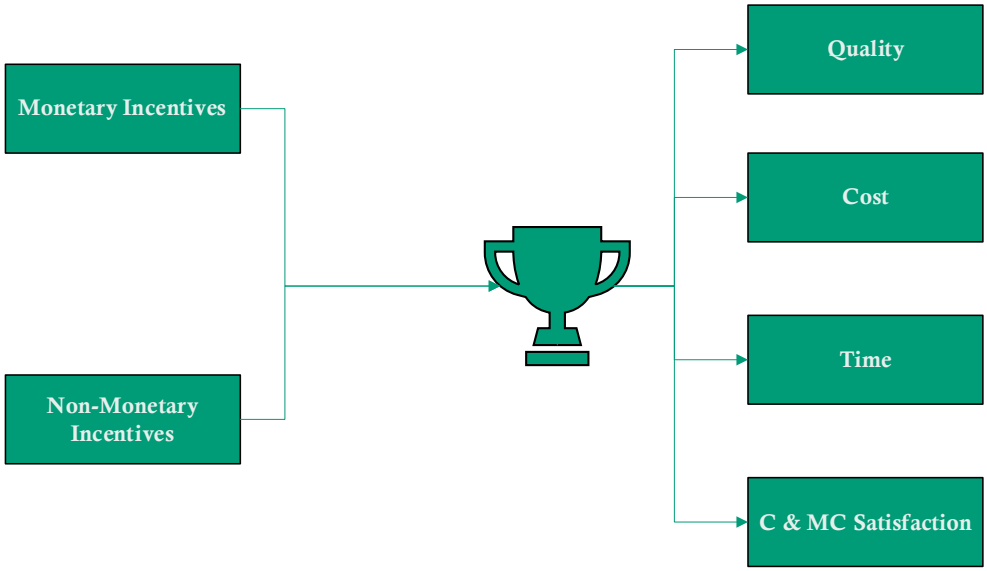
Non- monetary incentives are non- financial tools which can be applied to encourage the performance of third parties in the design phase of an ECI project delivery method. These incentives are based on the desire of third parties to maintain or improve their reputation in the competitive market. These incentives can take form by offering future work, such as, contract extension and network. In a contract extension, the third party is offered additional work for other phases of the construction project. In a network relation, the main contractor works with a limited number of parties in future construction projects. This research focusses on public clients, who are obliqued to use tender requirements for construction projects above the European threshold amount. Therefore, network relation is only applied between the main contractor and his third parties.

KPI's can be implemented as an additional tool for the cost reimbursable (or Cost Plus) payment methods, the Bonus Malus concept or for an overall project evaluation. This form of criteria prevents favouritism and provides transparency between parties. The following indicators are presented for the design phase of an ECI project: cost management, time management, quality, client and main contractor's satisfaction, risk management, constructability, maintainability and innovation. Even though many indicators can be used to monitor the performance of third parties, Swan (2004) advises to use a maximum of 8- 12 indicators. The application of more indicators can become complex to manage.

A theoretical framework is set up, with the contractual incentives which can be implemented in the design phase of a ECI project. This theoretical framework is presented in Figure 10. The framework illustrates that both the monetary and non-monetary incentives can influence the performance of third parties in an ECI project. This framework is also focused on the contractual incentives which can be implemented by the main contractor towards his third parties. This framework is used as a stepping stone for the empirical study.

There is no academic support on how the contractual incentives should be applied in contracts between the main contractor and his third parties. The contractual incentives for third parties will be evaluated in the empirical study.

Influence Contractual incentives on the performance of third parties



Contractual incentives between the main contractor and his third parties

Monetary Incentives

Payment method

- Cost reimbursable
- Cost Plus Fixed Fee (CPFF)
- Cost Plus Incentive Fee (CPIF)
- Cost Plus Award Fee (CPAF)

Risk sharing

- Risk pot
- Bonus Malus
- Target price

Additional tool (KPI)

- Cost management
- Time management
- Quality
- Client and main contractor's satisfaction
- Risk management
- Constructability
- Maintainability
- Innovation

Non- monetary Incentives

Future work

- Contract extension
- Network

Figure 10 Theoretical Framework

Phase II Empirical Study

Chapter 3 Case study method

This chapter describes the case study method used. According to Yin (1994), case study designs can be divided into four categories with respect to its nature; the single case holistic design, single case embedded design, multiple case holistic design and multiple case embedded design (Yin, 1994, p. 40). Due to the scope of this research, a multiple embedded case design is used. Four Bouwteam projects were selected for a document review and to conduct interviews. In each Bouwteam case, the client, main contractor and third parties across different companies were interviewed. This is done to compare the different perspectives of contractual incentives and its influence on performance. The Bouwteam projects are selected based on the case study selection criteria presented in section 3.1. The final case selection is given in section 3.2. Section 3.3 gives an overview of the retrieved documents. The interview set up is given in section 3.4. Finally, an explanation of the data analysis is presented in section 3.5.

3.1 Case study selection criteria

The selection of Bouwteam projects for the case study is based on the following criteria:

1. Bouwteam: Each case is a Bouwteam project between the client and the main contractor.
2. Design responsibility: The design responsibility of the construction project is shifted towards the main contractor. It is required that the main contractor is at least responsible for the final design.
3. Standard agreement for third parties: The main contractor uses the TNR 2011 as a standard agreement with third parties. Note: both the DG2020 and BN2021 models use the TNR 2011.
4. Bouwteam status: The research is focused on the performance of the design team, therefore it is required that design phase is recently completed (maximum 3 years) or is in the final stages.
5. Composition: The Bouwteam consists of the client, main contractor and at least one third party hired by the main contractor. Both the main contractor and the third party are willing to participate in the interviews. The client is asked to participate in the interviews, to compare their view on contractual incentives with the view of the main contractor.
6. Documentation: The cases are selected based on data availability. The selected Bouwteam project should include documents of; the Bouwteam agreement, an evaluation report and preferably the contracts between the main contractor and their third parties.

3.2 Final case selection

Based on the selection criteria, four Bouwteam cases are selected. Each case consists of a Bouwteam agreement (that meet the requirements of the TNR2011) between the client and a main contractor. The design responsibilities in the Bouwteam cases are shifted towards the main contractor and his third parties. The main contractor is involved for at least the final design. Furthermore, each selected Bouwteam project consists of a client, main contractor and at least one third party (from the main contractors side), which was involved in the Bouwteam phase. It was also important that the design phase of the selected cases were completed or in their final stage. Finally, the Bouwteam projects are selected on the available Bouwteam agreements. The contracts between the main contractor and their third parties were kept private, these parties deemed it undesirable to share these documents. Furthermore, two Bouwteam projects did not complete their evaluation round, therefore, these evaluation reports were not granted. The criteria check is given in Table 1.

Table 1 Criteria check for the Bouwteam projects

Case nr.	Bouwteam	TNR2011	Design responsibility MC	Composition	Status	Documentation
Case I	✓	✓	✓	✓	✓	✓
Case II	✓	✓	✓	✓	✓	✓
Case III	✓	✓	✓	✓	✓	✓
Case IV	✓	✓	✓	✓	✓	✓

3.2.1 Case description

The selected Bouwteam projects are in the infrastructure sector, varying from a construction project of a bridge to a water sewage treatment plant. An overview of these Bouwteam projects is given in Table 2.

Table 2 Selected Bouwteam projects

Bouwteam projects	Contract construction phase	Bouwteam activities	Category	Margin Bouwteam scope (million)	Duration Bouwteam phase (years)
Case I	UAC-IC	PD, FD and DD	Renovation bridge	€1,0- €1,5	Jan 2021-dec 2021
Case II	UAC-IC	PD and FD	Renovation water works	€1,5- €2,0	unknown
Case III	UAC-IC	FD	Renovation water sewage plant	€1,5- €2,0	Nov 2021- Dec 2022
Case IV	RAW (UAC)	FD and DD (including RAW specifications)	Expansion ferry and translocate bridge	€ 0,5- € 1,0	Sept 2019- Aug 2020

Case I Renovation bridge

This Bouwteam project consists of two bridge parts. The first part of the bridge will be replaced and the second part will undergo major maintenance. The second part of the bridge will be also be expanded, to create more space for pedestrians and cyclists. Currently, a bicycle tunnel is located beneath the bridge. This pedestrian tunnel will be renovated and a bicycle underpass will be created. The future bicycle traffic will cross on different levels. The main goals are to design the bridge in such a way that the bridge becomes sustainable. The estimated total costs for the construction project are €22,- million, were between €1,0 -€1,5 million was reserved for the Bouwteam phase.

Case II Renovation water works

This Bouwteam project is a part of an extended programme, in which, the water authority, province and the municipality are planning to execute maintenance and renovation for the waterworks. This particular Bouwteam project is tendered by the water authority to do the following work:

- Demolish the existing pumping station and build a new pumping station
- Build facilities at the shore
- Renovate the existing sluice

The water authority started with the design and hired a designer in the SD and PD phase. Next, the client outsourced to job to the main contractor to test the PD and FD on constructability. The total costs for this construction project are estimated at € 27,5 million. The task budget for the Bouwteam phase is estimated between €1,5- €2,0 million. The project goals are to improve the economy, livelihood and ecology of the location. After the completion of the Bouwteam phase, the client decided to outsource the construction phase with an UAC-IC contract.

Case III Renovation water sewage plant

During the purification process of sewage, a residue of silt is left. With this silt, natural gas is made to generate electricity or to create fertilizer for agriculture. Due to safety issues, a sewage plant in the Netherlands was closed in 2019. The water authority decided to renovate this sewage plant. Next, to the renovation process, the new sewage plant will also produce green gas as a sustainable solution. In 2020, the water authority started a Bouwteam agreement with one main contractor. This project will cost approximately €36,5 million and is a combination of a Bouwteam+ UAC-IC contract. The task budget for the Bouwteam phase is estimated between €1,5- €2,0 million.

Case IV Expansion ferry

The municipality of a busy city, estimated that the traffic in 2030 will increase between 80.000- 100.000 travellers a day. In order to accommodate this amount of travellers, there will be an expansion of the current ferry and the bridge for pedestrians and cyclists. This Bouwteam project is tendered by the municipality to execute the following activities:

- Translocate the sailing route of the ferry
- Expansion of the current quay
- Translocate the bridge for pedestrians and cyclists
- Maintenance of a monumental structure

The three main goals of the expansion of the ferry is to discharge current traffic streams and to decrease the travelling time of traffic. The structural and preliminary design is done by the client, after which the final design and detailed design outsourced to a main contractor. The main contractor is selected based on his competencies in: execution, construction planning, construction phasing, risk management etc. The main contractor is paid with a lump sum payment method in combination with milestones. The estimated costs for the Bouwteam phase were between € 0,5- € 1,0 million.

3.3 Data gathering

The case study consists of a document review and interviews. The case study starts with a document review to investigate the contractual incentives used in the Bouwteam projects and the contracts between the main contractor and third parties. The following documents were reviewed:

- Bouwteam agreement (with product requirements)
- Contract between the main contractor and his third party
- Evaluation report

Table 3 presents the available documents, which were available per case and which are reviewed in this study.

Table 3 Available documents

Case nr.	Bouwteam agreement	Contract between MC and TP	Evaluation report
Case I	✓	X	✓
Case II	✓	✓	X
Case III	✓	X	X
Case IV	✓	X	✓

3.4 Interview set up

The goal of the interview is to create a detailed understanding on contractual incentives in Bouwteam projects and how these incentives affect the performance of third parties. The attitude, opinion and thoughts of different interviewees are explored. Furthermore, a semi structured interview method is used. The interview questions are based on prescribed themes (Saunders et al., 2016, p. 391). The interviews are divided in categories, which are based on the theoretical framework. The following categories are used during the interviews:

- Bouwteam: This category is focussed on the role and function of the interviewee, within the Bouwteam project.
- Monetary incentives
    - Payment method
    - Payment terms
- Incentives for mitigating risks
- Non-Monetary incentives
- KPI
- Project success and evaluation

The interview questions for the client, main contractor and third parties differ. The client are asked which contractual incentives they implemented in the Bouwteam agreement and how these incentives had an influence on the main contractors. The main contractors are asked which contractual incentives they implemented in the contracts with their third parties and how these incentives affected the performance of the third parties. Lastly, the third parties are asked which contractual incentives were applied in the contracts with their main contractor and how these incentives influenced their performance in the Bouwteam. The interview questions are given in appendix VIII.

3.4.1 Interviewees

Thirteen practitioners participated in the semi-structured interviews. The aim was to interview the client, main contractor and third party (hired by the main contractor) of each Bouwteam case. In case I, a third person, who is employed in a sister company of the main contractor is interviewed. Based on the possible relation between this third person and the main contractor, another third party was asked to participate in the interview. For this reason, interviews were done for the client, main contractor, third person and a third party in case I.

In case II, the main contractor and third party participated in the interviews. Unfortunately, no contact was obtained with the client of this Bouwteam case, during the execution of the empirical study. In case III, the client, two main contractors and one third party participated in the interviews. In this Bouwteam case, two main contractors were involved in the Bouwteam phase and both parties were open to participate in the interviews. In Case IV, the client, main contractor and third party participated in the interviews. Table 4 presents an overview of the interviewees and their role in the Bouwteam case.

Table 4 Overview of interviewees

Case nr.	Interviewee ID	Party	Role	Type of organisation
Case I	C1	Client	Contract/ Technical manager	Province
	MC1	Main contractor	Senior Project coordinator	Contractor
	TP1A	Third party	Design leader	Engineering firm
	TP1B	Third party	Senior project Coordinator/ design leader	Engineering firm
Case II	MC2	Main contractor	Project manager	Contractor
	TP2	Third party	Project leader	Engineering firm
Case III	C3	Client	Project manager	Water authority
	MC3A	Main contractor	Project manager/ construction manager	Contractor
	MC3B	Main contractor	Project leader/ design leader	Contractor
	TP3	Third party	Project leader	Engineering firm
Case IV	C4	Client	Project leader/ project manager and contract manager	Municipality
	MC4	Main contractor	Project leader	Contractor
	TP4	Third party	Technical manager	Engineering firm

3.4.2 Interview protocol

The duration of an interview is approximately 60-90 minutes and is captured with audio and visual recordings via MS Teams and note taking. An informed consent form is sent to the participants prior to the interview, explaining the goal of the interview and how the researcher deals with privacy. The interviewee is asked to sign the consent form prior to the interview. The consent form is presented in appendix VII. The participants should have sufficient knowledge on contracts, therefore the focus is on project managers, project leaders, contract managers and design leaders. These parties are interviewed individually to compare their perspectives on contractual incentives and the effect of these incentives on performance. At the end of the interview an anonymized transcript is sent to the interviewee, in which they can comment on the interview report.

3.5 Data analysis

The data collected from the case study is considered as descriptive categorical data (Saunders et al., 2016). The software ATLAS.ti is used for coding the interview transcripts. The different perspectives on contractual incentives are given in the case study results. The case study data (documents and interviews), will be evaluated in the comparison of cases. In this comparison of cases, an overview is given on the different contractual incentives and their influence on performance. The codes in ATLAS.ti are divided in the same order as the interview questions and are coded with A,B,C,D E and F. The categories are:

A. Bouwteam: general information about the Bouwteam, such as, the costs, duration of the Bouwteam and the role of the interviewee in the Bouwteam.
B. Monetary incentives: This code includes the information on the used payment method and payment terms. This code also includes suggestions on the payment method and payment terms.
C. Incentives for mitigating risks: this code include information on the used mitigation tools and suggestions made by the interviewees.
D. Non-monetary incentives:
E. KPI: this code includes information on the used KPI's and suggestions made by the interviewees.
F. Project goals and evaluation: this code includes information on the project goals and evaluation during the Bouwteam phase. The final suggestions of the interviewees are also given in this code.

Figure 11 illustrates a snapshot of the codes in ATLAS.ti. The statements of the interviewees are included in appendix IX.

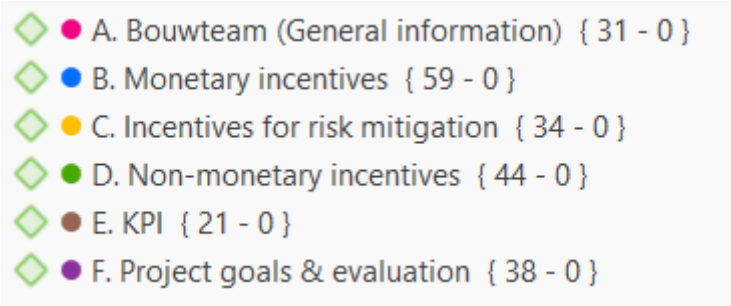


Figure 11 Snapshot codes in ATLAS.ti

Chapter 4 Case Study Results

This chapter elaborates on the contractual incentives used in the four Bouwteam projects and how these incentives can influence the performance of third parties. The required information for contractual incentives are derived from a document research and semi-structured interviews. The interviewees are selected based on their role as a: client, main contractor or third party (hired by the main contractor). The case study results are given for each Bouwteam case, section 4.1 presents the results of the renovation of the bridge. Section 4.2, presents the results of the renovation of water works. Section 4.3, presents the results of the renovation of the water sewage plant. And section 4.4, presents the results on the expansion of the ferry.

The results are divided into applied and suggested contractual incentives. The references used in the case study results are originated from the interview transcripts, the quotations of the interview are presented in appendix IX. The coding is based on the category (A- F) and an interview ID, as presented in Table 4.

This chapter ends with the answer on sub question 2: "Which contractual incentives are currently used in practice in the design phase of Bouwteam projects?" in section 4.5.

4.1 Case I Results

The client and two main contractors entered in a Bouwteam agreement, for the design and preparation work up to the final design (PD and FD). The Bouwteam agreement had three project goals: sustainability, planning and budget. The important goals for the main contractor and third parties were to create an integral design within the given budget. The tender criteria for the main contractor was based on the Most Economic Advantageous Tender (MEAT) criteria. Both the client and the main contractor were responsible for the design in the Bouwteam (A.C1.3). The main contractor included specialists in two ways: hiring third persons and a third party. The third person, who participated in the interview, was an employee at a sister company of the main contractor (A.TP1A.1). Because of this relation, the main contractor hired third persons from his sister company, with the expertise in the field of mobility and roads. The relation between the third persons and the main contractor can have an effect on their perspective on contractual incentives. For this reason, it was decided to include a third party, that did the design for the mechanical and steel parts of the bridge. This third party was also involved in the tender phase, Bouwteam phase and is currently working on the detailed design phase (A.TP1B.4, A.TP1B.5). After, this Bouwteam phase is finalised, the main contractor becomes the first advantageous tenderer to submit his bid for the construction phase. The UAC-IC contract is applied in the construction phase.

4.1.1 Applied contractual incentives

During the interviews, each participant was asked questions on the applied monetary and non-monetary incentives. The monetary incentives are described in point A and B. The non-monetary incentives are described in point C, D and E.

A. Payment method

The client paid the main contractors with a cost reimbursable payment method, which is based on feature rates. The feature rates consist of: travel expenses, accommodation costs, communication costs, office costs, system and computer costs and net working hours. The cost reimbursable payment method was combined with a partial task budget (for the Bouwteam phase). A task budget is a provisional budget determined by the client in the tender phase to execute different activities in a construction project. In such a task budget, the parties in a Bouwteam guard the budget and are required to report changes in the budget with substantiation. In the Bouwteam agreement it is stated that the task budget was also considered as a price ceiling. The main contractor also implemented the cost reimbursable payment method in combination with a task budget in his contracts with third parties. However, it is stated by the third party, that the effect of the task budget was not always prevalent, as they did not receive feedback whether the design costs stayed within budget (B.TP1B.24).

The interviewees were asked what their experience was using the cost reimbursable payment method in combination with a task budget. According to the interviewees, the cost reimbursable payment method was the most suitable method in this Bouwteam project. The following reasons were given for using the cost reimbursable payment method:

- It could not be defined how much time was needed to complete the design (B.C1.4 , B.TP1A.3, B.TP1B.10)
- Stimulates qualitative work (B.C1.7, B.MC1.11)
- Less risk for third parties (B.TP1B.9)
- The collaboration and dependency of the parties in the Bouwteam made it complex to submit a fixed price (B.TP1B.3)

Next, the interviewees were asked, which risks were related to the payment method. The risks of applying the cost reimbursable payment method in combination with a task budget is that there is an occurrence of budget overruns (B.MC1.6). It was stated by the client, that there were many parties involved from the main contractor's side. Resulting that the work could have been executed more efficiently (B.C1.8) The client stated that the Bouwteam consisted of nearly 80 employees, working in different departments (civil engineering, mechanical engineering, electrical engineering, etc). This amount of people involved, requires good management and accounting, which was not always met by the main contractor (B.C1.5, B.C1.8). This may play an significant factor in budget overruns. According to the main contractor, the reason for budget overruns, is that engineers are eager to do detailed work, even in if this is not necessary. For detailed work, time is needed, which also leads to budget overruns (C.MC1.5). Despite the risks in budget overruns, the interviewees recommend using the cost reimbursable payment method in future Bouwteam projects. In short, the cost reimbursable payment method has several advantages, but mitigation tools are needed to limit the budget overruns.

B. Payment terms

The main contractors were paid every four weeks and the time accounting was submitted every two weeks. The main contractors applied a paid-when-paid concept with their third parties. The third parties submitted their time accounting every week. In a paid-when-paid concept, the main contractor informs his third party that they will be paid when the main contractor is paid by the client (Viator, 2018). Due to the paid-when-paid concept, the third parties can have a delay of 15-30 days. The third party did mention that this did not influence the performance in deliverables, but was rather a risk that was taken into account (B.TP1B.25).

C. Early involvement

According to the main contractor, early involvement is important for third parties to understand the scope of the construction project. The engineers and designers will have the opportunity to explore the project in an earlier stage and will be able to detect risks. The third parties will also have the opportunity to ask important questions and retrieve information. The number of defects in the design will decreases (D.MC1.12).

D. Direct involvement

Interviewee TP1B was directly involved as a third party in the Bouwteam and was present at meetings concerning the design. During the interview, TP1B mentioned the following reason why direct involvement is important: *"Suppose a decision has to be made, but you actually want to know something extra before you make a decision. Well, then it is very useful if such a party is sitting at the table who can provide an answer to this, in order to be able to make a decision immediately. Otherwise you keep going back and forth between one party to the other party (…). And then you don't have a real dialogue, then a contractor who is in that Bouwteam becomes a kind of conduit"* (D.TP1B.17).

E. Network

The client included the main contractor in publications. According to the client, this would build up the reputation of the main contractor (D.C1.15, D.C1.16). The third person and third party stated that the tasks were granted through a network relation. TP1A works for a sister company of one of the main contractors, which led them to be hired for this Bouwteam project. TP1B, stated that they have worked together with the main contractor in previous projects. This network relation stimulated them to deliver high quality work, to maintain their relation with the main contractor for future work (D.TP1B.8).

4.1.2 Suggested contractual incentives

The participants were also asked, which suggestions they would consider for future Bouwteam projects. These suggestions are divided into monetary and non-monetary incentives. The monetary incentives are described in point A. The KPI's are described in point B and the non-monetary incentives are presented in point C and D.

A. Incentives for mitigating risks

As mentioned in sub section 4.1.1, the cost reimbursable payment method was combined with a task budget to limit the risk for the client. However, this mitigation tool was not sufficient, as budget overruns did occur during this Bouwteam project. Therefore, the interviewees were asked which incentives, are recommended for future Bouwteam projects. According to the client, the risk for budget overruns in a Bouwteam phase, should be shared with the main contractor. This is substantiated with the following statement: "Not everything with the cost reimbursable payment method, but also a joint responsibility in the event of budget overruns" (B.C1.10). This incentive can stimulate the main contractor to improve their financial management.

The Bonus Malus concept can be a second option for mitigating risks. TP1B, stated that a form of Bonus Malus concept was applied between their party and the main contractors in the tender phase of the construction project (C.TP1B.15). According to the third party, this concept can also be applied in the Bouwteam phase. No information was given, how this incentive would influence the performance of third parties in a Bouwteam.

B. KPI

A KPI is not considered as a contractual incentive but as an additional tool, to evaluate the performance of the parties in the Bouwteam and a helping tool for other contractual incentives (such as an incentive fee or a Bonus Malus concept). The client mentioned that the MEAT was considered as the most important tool to evaluate performance during the Bouwteam phase, the KPI's were an additional tool (E.C1.20). The article of Pianoo (n.a.) explains the differences between the MEAT and KPI and states the following: "*MEAT criteria in a contract are often translated into KPI's and are constant monitored as key indicators during the construction phase. The KPI's must be recorded in such a way that only one explanation is possible*". The client mentioned that the KPI's were used in the beginning of the Bouwteam but were not consequently used after a while. The main contractor further explained that, these KPI's were not implemented in the contracts with his third parties. The main contractor used a Gate review to evaluate the design process (E.MC1.14). Based on this gate review, a greenlight was given if all requirements were met (E.MC1.14).

C. Third party defines the level of detail

The main contractor stated that the knowledge of third parties should be used in defining what is delivered in the Bouwteam phase. This is substantiated by the following statement by the main contractor: *"Defining good starting points together: what do we expect from each other? What is that so-called definition for your part? And to let them think about it themselves or to give them more advice. (…) And that we let ourselves be advised instead of us directing. (…) that person is a specialist. So let them think about that too"(*D.MC1.13*).*

D. Limit staff

The interviewees of this Bouwteam case agreed that there were many people involved in the Bouwteam and that it became complex to financially manage it. This is also mentioned in sub section 4.1.1, it is explained that budget overruns can be caused by "bigger" Bouwteam projects, as it becomes more complex to financially manage it. According to TP1A and TP1B, this amount should be limited in future Bouwteam projects. The following statement are given by TP1B:

- *"What I would say is that, a Bouwteam should make agreements in advance about the size of the Bouwteam"*(F.TP1B.18).
- *"If I were a client, I would set some limits to the size of the Bouwteam (…). And, these must be people who are experts in their field"*(F.TP1B.19).
- *"(…) and maybe you can also split up the Bouwteam a bit into different phases. So, especially in the beginning, you use few people. And capture the outlines of the design well. And then, you're going to work out a bit more after that. And then you make that Bouwteam a bit bigger. But very focused on the design and not on the implementation"*(F.TP1B.22).

4.1.3 Summary case I

The project goals differed between the parties. For the client, the following project goals were important: sustainability, planning and budget. The main goal of the main contractor and his third party was to design an integral design and to stay within budget.

The client in this Bouwteam case, used the cost reimbursable payment method in combination with a task budget. Through Back-to-Back contracting this payment method and mitigation tool were used in the contracts between the main contractor and his third parties. This payment method was suitable, as there were many uncertainties for the design. The cost reimbursable payment method also created space for third parties to focus on the design and to submit qualitative work. However, the case results show that the task budget was not sufficient to limit budget overruns. Two reasons were given for this. Many people were involved in the Bouwteam, which made project control more complex for the main contractor. Secondly, designers and engineers are eager to do detailed work even if this is not necessary.

The non-monetary incentives were implemented by both the client and the main contractor in the Bouwteam. The client involved the main contractor in publications of the Bouwteam projects. According to the client, publications would build up the reputation of the main contractor. The designing third party was involved in an early stage of the construction project. According to the main contractor and third parties, early involvement is important for efficiency in a Bouwteam. Through early involvement, third parties are able to gather knowledge from an early stage, this increases the probability of directly submitting qualitative work (and to make less design errors). The designing third party was also directly involved in the Bouwteam and had a direct communication line with the client. According to the interviewees, direct involvement is important for decision making regarding the design.

Next, several suggestions were made to implement contractual incentives to influence the performance in a Bouwteam. First, the risk sharing between the client and the main contractor was suggested. This mitigation tool can stimulate the main contractor to improve their project control. Secondly, the Bonus Malus concept was introduced, however, no explanation was given how this mitigation tool can influence the performance of third parties in a Bouwteam.

Next, several non-monetary incentives were suggested to influence the performance in a Bouwteam. To improve the expectations of different parties in a Bouwteam, it is suggested, that third parties should define the level of detail of a design and the main contractor does a review. Furthermore, it is stated that the Bouwteam size should be limited, as it becomes complex to financially manage “bigger” Bouwteam projects, however, no specific contractual incentive was given to limit the staff in the Bouwteam phase.

4.2 Case II Results

In this Bouwteam case, the main contractor and his third party participated in the interviews. The project goals for this Bouwteam projects were: time, budget and dry feet in 2030 (F.MC2.31). The client (water authority) and their third party designed the preliminary design, after which the client outsourced the design work to one main contractor, to review the preliminary design on constructability (A.TP2.2). The main contractor was also responsible for the final design, detailed design, risk documents, planning, BLVC plan (a plan for accessibility, liveability safety and communication), permits and the budget (A.MC2.3). The main contractor hired a third party to do the design in civil engineering, mechanical engineering and electrical engineering (A.MC2.3, A.TP2.1). Furthermore, a designer was hired to design a building and another third party was hired for the landscape design (A.TP2.1). The third party who was responsible for civil engineering, mechanical engineering and electrical engineering, joined the Bouwteam after the preliminary design was finalised (A.TP2.3). After the Bouwteam phase, the main contractor will be the first advantageous tenderer for the construction phase, where the UAC-IC 2005 contract applies.

4.2.1 Applied contractual incentives

During the document research and the interviews, the several monetary and non-monetary incentives were mentioned. The monetary incentives are described in point A and B. The non-monetary incentives are listed in point C and D.

A. Payment method

The client paid the main contractor with a cost reimbursable payment method in combination with a task budget. The cost reimbursable payment method was used, as it was not possible to determine the design costs (B.MC2.5). The main contractor applied Back-to-Back contracting, with the monetary incentives, and also applied the cost reimbursable payment method in combination with a task budget for his third party. According to the Bouwteam agreement, the task budget for the Bouwteam phase was estimated between €1,5 and €2,0 million. This task budget included the costs for the main contractor and his third parties. According to the interviewees, this task budget was modified several times. The reason given for the budget overruns, can be substantiated by the following two statements of the main contractor: "W*hat happens in practice is, that everyone is busy with the design, (…) it has to be finished. And more people need to join in, otherwise it won't be done. And then finally we're there and then someone says, I press the button, and now we've spent a lot more money. So then we report afterwards that it has become much more expensive than actually stated in the task budget" (B.MC2.8). "The problem is that the people who are working on it, they are all busy and they do not signal, how much time or how much budget they have and how much time they spend on it" (B.MC2.10).* The main contractor also mentioned that the additional costs were reported "late"(B.MC2.13). In contrary, the third party mentioned that they filled in their time register in the system of the main contractor. This shows that there might be a mismatch in the project control of the main contractor and third party.

The third party explained that they submitted their open calculation in the tender phase, which was based on estimated costs. According to this third party, it became disadvantageous, as their open calculation was used as a task budget, while there was a high level of uncertainties in the design. If the third party stays within budget, the client would have profit. However, budget overruns lead to many discussions (B.TP2.4, C.TP2.5).

The third party further explained that this task budget led to discussions, which possibly had an influence on the planning. This can be substantiated with the statement given by the third party: "*especially if you have a real cost reimbursable payment method, so without a price ceiling. Then it just helps, because you don't have constant discussions about the scope. It helps planning technically. So you can get through a little faster because you don't have to put down the work because you have to talk about the scope. You can just do what is asked of you" (B.TP2.7).* In future Bouwteam projects, this third party would work with a cost reimbursable payment method without a task budget. Or to work with a lump sum payment method with a list of exemptions (F.TP2.13).

B. Payment terms

The client paid the main contractor every four weeks. The main contractor was required to submit an invoice one month prior to their payment. The main contractor applied a paid-when-paid principle with his third party. Resulting that there were delays in the payment towards his third parties, which was perceived as a disadvantage. The delay in payment did not have an influence on the performance of the third party in the Bouwteam.

C. Network

The main contractor and third party had a network relation prior to this Bouwteam project. Both the main contractor and the third party mentioned, that "good" collaboration is needed for future construction projects. This is substantiated by the following statement of the main contractor: *"we have done another Bouwteam together with the third party, so we know that party from that. And you work together in a way. We have also asked them for this Bouwteam project and if they do well then we can ask them again in the next Bouwteam project. I think that's very important that we can work together in a certain way and that you can do it again next time"* (D.MC2.27).

D. Early involvement

The designing third party was already involved in the tender phase, however, no explanation was given how this incentive influenced the performance of third parties in the Bouwteam.

4.2.2 Suggested contractual incentives

The participants were asked, which contractual incentives they suggested for future Bouwteam projects. These suggestions are divided into monetary and non-monetary incentives. The suggested monetary incentives are described in point A. The non-monetary are described in point B and C.

A. Incentives for mitigating risks

The main risk of the payment method was budget overruns. As implementing a task budget, was not sufficient to limit budget overruns, the main contractor recommended to connect an incentive fee with the amount of active employees of the third party in the Bouwteam. The reason given for limiting staff, is that "bigger" Bouwteam projects become complex to manage on time and budget (project control). In this case, one has to decide to let go of the planning, because a smaller team can eventually lead to a longer design duration (C.MC2.15, C.MC2.19). The main contractor would also like to have more insight who has a contribution in the Bouwteam, this is substantiated by the following statement: "*next time I would like to have more insight into who is working on it. And say in advance that only a limited number of people can be on it. Because then you have a much better overview of the costs"(D.MC2.17).*

The main contractor also stated that an incentive can be applied for the design costs. In this case, the third party receives a profit, if they stay within budget. However, the main contractor doubted if this fee is a positive incentive for a third party (C.MC2.21). Two statements are given on the practicability of an incentive fee based on design costs: *"if they spent less time on it, they would have more money left over, so that could be a financial incentive. On the other hand, the quality of the work comes under pressure"* (C.MC2.22). The second statement given, is: *"There may be someone who says: (..) I still want something else. So then it has to be done all over again, so the influences of that, in a Bouwteam of external parties, which you as an engineering firm have no influence on, it actually makes it difficult to work with a bonus in that way"* (C.MC2.24). However, an incentive based on the planning may work, as a third party has influence on time spent in the Bouwteam (C.MC2.25).

B. Bouwteam partners

An alternative is given by the main contractor as a combination of early involvement and direct involvement. The main contractor can include and engineering firm as a Bouwteam partner and jointly enter the tender phase. This is supported with a statement of the main contractor: *"What could also have been possible is that we immediately connect an engineering firm to us during the tender phase (for example an electrical and mechanical contractor). Actually, to make kind of a partner and jointly describe it as one party"(D.MC2.28).* The disadvantage is, that this form of collaboration eliminates the competitiveness between third parties. This is explained in the following statement: *"And if you already have those parties with you in the tender phase, then you don't know anything about the total costs you have. But you can no longer assign other parties" (D.MC2.29).* No information was given how this incentive can influence the performance of third parties in a Bouwteam.

C. Direct involvement

The third party mentioned that direct communication was needed with the client, as the important work was done by them. This is substantiated with the following citation of the third party: *"That is precisely one of the reasons why I would say, I want to attend those Bouwteam meetings myself, because I see what is happening in my project team. I see people are working on it, but I can't speak directly to the client. Because in the end, a large part of our additional costs actually increased, because of their administrators (of the client) kept asking us to do extra things. (…) And our project team was very helpful. It feels a bit like sand through your fingers, then you don't have a steering wheel on it anymore. But is will cost more"(F.MC2.33).* The third party also explained that the indirect involvement can lead to information loss, which can affect the quality of the work (D.TP2.9).

4.2.3 Summary case II

The project goals were based on time and budget. In this Bouwteam project, a cost reimbursable payment method was used in combination with a task budget. Similar to case I, the main contractor used Back-to-Back contracting with the payment method and mitigation tool. The case results show that the task budget was not sufficient to limit budget overruns, as this budget was modified several times. According to the main contractor, the designers and engineers were less focussed on the time and budget. The main contractor also explained that the management of finance became complex, as decisions in the Bouwteam had a delayed effect on the costs.

The designing third party was involved in an early stage (tender phase) of the construction project and they were hired through their network relation with the main contractor. The main contractor and third party worked together in previous construction projects.

The main contractor introduced different variants for an incentive fee. These incentives can be based on design costs, design planning or limiting staff. The main contractor stated that these incentives are useful, as third parties have an influence on the planning and limiting staff. The limiting of staff is of great importance, as a “bigger” Bouwteam size becomes more complex for project control. A disadvantage of these incentive fee, is that the quality of work can be affected, as third parties are stimulated to spent less time, costs or staff on the design.

Several suggestions were given for non-monetary incentives: direct involvement and Bouwteam partners. Direct involvement of third parties is needed in decision making, as designing third parties execute the majority of the design. The main contractor mentioned that a Bouwteam partner can be formed with an engineering firm, as a combination of early and direct involvement. No further information was given on how the formation of a Bouwteam partnership would influence the performance of third parties in a Bouwteam.

4.3 Case III Results

The main project goal of this Bouwteam project was quality, as the focus of the client was on the control of the water sewage plant(E.C3.12). The client entered the Bouwteam agreement with two main contractors. The main contractors were responsible for the design in the final design phase of the Bouwteam. Approximately 80% of the design was done by the main contractors and their third parties, the remaining 20% of the design was done by the client (A.C3.3). The main contractors were engaged with project control (in costs, planning and risks) and the design in civil engineering (A.MC3B.2). The third party (hired by the main contractors) executed the majority of design and also drafted the cost specifications (A.C3.4, A.TP3.3, F.TP3.22, F.TP3.23). After the Bouwteam phase is completed, the main contractors become the first advantageous tenderers to submit a bid for executing the work in the construction phase, where the UAC-IC contract is applied. In this Bouwteam case, practitioners of the client, two main contractor organisations and a third party, participated in the interview.

4.3.1 Applied contractual incentives

During the interviews, each participant was asked which contractual incentives were used in the Bouwteam projects. The contractual incentives are divided into monetary and non-monetary incentives. The monetary incentives are described in point A, B and C. The non-monetary incentives are described in point D and E.

A. Payment method

According to the Bouwteam agreement, the client paid the main contractors with the cost reimbursable payment method in combination with a task budget. Through Back-to-Back contracting, the main contractors also implemented the equivalent payment method and mitigation tool for their third parties (B.MC3A.3). This payment method was the most suitable, as there were many scope uncertainties (B.C3.7). Furthermore, the level of quality would not be met with a lump sum payment method, as there is a limited budget available to execute the work (B.MC3B.7, B.MC3B.8). As mentioned in Bouwteam cases I and II, the risk of a cost reimbursable payment method is budget overrun, hence, the client applied the task budget. However, the case results show that this mitigation tool was not sufficient to limit budget overruns. The task budget was exceeded several times, up to a point where the main contractors became responsible for the additional costs (B.MC3B.13, C.MC3B.16). The client stated that the risk of budget overrun can be caused by, extra time spent on the design (B.C3.10). The main contractor (MC3B) explains the reason for budget overruns, in the following statement: *"the parties put in more effort than expected and the third party increased their team size to finalise the design and engineering work in time"* (B.MC3B.5).

It was also mentioned that, the client and main contractors discussed the planning during their weekly meetings. However, additional work was not reported in time. This was caused by an accumulation of activities which were not reported adequately (between the main contractors and their third parties), which led to a delay (F.MC3A.24). In the case of cost reimbursable payment method, a delay in time leads to budget overruns.

The main contractor (MC3A), doubted whether the cost reimbursable payment method should be used in a future Bouwteam projects. This is substantiated in the following statement by the main contractor (MC3A): *"Well I don't know, if I were to do a Bouwteam again (which is beneficial for us of course), but to a third party I wouldn't specifically do that. I prefer a fixed price and just based on the products and quantity that is delivered. We pay that. (…) if they are a month late, then it is also lawful to postpone the payment for that product for a month"* (B.MC3A.15). A second reason is given by MC3B, to use a lump sum payment method in a future Bouwteam. According to this main contractor (MC3B), the lump sum payment method influences third parties to work more efficient, as the focus is on executing the required work (B.MC3B.6).

B. Payment terms

According to the Bouwteam agreement, the client paid the main contractors once every four weeks. The payment was based on the approval of the progress reports, which were submitted every four weeks by the main contractors (B.MC3A.6, B.MC3A.7). The progress reports consist of the following: cost estimates of the working hours, general progress of the Bouwteam, deviations from the Bouwteam agreement, risks and other design agreements (B.MC3B.14).

The main contractors applied the paid-when-paid principle for their third parties (B.C3.14). It is also mentioned that there was a delay in the payment of these third parties (B.C3.14). This delay in payment was not considered as a risk for non-payment, however, the third party stated that they had to pay their expenses in advance and this was considered as a disadvantage (C.TP3.8). It was recommended that the third party would put a limit to the payment terms of the main contractors, with approximately five days (C.TP3.11, C.TP3.12). However, payment terms do not have an effect on the performance of third parties in a Bouwteam (B.MC3B.15).

C. Incentives for mitigating risks

The third party mentioned that there was an agreement included in the Bouwteam agreement and their contract with the main contractors. The interviewee, mentioned the budget margin for cost specifications. With a budget margin for cost specifications, the third party submits a cost estimate, the actual costs can deviate within a specified margin (E.TP3.20). If the actual costs are higher than the specified margin, the main contractor and third party is held responsible for the remaining costs.

D. Early involvement

The third party, mentioned that they were already included in the tender phase, however, it is not mentioned how the early involvement had influence on the performance of the third party(D.TP3.17).

E. Direct involvement

The third party was directly involved in the Bouwteam, however, they were not available during the contract management meetings about scope change(D.TP3.2). Whilst, the third party spent the majority of hours on the design (B.TP3.7). The third party explained, that there was a table system. In this table system, a meeting was held every two weeks to keep the client up to date. The disadvantage of the table system, is that many additional hours are spent next to the design hours (B.TP3.15). However, when the meetings included topics that had influence on the overall contract between the client and the main contractors, the third party was involved to share their knowledge (D.TP3.16).

4.3.2 Suggested contractual incentives

The interviewees were asked which contractual incentives they suggested for future Bouwteam projects. These suggested contractual incentives are divided into monetary and non-monetary incentives. The monetary incentives are described in point A. Furthermore, several KPI's were suggested to improve project control, this is described in point B. The non-monetary incentives are described in C and D.

A. Incentives for mitigating risks

The interviewees were asked which incentives are suggested to mitigate risks in the Bouwteam phase. According to the client, the use of a cost reimbursable payment method is sufficient and no additional incentive is suggested to affect the performance of parties in a Bouwteam (B.C3.13).

The main contractor (MC3A) mentioned that the liability period for third parties should be extended into the construction phase, as the main contractor is held responsible for the design errors which are discovered in the construction phase (B.MC3A.17). The extension of the liability period can be connected with a Bonus Malus concept. The third party receives a bonus if no design errors are discovered in the construction phase and a fine if design errors were discovered (C.MC3A.18). However, no explanation is given how this incentive will influence the performance of third parties in a Bouwteam.

The main contractor (MC3B), suggested a risk pot as an incentive to improve performance in a Bouwteam. The main contractor, stated that the client can make a budget available in the Bouwteam. The agreement is made that the remaining amount in the risk pot is shared with the parties in the Bouwteam. However, it is required to have sufficient knowledge of the costs in the Bouwteam. According to the main contractor, this incentive becomes complex as the Bouwteam is a fluid process (C.MC3B.17).

B. KPI

Several KPI's were included in the plan of action (tender phase) and in the first progress reports. These KPI's were excluded after a while (E.C3.15, E.MC3B.20). The KPI's were translated into a list of requirements for the deliverables. These requirements were based on time and quality (E.TP3.18, E.TP3.19). The main contractor (MC3B) mentions, that KPI's can be used if it is measurable and defined properly in the tender phase. These KPI's can be used for project control. In this case, a separate person should be appointed to do the project control and to evaluate the products (F.MC3A.23, F.MC3B.23). The main contractor would then use the time indicator for the weekly evaluation of the Bouwteam (E.MC3B.21). Main contractor (MC3A), suggested that KPI's can be used to indicate the quality-and quantity of the deliverables and to regulate the Bouwteam size (E.MC3A.19). However, it is complex to measure quality.

C. Contract extension

The main contractor (MC3B) was planning to apply the contract extension and to offer his third party to do the detailed design. It appeared that the third party was not interested to be involved in the detailed design phase (D.MC3B.19). The main contractor explained that the cost specification submitted by the third party was too expensive to transfer it back to the client. Therefore, it was concluded that the third party was insensitive for the contract extension (D.MC3B.24). This can be caused by the competition between different parties in the field. There were several third parties involved in the Bouwteam, which were qualified to execute the work in the detailed design phase. A second reason given, is that the lump sum payment method is applied in the detailed design phase, this can be less attractive for the third party, as they were paid with the cost reimbursable payment method in the Bouwteam phase (D.MC3B.25).

D. Limit staff

Similar to Bouwteam case I and II, it is stated that the third party included many staff members to finalise the design. According to the main contractor, a large Bouwteam becomes more complex to financially manage (B.MC3B.9). The reason for a decrease in management is given in the following statement by the main contractor (MC3B): "*the client said at one point, (…) We have to stop designing. (…) And before that ship stops, that great colossus what is planned and everyone is busy with. Yes, that will take a few weeks. Then at a certain point you will see that costs decrease somewhat, but that is actually very gradual. You can hardly get a grip on it"* (B.MC3B.10). In order to limit the Bouwteam size, the main contractor (MC3A), suggested that they would do interviews with the staff from the third party, to regulate who is involved (D.MC3A.20, D.MC3A.21).

4.3.3 Summary case III

The main goal of this Bouwteam project was quality, as the focus was on the control of the water sewage plant. The cost reimbursable payment method in combination with a task budget was used in the Bouwteam agreement and the contracts between the main contractors and their third parties. According to the interviewees, the cost reimbursable payment method was suitable as the Bouwteam project had a high level of uncertainty, and to reach the desired level of quality in the design. Similar to Bouwteam case I and II, this Bouwteam project have exceeded the task budget several times. Which shows that the task budget was not sufficient to limit budget overruns. The two main reasons given for budget overruns are the following: third parties include more staff to finalise the design within the planning and designers and engineers are eager to do detailed work, even if this is not required. The main contractors stated that the cost reimbursable payment method was advantageous for them, but they would not necessarily suggest this method in contracts with their third parties. According to them, they would use the lump sum payment method. In this way, the delay of deliverables can also be translated in a postponed payment. The interviewees mentioned, that payment terms had no influence on the performance in the Bouwteam.

The main contractors were paid every four weeks and they applied the paid-when-paid concept with their third parties. The third party mentioned, that a budget margin was applied in the contract with his main contractor. The budget margin would stimulate third parties to improve their cost specifications (project control).

The third party was included in the tender phase and had a direct involvement in the Bouwteam. However, the third party was not included in meetings about the scope change, whilst, the majority of design work was executed by them.

The interviewees were also asked which contractual incentives they suggested for future Bouwteam projects. The following monetary incentives were given: implement a risk pot and extend the liability period of designing third parties and combine this with a Bonus Malus concept. A risk pot would improve the performance in a Bouwteam, as the residual costs in the risk pot are shared between different parties. According to the main contractor, design errors should be tested in the construction phase, to stimulate qualitative work from the third parties in the Bouwteam phase. Therefore, it is needed to extend the liability period of the third parties and combine this with a Bonus Malus concept. The interviewees also suggested the following KPI's to improve project control in a Bouwteam: design costs and design planning. The quality and quantity indicator can also be used, but is more complex to measure.

Contract extension and limit staff were mentioned as non-monetary incentives. The contract extension is not always considered as a positive incentive. In this Bouwteam project, the third party was insensitive for contract extension, to execute the detailed design. According to the main contractor this can be caused by the competitive market and the lump sum payment method, which was used in the detailed design phase. Next, it was suggested to limit staff by interviewing staff of the third parties. No information was given how this would influence the performance in a Bouwteam.

4.4 Case IV Results

The Bouwteam case is located in a busy city with many construction activities. Due to the developments in the city, the main project goals were, meeting the planning and budget (F.TP4.20). In this Bouwteam project, the client, main contractor and a third party participated in the interviews. The structural design and preliminary design was already completed prior to the Bouwteam phase (A.C4.2). The main contractor entered the Bouwteam to evaluate the preliminary design on constructability and to do the detailed design in the form of a RAW specification (A.MC4.1). The client assisted the main contractor in the field of mechanical engineering, structural engineering and geotechnical engineering and reviewed the work delivered by the main contractor and his third party (A.C4.3). Approximately 60% of the design was executed by the third party (F.TP4.21). There were no specific requirements made in the Bouwteam agreement for the third parties hired by the main contractor, as the client had no insight on which tasks were outsourced to third parties (A.C4.4). After the Bouwteam is finalized, the main contractor becomes the first advantageous applicant to submit a price offer for the construction phase, which will be executed with a UAC contract.

4.4.1 Applied contractual incentives

During the interview, the participants were asked which monetary and non-monetary incentives were used in the Bouwteam project. The monetary incentives are described in point A and B, and the non-monetary incentives are described in point C, D and E.

A. Payment method

In this Bouwteam, the client paid the main contractor with a lump sum payment method, which was based on the performed milestones (A.MC4.1). The reason a fixed price was chosen, is substantiated with the following statement of the client: *"We let the quality be decisive and we wanted to prevent that if we submitted a subcription for a price bid, in addition to a number of quality criteria, that the price would be the main goal. (…) that the task would be delivered by registering a low price. So we chose to set a fixed price"*(B.C4.5). The main contractor applied the Back-to-Back contracting principle, and also used a lump sum payment method in combination with the payment per achieved milestone for his third party. The reason for Back-to-Back contracting, is explained in the following statement by the main contractor: "*That is actually a bit of risk spreading. (…) as a third party, you get paid 100% for an assignment. Then you just have to see as the main contractor to collect that money from your client" (B.MC4.2).*

The interviewees mentioned several risks for applying a lump sum payment method. First, the client mentioned that the estimated fixed price was modified several times before some main contractors did an offer, in the tender phase (B.C4.5). According to the client, this modification in estimated price, had to do with uncertainties that came with the managerial tasks, such as environmental management (B.C4.5). Additional work led to a budget overrun, where the main contractor became responsible for the additional costs (B.C4.9). According to the main contractor, this additional work can be related to external factors. For instance, stakeholders can influence change in the project scope. For this reason, the main contractor would not advice the client to work with a fixed price in the Bouwteam phase (C.MC4.4). The final risks given, is stated in the following citation of the main contractor: *"If you agree on a fixed price, you run the risk that people think at some point: well, that work meets the requirements, but does not meet all wishes. And the budget is finished, (...) then you have no room anymore to explore opportunities for the construction phase" (B.MC4.6).* This can directly affect the quality of the design.

According to the third party there is a disadvantage in applying the lump sum payment method. It is mentioned that the design products are paid in the form of a calculation, report, etc. However, the process to come up with these design products is often overlooked in the lump sum payment method (F.TP4.26).

B. Payment terms

According to the Bouwteam agreement, the payment was based on the performed milestones. The following milestones were set up by the client (C.C4.11, C.C4.12):

1. 10% after signed Bouwteam agreement
2. 10% after submitted collaboration plan
3. 20% after accepted conceptual final design by the client
4. 10% after completion of the cost specifications for the final design
5. 30% after accepted detailed design by the client
6. 10% after completion of the cost specifications for the detailed design
7. 10% after completion of the Bouwteam phase

In this case, the milestones are defined in the tender phase. The parties are stimulated to meet the requirement, as they are rewarded after completion of each milestone (DTU, 2019).

C. Network

The main contractor mentioned that the third party was hired based on their network relation. The third party was selected for their reputation in delivering qualitative work (D.MC4.9). It is also mentioned that the main contractor and third party often work together. No further information was given on how this incentive could influence the performance of third parties.

D. Early involvement

The interviewee mentioned that the third party was involved in the tender phase. Early involvement of third parties, depends on the role which is given to them. For an engineering firm it is of interest to be involved in a longer process and not only to execute a short task (D.TP4.18). No further explanation was given, how this incentive affects the performance of third parties in a Bouwteam.

E. Direct involvement

The third party stated the disadvantage of indirect involvement. It is mentioned that they had influence on the choices made in the Bouwteam. However, their absence in the discussion on additional work, formed a risk for budget overruns. This is substantiated with the following citation: *"What is a disadvantage if you work as a third party, that I depend on what the relationship with the client is. The main contractor communicates about money, so I am suddenly dependent on the main contractor about what I think is additional work and what they want to discuss with the client. So that route is more difficult for a third party. I can't immediately talk to the client as a third party, while what I do might be additional work for the client, but I always have to do that through the main contractor (D.TP4.6).*

4.4.2 Suggested contractual incentives

The participants were asked, which contractual incentives they suggested for future Bouwteam projects. These incentives can be divided into monetary and non-monetary incentives. The suggested monetary incentives are described in point A and B. The interviewees also shared information on project control and KPI's, these subjects are described in point C and D. The suggestions on non-monetary incentive are described in point E and F.

A. Payment method

The client recommended two options for the payment method:

1. Apply a lump sum for certain engineering activities and the main contractor submits a price for uncertain tasks (B.C4.7).
2. Apply a lump sum payment method for certain engineering activities and the cost reimbursable payment method for uncertain tasks (B.C4.7).

The two options were given, to reduce the risks, which occur in a lump sum payment method.

B. Incentives for mitigating risks

As mentioned in sub section 4.4.1, there are several risks which may occur during the Bouwteam phase. The participants were asked which incentives could be used to mitigate risks. The client was not in favour to use other incentives to mitigate risks. The following reason is given: *"With risk pots, together with the contractor, there is often a remainder in the risk pot (…) with a certain distribution (…), so it possibly is a strange incentive for the contractor (…). For example, he can neglect to report additional work. So that the remainder in the risk pot remains higher (…). That could be more beneficial, than to report it as additional work or to report it as a risk and to take it out of the risk pot" (C.C4.16).*

The main contractor mentioned that there should at least be an internal risk pot to mitigate the risks for additional work, caused by stakeholders (C.MC4.5). Furthermore, the suggestion was made to use an incentive fee for innovative work. In this way, the parties in the Bouwteam would receive a fee for their extra effort. According to the main contractor, design requirements can be met, but this fee would reward extra performance (C.MC4.7).

C. Project control

As mentioned in sub section 4.4.1, the third party had no direct contact with the client about additional work. An incentive is given, that the main contractor should guard the project scope of the third parties involved (D.TP.10). In this case, the added value for additional work towards third parties, should be researched by the main contractor. The main contractor discusses with the client how these third parties should be paid in case of additional work (D.TP4.11). The third party stated that it is of importance to them, that the main contractor defines the risk and profit division with their third parties. This should be in balance with the responsibility of each third party (F.TP4.24, F.TP4.25).

D. KPI

The KPI's are set up in the tender phase, but are not used consistently in the Bouwteam phase (E.C4.19). According to the main contractor and the client, it is complex to manage the KPI's. The reason is given by the following statement by the main contractor: *"you could, of course, determine certain KPIs in the end product. With regard to (then you are already looking very much indeed at) sustainability, CO_2-reduction with regard to the end product for the construction phase. But within the Bouwteam, there aren't that many KPI's I think that you could monitor" (E.MC4.10).*

E. Framework contracting

According to the client, non-monetary incentives were excluded in the Bouwteam agreement. *"If there is a tender offer, then a contractor has several reasons to take on the work. And one is, because it is good for his business, for his continuity (…). A contractor sometimes does it to have a reference projects (to be able to build up his references). But that's what the contractor does. Those are his choices, strategic choices and bid choices of that contractor. (…) We didn't consciously build incentives into it" (D.C4.17).* However, the client did mention that within the municipality framework contracting is applied. This contract form can last for several years, the option for extension is given in phases. This gives the main contractor a turnover guarantee (D.C4.18).

F. Contract extension

The third party also mentioned that contract extension in the construction phase, can be considered as an incentive (DTP4.14). The third party can fulfill the role of site engineering, designer of detailed work or environmental manager (D.TP4.15). This incentive can be of interest to the main contractor as knowledge is retained in the Bouwteam (D.TP4.16). The participant further explained the following: "*If you are already doing things in the preliminary phase, where you are not paid for yet. Then you have a chance (…). The contractor's earnings model also has the opportunity for fair payment in the construction phase. We actually don't have that in a longer phase, only in the Bouwteam phase"(D.TP4.17).* By extending the contract of the third party in the construction phase, the refund in the construction phase can compensated with the unpaid services in the tender phase.

4.4.3 Summary case IV

This Bouwteam case differs from the previous Bouwteam cases (case I, II and II), as this Bouwteam was in combination with a UAC (+ RAW specifications) contract in the construction phase. The client paid, the main contractor with a lump sum payment method in combination with a milestone payment. The milestones were divided in seven phases. The milestone payment stimulates parties to execute the predefined milestones, as they are rewarded after completion of their work (DTU, 2019). The third party mentioned that there was an disadvantage in the lump sum payment method, as they were solely paid for the submitted products and not for their service in the design process.

The client was not in favour to implement additional contractual incentives. According to the client, a risk pot can cause risks in a Bouwteam. According to this client, the main contractor can perform strategic behaviour. In this case, a main contractor can decide not to report additional work, as the costs for additional work will be subtracted from the joint risk port. The main contractor, suggested to implement an incentive fee for innovation, as the parties are rewarded for their extra effort.

Similar to the previous Bouwteam cases, the main contractor hired their third party based on their network relation. The third party was selected by their reputation for delivering qualitative work. Furthermore, the third party was involved in the tender phase. However, no explanation was given, how the network and early involvement affected the performance of third parties in the Bouwteam. There was an indirect involvement of third parties in meetings for scope change. The third party mentioned that the indirect involvement caused budget overrun, as important information was not directly shared with the client.

The third party stated that the project control of the main contractor should be optimized in such a way that the scope of the third party is protected. The third parties should also be paid according to their responsibility in the Bouwteam. It is also mentioned that the third party would prefer contract extension in order to earn more in the construction phase.

4.5 Conclusion

After conducting a case study including four Bouwteam projects, a collection is made, which contractual incentives are used in practice. During the interviews, thirteen practitioners from the client, main contractor and third party were asked which contractual incentives were used in the Bouwteam. The monetary incentives, as mentioned by interviewees consist of the payment method and incentives for mitigating risks. From now on, incentives for mitigating risks will be referred as mitigation tools.

The following payment methods are used in practice:

- **Cost reimbursable:** a payment based on the expenses made in the Bouwteam phase. The cost reimbursable payment method is used in project with a high level of uncertainties. Furthermore, this payment method stimulates qualitative work, as the focus is on the design, rather than the scope change.
- **Lump sum:** a payment based on a fixed price. This payment method stimulates efficiency, as third parties are stimulated to solely execute required tasks.

The following mitigation tools are used in practice:

- **Task budget:** a target price based on function rates. The parties in the Bouwteam are supposed to guard this task budget and report scope changes.
- **Price ceiling:** a hard budget. The main contractor and third parties are held responsible for costs above the price ceiling. This mitigation tool is often used as a last resort.
- **Milestones:** a payment based on the achieved milestones.
- **Budget margin:** a specified margin for design costs. The main contractor and his third parties become responsible for design costs which are higher than the specified margin.

The following non- monetary incentives, are used in practice:

- **Network:** the third party is hired by the main contractor through their network relation.
- **Contract extension:** the third party is granted a contract extension to execute work in the detailed design phase or the construction phase.

Next, the interviewees were asked to give suggestions for implementing contractual incentives for future Bouwteam projects. The following monetary incentive (mitigation tools) were suggested:

- **Risk sharing:** in case of a budget overrun, the costs are shared between the parties in a Bouwteam.
- **Risk pot:** a joint risk pot. The residual amount is shared between the parties.
- **Incentive fee:** an incentive based on design costs, design planning or for limiting staff in a Bouwteam.
- **Bonus Malus:** a fee is granted if the prescribed requirements are met, a fine is given is a party does not meet the requirements in the Bouwteam.
- **Extend liability period:** the liability period for the design is extended and is applied in combination with a Bonus Malus concept. A fee is granted if no design error occurred in the construction phase. A fine is given, if a design error occur in the construction phase.

The following non-monetary incentives were suggested:

- **Third party defines level of detail:** the designing third party defines the level of detail. An approval is given after the main contractor reviewed this level of detail.
- **Bouwteam partners:** this is a combination of early involvement and direct involvement. A partnership is formed in the tender phase, between the main contractor and an engineering firm.

In the following chapter, a comparison of cases is done to analyse how the applied and suggested incentive influence the performance of third parties in a Bouwteam.

Chapter 5 Comparison of cases

This section discusses the comparison of cases and answers sub question 3: "How can contractual incentives affect the performance of third parties in a Bouwteam?" Before the contractual incentives are compared, a short summary of the Bouwteam projects is given in Table 5. The selected Bouwteam projects had a project scope between €22,- and €37,- million. The main contractors and their third parties entered the Bouwteam to complete the design. The majority of the design is done by the third parties. The exact involvement of the main contractors and their third parties is presented through the different design phases, such as the Preliminary Design (PD) and the Detailed Design (DD) phase. The selected Bouwteam projects are all finalised and had a duration of approximately one year.

Table 5 summary Bouwteam projects

Bouwteam projects	Contract construction phase	Bouwteam composition	Bouwteam activities	Project scope (total costs, Bouwteam phase) (million)	Duration Bouwteam phase (months)	Payment method + mitigation tool(s)
Case I Renovation bridge	UAC-IC 2005	Client (province) & two main contractors	PD, FD	€22,- €1,0- €1,5	12	Cost reimbursable + task budget & price ceiling
Case II Renovation water works	UAC-IC	Client (water authority) & one main contractor	PD and FD	€27,5 €1,5- €2,0	12	Cost reimbursable + task budget
Case III Renovation water sewage plant	UAC-IC	Client (water authority) & two main contractors	FD	€36,5 €1,5- €2,0	13	Cost reimbursable + task budget
Case IV Expansion ferry	UAC+ RAW specifications	Client (municipality) & one main contractor	FD and DD (including RAW specifications)	unknown € 0,5- € 1,0	13	Lump sum + milestone payment

Based on the case study results, several aspects are featured. In section 5.1, information is given on Back-to-Back contracting in the Bouwteam. The payment method and mitigation tools are presented in section 5.2. Section 5.3, presents the overall perspective on payment terms and the effect on performance. The non-monetary incentives are discussed in section 5.4. Section 5.5, presents information on the project performance and evaluation. In the theoretical study, several KPI's were given as suitable indicators for a Bouwteam project. However, the case study results indicate a different perspective on the KPI's, this is presented in section 5.6.

5.1 Back-to-Back contracting

The result of the interviews showed that the client is more willing to implement contractual incentives (monetary incentives) to improve the performance in a Bouwteam, when compared to main contractors. According to the main contractors, every incentive comes with a set of risks. However, the case results show that main contractors are willing to implement contractual incentives (monetary incentives) in contracts towards their third parties, if these incentives are included in the Bouwteam agreement. In this case, the main contractors can transfer the risks of the monetary incentives back towards the client.

5.2 Payment method and mitigation tools

In three Bouwteam projects, the client applied the cost reimbursable payment method. The cost reimbursable method is suitable for undefined project scopes with a high level of uncertainty. According to the interviewees, the advantage of applying the cost reimbursable payment method, is that it leads to less design discussions. A designer and engineer can focus more on the technical aspects and deliver qualitative work. This is also shown in in the case results, in general, the interviewees were content with the quality of the final deliverables. However, this payment method is more sensitive to budget overruns as there are no direct limits in costs on the design. In the three Bouwteam projects, the client chose to combine this payment method with a task budget. The task budget is based on cost specifications (function rates) set up by the main contractor and their third parties. The case results show that the combination of the cost reimbursable payment method with a task budget is insufficient to limit budget overruns. The task budget of the three Bouwteam projects were modified several times up to a point that, the client set a price ceiling as a last resort. In this case, the main contractor became responsible for the additional costs.

The lump sum payment method is used in one Bouwteam case. This payment method is suitable for defined project scopes with a low level of uncertainty. The client in this Bouwteam case had sufficient knowledge on the products and indicated what they expected for the final and detailed design. There was also a budget overrun, but this seems to be in lesser extends when compared to the Bouwteam projects, with a cost reimbursable payment method. The client used the milestone payment to pay the main contractor. This is advantageous for the main contractor, as the milestones were divided in seven stages (the main contractor and third parties were paid in seven terms).

Several mitigation tools are suggested to limit budget overruns, these are as follows: risk sharing, budget margin, incentive fee and the Bonus Malus concept. The practicability of the Bonus Malus concept in the Bouwteam remains unknown.

5.3 Payment terms

The cost reimbursable payment method was used in Bouwteam case I, II and III. In these Bouwteam projects, the main contractors were paid every four weeks. The main contractors applied the paid-when-paid concept with their third parties. The third parties mentioned that there was a delay in the payment between them and the main contractor. However, the interviewees, stated that the payment terms in Bouwteam projects with a cost reimbursable payment method, did not have an effect on the performance in the Bouwteam.

Bouwteam case IV, differed from the previous Bouwteam projects. The main contractor and his third parties were paid after the completion of milestones. The payment terms were divided in seven milestones.

5.4 Non- monetary incentives

The non-monetary incentives mainly refer to the involvement of third parties in the Bouwteam and their network relation with the main contractor. The results of the case study shows that third parties with a high design responsibility, are already involved in the tender phase. Third parties with a smaller responsibility, however, are involved at a later time. With early involvement of a third party, important information can be retained in the Bouwteam. Secondly, it is explained that direct involvement of third parties is important for decision making. The third party is has direct communication with the client, in case of direct involvement.

Main contractors hire their third parties based on their network relation, this non-monetary incentive stimulates third parties to keep the main contractor satisfied in order to maintain their reputation. Contract extension, can also be considered as a non-monetary incentive, the main contractor offers the third party job opportunities in the construction phase (detailed design, environmental management, etc). However, third parties are not always sensitive to this contractual incentives. Two reasons are given for this: there is a competition with other third parties and if the Bouwteam phase is based on a cost reimbursable payment method, it can become less attractive for a third party to accept the lump sum payment method in later phases of the construction project.

5.5 Project evaluation & performance

The interviewees were asked on the most important project goals. The two main project goals given, are time and costs. Many project goals eventually have an influence on the costs. For example, extra time and poor quality have influence on the design costs. Thereafter, the interviewees were asked on the project goals and the evaluation process in the Bouwteam. Many interviewees, viewed the evaluation of the Bouwteam as a social aspect and not only the performance of the deliverables. The interviewees stated that digital tools were used to evaluate the collaboration between different parties. However, the response on these digital evaluation rounds remained low. As this study is about the performance of third parties on the deliverables in a Bouwteam, the social aspect of the evaluation was excluded from this research.

Furthermore, the interviewees mentioned that, there were weekly design consultations between the client and the main contractors in the Bouwteam projects. In these meetings, the progress of the Bouwteam was discussed. However, it was stated several times that there was a late indication on additional work by the main contractor and his third parties. This resulted into budget overruns that were unexpected for the client. The main contractor and the third parties were then asked how they reported extra time and budget. It is mentioned that the third parties were required to submit weekly stats of the project, where the extra time and budget could be tracked. However, the management of time and budget (project control), becomes more complex, if many staff members are included in the Bouwteam. For this reason, it is stated several times, that the Bouwteam size should be limited.

Lastly, it is mentioned several times that there are some points of improvement in project control. It was advised that a person from the main contractor's organisation should be responsible for the project control. The design costs and design planning of the Bouwteam should be evaluated weekly and the main contractors, should protect the scope of their third parties in case of scope change. The main contractors should also define a fair risk and profit division towards their third parties.

5.6 KPI

The KPI's were first presented in the literature study, in sub section 2.2.3. It became clear that KPI's are not considered as contractual incentives, but as additional tools. Furthermore, it was stated that KPI's can be used to evaluate project performance and can be applied in combination with the Bonus Malus concept, target pricing and with the cost reimbursable variants. With this information on KPI's, the interviewees were asked how these indicators were applied in the Bouwteam projects. Several interviewees mentioned the MEAT plan, when they were asked about the KPI's. The reason might be that, the KPI's are often set up in the tender phase and are part of a MEAT plan. In such a MEAT plan, main contractors describe how they will meet the requirements of the client in the construction project. The criteria in the MEAT plan are often reviewed in the construction phase. Therefore, it is more complex to define indicators, which can be used in the Bouwteam phase. This is also shown in the case results, as KPI's were not consistently used in the Bouwteam phase. Interviewees stated that, KPI's can be of great use when the indictors are defined properly and can be quantified.

Such indicators are: design time, design costs and the amount of staff members. However, two less measurable indicators were suggested: innovation and sustainability. Lastly, it is stated that these KPI's (time, cost and staff members) can be used in project control, were the budget and planning can be evaluated weekly.

5.7 Conclusion

The applied and suggested contractual incentives might have an influence on the performance in a Bouwteam. These contractual incentives are divided into monetary and non-monetary incentives. First, the effects of the applied monetary incentives are discussed:

- **Cost reimbursable payment method:** this payment method was used in three Bouwteam projects (Case I,II and III). This payment method is suitable for Bouwteam projects with an undefined project scope, high level of uncertainty, high dependency between parties and to stimulate qualitative work. However, the cost reimbursable payment method is sensitive to budget overruns, two reasons are given for this. First, third parties include many staff members to finalise the design in time. Secondly, designers and engineers are eager to do detailed work even when it is not necessary.
- **Lump sum payment method:** this payment method was used in one Bouwteam project. This payment method is suitable for Bouwteam projects with a defined project scope and low level of uncertainty and improves efficiency in the Bouwteam. However, the quality of the design can be affected by the available costs.
- **Task budget:** this mitigation tool was mainly used in combination with a cost reimbursable payment method to limit budget overruns. This mitigation tool is based on function rates. However, this mitigation tool is not sufficient to limit budget overruns.
- **Price ceiling:** the price ceiling is a hard limit for the design costs, the main contractor and his third parties become responsible for design costs above the price ceiling. This mitigation tool is set as a last resort in the three Bouwteam projects (Case I, II and III). A hard limit in the budget can have a negative influence on the quality of the deliverables.
- **Milestones:** this mitigation tool was applied in Bouwteam IV in combination with a lump sum payment. This mitigation tool is based on the achieved goals of the contracting parties. A milestone payment stimulates parties to submit qualitative work in time, as they are rewarded for the completed tasks.
- **Budget margin:** this mitigation tool was applied in contracts between the main contractor and third party in Bouwteam project III and is used to mitigate the risk for budget overruns. The cost specification can deviate within the specified budget margin. If the cost specification, exceeds the specified budget margin, the main contractor and his third party become responsible for the additional costs.

The following non-monetary incentives were used in the Bouwteam projects:

- **Early involvement:** third parties with a significant responsibility for the design, are often involved in the tender phase of a construction project (prior to the Bouwteam phase). The early involvement of third parties is advantageous as knowledge is retained in the Bouwteam and reduces design errors.
- **Direct involvement:** in this case, a direct communication line is created between a client and third party (hired by the main contractor). Direct involvement is important for decision making, knowledge can be shared without the risk of information loss.
- **Network:** third parties are hired based on their network relation with the main contractor. A network relation is important for third parties and stimulates them to deliver qualitative work, in order to keep their reputation for future work.
- **Contract extension:** the third party is hired to execute tasks after the Bouwteam phase (design phase or other activities in the construction phase. Contract extension is not always considered as a positive incentive. First, there can be competitiveness between different third parties within the field. Secondly, a switch from cost reimbursable payment method in the Bouwteam phase and a lump sum payment method in the construction phase, can demotivate third parties to accept the job offer.

Next, the effect of the suggested monetary incentives are discussed:

- **Combination of payment methods:** two options were suggested to combine the payment methods to reduce the effect on budget overruns. No information was given how this combination in payment methods, would influence the performance of third parties in a Bouwteam. The two payment options are described below:
    - Lump sum payment method for certain tasks and the main contractor submits a subscription price for uncertain tasks
    - Lump sum payment method for certain tasks and a cost reimbursable payment method for uncertain tasks.
- **Risk sharing:** the shared responsibility in case of a budget overrun, can stimulate a party to improve their project control.
- **Risk pot:** a risk pot can stimulate parties to improve their project control. However, this incentive is sensitive to strategic behaviour. Third parties can choose not to report additional work, as this is deducted from the risk pot and affects their profit.
- **Incentive fee:** a fee based on the design costs, design planning or limiting staff. The incentive fee stimulates third parties to work more efficient but it may influence the quality of the design, as third parties are stimulated to spent less time, money or staff in the design phase. The incentive for limiting staff is suggested to keep the Bouwteam manageable for project control.
- **Bonus Malus:** The Bonus Malus concept is also mentioned by the third party in Bouwteam case I, according to this interviewee, this concept was applied in the tender phase and can possibly be implemented in the Bouwteam phase. However, the effect of both the extension of liability period and the Bonus Malus concept on the performance of third parties remain unknown.
- **Extend liability period:** The extension of liability period would be combined with a Bonus Malus system. The third party would receive a fee, if no design error is discovered in the construction phase. And the third party receives a fine if design errors are discovered in the construction phase. This contractual incentive is brought up to stimulate the third parties to deliver qualitative work.

The effect of the following suggested non-monetary incentives are discussed:

- **Bouwteam partners:** a combination of early involvement and direct involvement of a third party. The main contractor forms a partnership with an engineering firm in the tender phase of a construction project. This incentive can form a risk for the main contractor if the engineering firm does not meet the main contractor's satisfaction. In this case, the main contractor cannot easily terminate their contract with the engineering firm. No information was given, how the formation of Bouwteam partners would influence the performance of third parties in a Bouwteam
- **Third party defines the level of detail:** the designing third party defines the level of detail and the main contractor gives his approval after the work is reviewed. This incentive can improve the level of expectation between the main contractor and his third parties.

Lastly, KPI's are not considered as an contractual incentive, but as an additional tool for project evaluation, weekly project control or as a criteria for the incentive fees and the Bonus Malus concept. The majority of Bouwteam projects, implemented the KPI's in their MEAT plan, but are not used consistently. KPI's should be formulated in such a way that it is measurable. The following indicators were suggested: design costs, design planning, limit staff and innovation and sustainability. A summary of the effects of the contractual incentives are presented in appendix VI.

A preliminary framework is developed in the next chapter. This framework is divided in two parts. The first part aims at the client to implement suitable monetary incentives in the Bouwteam agreement (between the client and main contractor). The second part of the framework aims at the main contractor to implement suitable non-monetary incentives in contracts (between the main contractor and third parties).

Phase III Evaluation & final

Chapter 6 Framework development

This chapter presents the final framework for contractual incentives, which can be implemented by main contractors to influence the performance of third parties in a Bouwteam. The chapter starts with the preliminary framework in section 6.1, followed by the expert evaluation in section 6.2. This chapter presents the final framework and helps answering sub question 4: "How can the main contractor incorporate contractual incentives in contracts with their third parties?" in section 6.3.

6.1 Preliminary framework

It is mentioned in Chapter 5, that main contractors are willing to implement monetary incentives in their contracts with third parties, if these incentives are included in the Bouwteam agreement. These monetary incentives consists of the payment method and mitigation tools. The acquisition of the contractual incentives is called Back-to-Back contracting. This form of contracting is applied by the main contractor, as the risks can be transferred back to the client. Therefore, it is suggested for clients to first implement the suitable monetary incentives in the Bouwteam agreements, before the main contractors apply these incentives in contracts towards their third parties. With the information of the comparison of cases, presented in Chapter 5, a preliminary framework is set up. In this preliminary framework, an overview of contractual incentives is plotted against a timeline. The preliminary framework is categorised into two parts, step 1 and 2 aims at the client. Step 3 to 5 are contractual incentives incorporated by the main contractors towards their third parties. This preliminary framework is presented in Figure 12. The steps are described below:

STEP 1: Define the project scope, goal and the level of uncertainties

The goal of this step is to apply a suitable payment method, which is based on the project goal, project scope and the level of uncertainty in the Bouwteam project. The main project goals are: the design costs, design time, quality or client's satisfaction.

STEP 2: Set up a risk profile, which is based on the applied payment method and implement the most suitable mitigation tool(s)

By defining the risk profile, the client implements suitable mitigation tool(s). Step 2 consists of two categories. Step 2A, consists of standard mitigation tools which can be combined with the payment method, these mitigation tools are already applied in practice. Step 2B are additional mitigation tools, which were suggested by the interviewees in the case study.

STEP 3: Define which contractual incentives are applied in contracts with third parties

After the monetary incentives are applied by the client, the main contractor evaluates which monetary incentives are applied in the contracts with his third parties. It is also important for the main contractor to evaluate the risk and profit division with their third parties.

STEP 4: Define the involvement of the third parties

This main contractor evaluates the involvement of third parties in a Bouwteam project. The involvement of third parties should be based on their responsibility in the Bouwteam.

STEP 5: Incentive for future work

Many third parties are hired through their network relation with the main contractor. Case study results show, that future work is important as third parties desire to maintain their reputation towards the main contractor by delivering qualitative work.

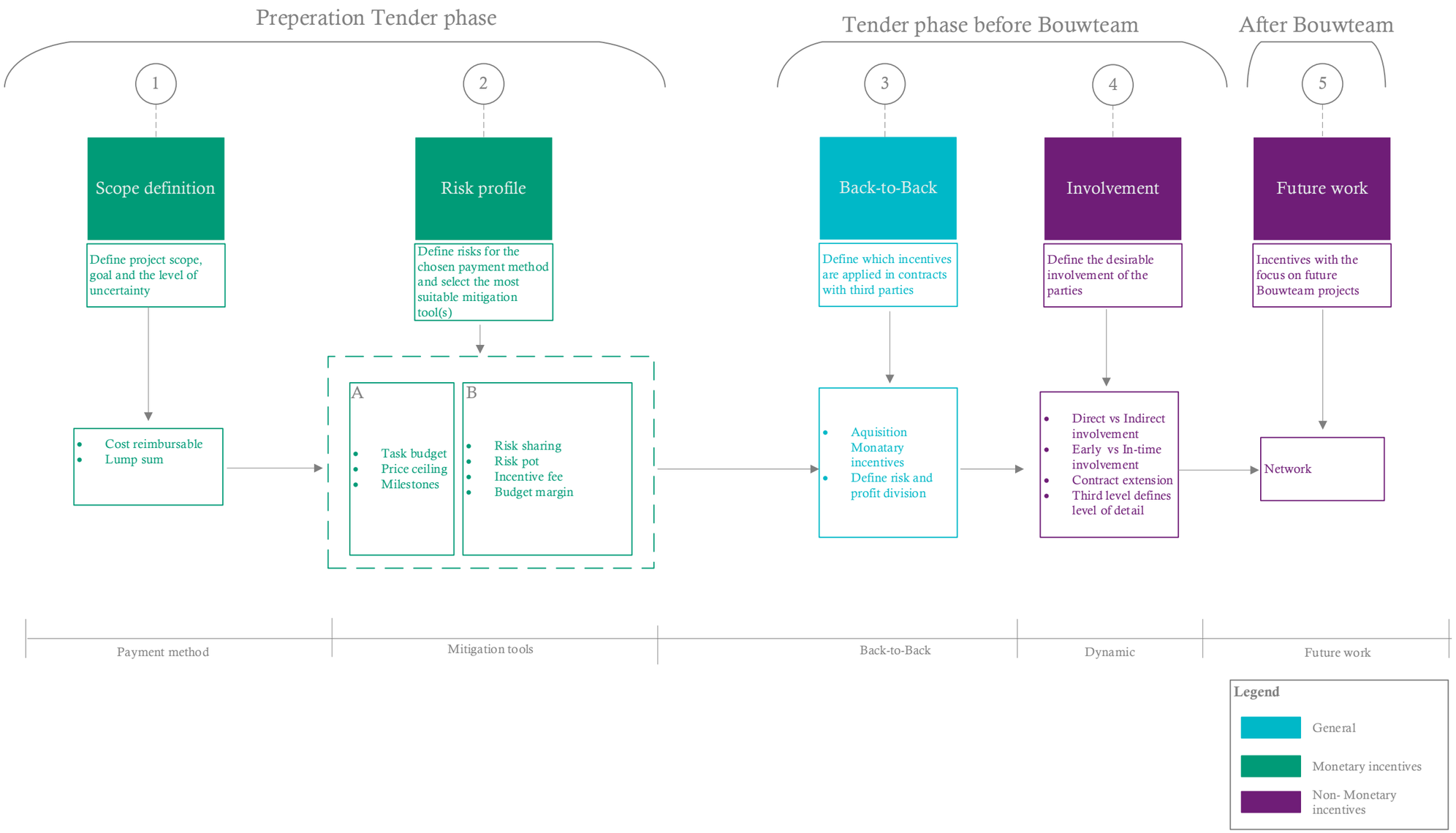


Figure 12 Preliminary framework of the contractual incentives between main contractors and their third parties

Point of discussion

Several suggestions on monetary incentives were shared during the interviews. However, no information was given how these incentive would affect the performance of third parties in a Bouwteam. These incentives are not presented in the preliminary framework, but will be discussed during the expert evaluation. The following incentives will be evaluated:

- **Lump sum for certain roles and subscription price for the uncertain tasks:** the client defines the certain and uncertain tasks. The client applies a lump sum payment method for certain tasks within the Bouwteam and the main contractor can submit a subscription price for the uncertain tasks.
- **Lump sum for certain roles and cost reimbursable payment method for uncertain tasks:** the client defines the certain and uncertain tasks. A lump sum payment method is used for the certain tasks and the client applies the cost reimbursable payment method for uncertain tasks.
- **Extend liability period:** the decision can be made to extend the liability period of a third party. In this case, the design errors will be tested in the construction phase. This incentive can be combined with a Bonus Malus concept. The third party receives a fee if no design error was found during the construction phase or they receive a fine if design errors occurred during the construction phase.
- **Bouwteam partners:** the decision can be made to form a partnership with an engineering firm, before entering the Bouwteam. The main contractor and the chosen third party become liable for 50%. A disadvantage is that, if the main contractor is not satisfied with the work of the engineering firm at the end of the tender phase, they remain contractually connected to that engineering firm.
- **Bonus Malus concept:** the parties receive a bonus which can be compared with an incentive fee and a fine for not meeting the client or main contractor's satisfaction.

6.2 Expert evaluation

The goal of this section is to evaluate the preliminary framework with the perspective of four experts within W+B. The experts are employed in different departments of W+B and fulfill the role as a contract manager, project leader or design leader. These experts have experience in several Bouwteam projects and were not involved in the empirical study. Due to inconvenience three evaluation sessions were planned, separate meetings are held with expert 1 and 2. Expert 3 and 4, participated in the third session which was mainly based on a discussion. A summary of the selected experts is presented in Table 6.

Table 6 Information of experts

Experts	Department	Specialisation	Role	Years of experience in W+B	Other	Session
E1	Infrastructure & mobility	Relational contracting	Tender manager, project manager, contract manager (current role)	23	Specialised in Bouwteam projects	Session 1
E2	Infrastructure & mobility	Replacement & renovation of construction works	Design and structural engineer, design and project leader (current role)	10	Specialised in Bouwteam projects	Session 2
E3	Energy, water and environment	Energy systems		6	Experience in several Bouwteam projects	Session 3
E4	Infrastructure & mobility	Risk driven contracting		6	Experience in several Bouwteam projects	

Prior to the expert sessions, an explanation is given on the purpose of this research and the preliminary framework. During the sessions, the suggested contractual incentives were evaluated. The experts could rate the different contractual incentives on the importance, willingness and practicability. A scale is given from 1 (strongly disagree) to 5 (strongly agree). The evaluation form has been filled in by expert 1 and 2 and are presented in appendix X. Expert 3 and 4 did not manage to fill in the evaluation form, as the meeting was led by a discussion.

Incentive fee

The experts shared their perspective on the incentive fee. The incentive fee is based on design costs, design planning, innovation and sustainability and limiting staff.

The experts can confirm that the design costs in Bouwteam projects can quickly increase. According to expert 2, time and costs can be saved on the introduction of the Bouwteam, where different parties focus on the collaboration. Expert 1 mentioned that the incentive fee has a different influence on the payment methods (cost reimbursable and lump sum). Based on the three themes, expert 1 would not recommend an incentive fee based on design costs for Bouwteam projects with a cost reimbursable payment method. In the cost reimbursable payment method there is already a build-in profit for third parties, this would possibly rule out the profit of the incentive fee. This incentive fee, would be more practical for Bouwteam projects with a lump sum payment method, as additional work is not automatically connected to higher payments. However, all four experts agreed that an incentive fee based on design costs and design planning can be disadvantageous for the quality, as a fee is granted to spent less time and costs on a design. Expert 2 and 4 further explained that the Bouwteam principle is to involve as many knowledge and experience in the Bouwteam phase, as an investment for innovative ideas to lower the total construction-or-maintenance costs. This makes a Bouwteam more

expensive. Expert 4 explained that the budget overruns of a Bouwteam are also caused by the modifications in project scopes, initiated by external stakeholders. Hence, it is more difficult for a third party to keep the design costs low. According to experts 3 and 4, the aim of the incentive fee for costs and planning should be on the entire construction project and not solely on the design phase.

Furthermore, the experts shared their opinion on an incentive fee based on innovative and sustainable ideas in the design. According to the experts it is complex to reward third parties on innovative and sustainable ideas in the Bouwteam phase, as this topic is subjective. Expert 1 and 2 explained that third parties are willing to implement innovative ideas. However, due to regulations, insufficient space is created for third parties to deliver innovative and sustainable designs. Furthermore, expert 3 and 4 explained that the outcome of innovation and sustainability is best seen in the construction phase and not in the Bouwteam phase. It is complex to measure the level of innovation and sustainability in the Bouwteam phase. It is also mentioned that this incentive can have a negative impact on the planning of the Bouwteam, as innovative and sustainable ideas often require more time.

Next, the experts were asked to share their perspective on an incentive fee based on limiting staff. The experts agreed that there is an importance to limit staff, as a compact Bouwteam size would be better to manage. However, expert 3 mentioned that it is not practical for third parties to limit their staff. The expert further explained that a great amount of load is placed on one designer, if this designer is placed full-time on one Bouwteam project. If this designer is prevented to execute the work for any reason, it becomes a risk for the third party. In this case knowledge can get lost, therefore third parties should remain flexible with involving staff in Bouwteam projects. Expert 3, also explains that this incentive can lead to an exceedance in planning and in some cases can affect the quality, as less staff is available to finalise the design. However it is mentioned that, the limiting of staff should be done for the key persons (between the client and the main contractor). According to expert 2, many times double functions are involved in the Bouwteam meetings, as a result of lack of trust.

Two remarks are given by expert 2 and 3 for the use of an incentive fee. According to expert 2, the influence of this mitigation tool on the collaboration between different parties in a Bouwteam project, should be evaluated. Furthermore, clear agreements should be made on how third parties will receive their profit. For instance, what percentage of fee will third parties receive if they fulfill the requirements, but the main contractor does not meet the requirements? The profit should also be in balance with the responsibility of the third party in the Bouwteam phase. Expert 3 suggested that there should be an incentive to stimulate better project control. The main contractors describe in the tender phase how they will manage project control in the Bouwteam- and- construction phase. In this case the incentive would be based on an award criteria in the tender phase.

Risk sharing, risk pot, budget margin and Bonus Malus concept

Based on the three themes (importance, willingness and practicability), the experts shared their perspective on risk sharing, risk pot, budget margin and the Bonus Malus concept. All experts asked if a profit is shared for the risk sharing and budget margin mitigation tools, as they are less willing to accept negative contractual incentives. This is substantiated by expert 1, who explained that risk sharing, budget margin and other forms of fines will stimulate third parties to focus more on the risk division and allocation rather than the technical work. Expert 4 recognises the importance of these mitigation tools but mentioned that this incentive should not be transferred to third parties. According to expert 4, the main contractor is able to recalculate their loss from the Bouwteam phase with a profit in the construction phase, a third party is not able to do this. It is also important to define why the budget overrun occurred. According to expert 4 budget overruns can also be caused by scope change initiated by external stakeholders. Expert 2 and 4, mentioned that the allocation of risks would be complex for third parties, as many parties in the Bouwteam are depended on each other.

Expert 1 mentioned that the Bonus Malus concept does not fit in the Bouwteam principle. This is explained by expert 4, who mentioned that the Bonus Malus concept can change the collaboration of third parties if a fine is issued. According to this expert, this incentive will affect the openness of parties in a Bouwteam.

Expert 2 further explains that the risk sharing, budget margin and the Bonus Malus concept, would not always affect the performance of main contractors. When a fine is issued in the Bouwteam phase, this will be recalculated in the cost specifications of the construction phase. It is also mentioned that the client would form a risk if they rewarded main contractors a fee in the Bouwteam phase and suffer losses in the construction phase. Expert 2, suggested a risk pot, between the client and the main contractor as a mitigation tool.

Lastly, expert 2 repeated that the risk and profit allocation should be defined in the tender phase. The following questions were asked: "What would happen if the third party meets the criteria for a Bonus, but the main contractor fails to meet their requirements?" "Is there a regulation that this third parties are paid max 50% of the bonus, if they meet the requirements, but their main contractor fail to meet their requirements?"

Contract extension

The experts shared their perspective on contract extension, where the third party is granted work in the detailed design phase or other tasks in the construction phase. According to expert 3, "good" performance of third parties is always granted with contract extension. According to this expert, this should not be included as a separate contractual incentive. However, it is stated by expert 4 that contract extension is not always granted to third parties after the completion of the Bouwteam phase. According to the expert, main contractors use their own expertise or less expensive third parties to finalise the detailed work. Hence, third parties put their focus on the Bouwteam phase, as they have a greater contribution, when compared to the construction phase. Expert 1, mentioned that a main contractor is not able to grant this insurance as they also have to place a bid at the end of a Bouwteam phase for their contribution in the construction phase.

Third party defines the level of detail

The experts were asked on their perspective on the incentive, to appoint third parties to define the level of detail, where the main contractor approves the proposal. According to expert 1 and 2, this incentive is sensitive to the different motives of the parties. It is explained that third parties and main contractors would prefer a high level of detailed work, which is translated to a higher payment (in case of a Bouwteam with a cost reimbursable payment method). This would insure third parties for more work. This incentive becomes attractive for main contractors, as many risks are mitigated in the Bouwteam phase. Expert 2 further explains that, it is difficult to define the level of detail in the initial phase of the Bouwteam project, as the project scope is undefined. Many times, other desires and requirements are made, at the moment the first design is presented.

Both expert 3 and 4 agree, that third parties should not define the level of detail, but they should be actively involved in the process for defining the level of detail. The most important here, is to tune expectations of the different parties. In this case an extra incentive would not add much in a Bouwteam phase. According to expert 3, the timing of this incentive is also important. Before, the Bouwteam agreement (tender phase) is signed, the level of detail should be defined. According to expert 4, this incentive would be strange as many specialists (parties) are needed in the tender phase, to define the level of detail.

Combining payment methods
The experts were asked to share their perspective on the combining payment methods. Where, the following two options are presented:
Option 1: Lump sum payment method for certain tasks and the main contractor submits a subscription price for the uncertain tasks.
Option 2: Lump sum payment method for certain tasks and cost reimbursable payment method for uncertain tasks.

The experts did not see a big difference between option 1 and a lump sum payment method. According to expert 1 and 2, the practicability of the combining payment methods, becomes complex in a Bouwteam project. Both experts mentioned that a designer can choose to book hours on uncertain tasks if there are no hours left to book on the fixed part of the payment.

Expert 3, rated the importance of the combining payment method low. According to this expert, a Bouwteam should be based on a cost reimbursable payment method. Expert 3 repeated that an incentive for project control would be of greater use. Where, these agreements are set up in the tender phase, on how the main contractor will control the Bouwteam project. It is suggested to appoint a person (main contractor) responsible for the project control, who evaluates the planning and budget weekly. Such a person should also evaluate if certain activities are necessary. The following example was given: in a Bouwteam designers and engineers are eager to do detailed work which may not be necessary, where the detailed work can take a week and cost €5000,- in order to save €3000,- in the construction phase. In this case it would not be necessary to do the detailed work.

Bouwteam partners
The experts are more willing to implement this incentive in the Bouwteam phase, but not in the construction phase. According to expert 4, the practicability of this incentive is low, as the goal of the main contractor and an engineering firm differs. The main contractor is involved in the construction phase, whereas the third party is only involved in the Bouwteam phase. In short, there is another turnover for the main contractor and third parties. According to expert 3 and 4, an early involvement should be sufficient. As, an engineering firm would not be accountable if a main contractor goes bankrupt.

Extend liability period
According to expert 1 and 4, it would not affect the performance of third parties if the liability period is extended in the construction phase. Expert 3, further explained that this would promote strategic behaviour, as third parties would organise extra quality checks and extra governance. Deploying these tasks leads to higher design costs. According to Expert 2, this incentive is not fair, as the engineering firms never calculate their costs specifications with a risk reservation. While, the main contractor always has a risk reservation. Expert 2 further explained that the risk should be allocated to the responsible party. However, in practice it is complex as there are many parties involved in the Bouwteam.

Overall evaluation on the preliminary framework
The experts were asked on their overall feedback on the preliminary framework, the following remarks were given:

- Expert 1: The allocation of the contractual incentives in different phases is complex
- Expert 2: A closed loop should be created in in the final framework, as the contractual incentives are monitored and adjusted during the Bouwteam phase.
- Expert 3: The question was asked who would implement these incentives and for who these incentives are intended.
- Expert 4: The allocation of the contractual incentives in the preliminary framework remains complex.

6.3 Conclusion

After conducting an expert evaluation, several modifications were done on the preliminary framework. First, a modification is done in the layout of the framework, as the phases, steps and allocation generated ambiguity during the expert meetings. Furthermore, the final framework is set up with a closed loop to implement the suitable contractual incentives. The closed loop is set up, as the implemented contractual incentives are monitored and adjusted during the Bouwteam phase. The final framework is divided into three parts. Part I, aims on the implementation of monetary incentives by the client in the Bouwteam agreement. The client first implements a suitable payment method, based on the project goal, project scope and the level of uncertainty. Secondly, the client applies suitable mitigation tools in combination with the payment method. Part II aims on the decision making of the main contractor towards his third parties. Part III aims at the incentive control, in this part the incentives are monitored and adjusted if needed. First, the main contractor evaluates which monetary incentives are implemented in contracts towards his third parties. This form of contracting is called Back-to-Back contracting and is advantageous, as the risks in the Bouwteam can be transferred back towards the client. The client can also set requirements, which monetary incentives should be transferred towards third parties of the main contractor. Based on the transferred monetary incentives, the main contractor should define the risk and profit division with his third party. This division should be equivalent to the responsibility of these third parties in the Bouwteam.

Furthermore, the contractual incentives in the final framework are modified. The incentive fee based on innovation and sustainability is removed from the framework, as these indicators are subjective and complex to measure, during a Bouwteam phase. The incentive for contractual extension is translocated in the future work category, as this incentive refers to the detailed design phase or activities during the construction phase, such as environmental management.

The following incentives, were placed in the point of discussion:

- Combining payment methods
- Extend liability period
- Bouwteam partners
- Bonus Malus concept

The incentive to use Bouwteam partners, is placed in the final framework. The remaining incentives (combining payment method, extend liability period and Bonus Malus concepts) are excluded from the final framework, as these incentives scored low on importance, willingness and practicability.

Lastly, the KPI's are included in the final framework, as the role of such indicators can be of great importance for project evaluation, project control and in combination with the incentive fee. The final framework is presented in Figure 13.

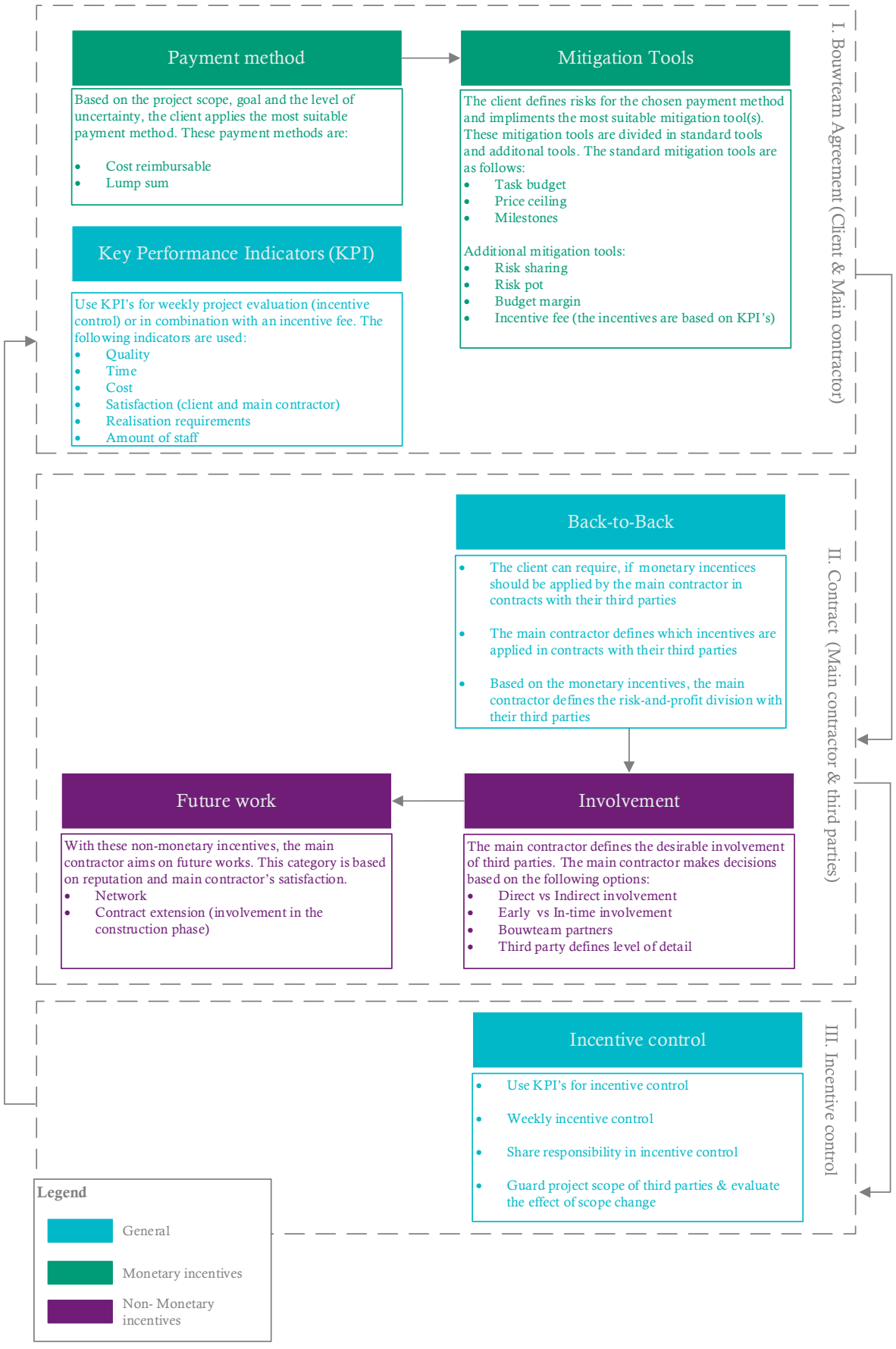


Figure 13 Final framework for contractual incentive between main contractors and their third parties

Part I: Bouwteam agreement (client & main contractor)

The first part of the final framework aims at the client. The client first applies the suitable payment method, based on the project scope, goal and the level of uncertainty. The following options are presented:

- **Cost reimbursable payment method:** the payment is based on the expenses made during Bouwteam phase. Applied in undefined projects scopes, with a high level of uncertainty. This payment method stimulates qualitative work, as the focus is on the design, rather than the modifications in the project scope. However, this payment method is sensitive to budget overruns.
- **Lump sum payment method:** the payment is based on a fixed price. This payment method is applied in defined project scopes, with a low level of uncertainty. This payment method stimulates efficiency, as parties are required to stay within budget. A disadvantage is, that every additional work leads to discussions, which can affect the quality of the deliverables.

After the payment method is implemented, a risk profile is set up by the client. The suitable mitigation tools are implemented, these tools consist of standard mitigation tools and additional mitigation tools. The following standard mitigation tools are presented:

- **Task budget:** this tool is a provisional budget determined by the client in the tender phase. This tool is mainly applied in combination with cost reimbursable payment methods, as this payment method forms a high risk for the client. The function of this tool is to limit budget overruns. However, the case results show that the application of this tool is not sufficient to limit budget overruns in the Bouwteam phase.
- **Price ceiling:** this tool is mainly applied in combination with cost reimbursable payment methods. The client sets a hard limit for the budget spent during the Bouwteam phase. Main contractors are held responsible, if they exceed this price ceiling. The case results show that this tool is mainly applied as a last resort for the task budget.
- **Milestones:** this tool can be applied for both the cost reimbursable and lump sum payment method. The main contractor is paid in several terms. These payment terms are based on redescribed milestones. This mitigation tool stimulates the main contractor to deliver a qualitative design within time, as the achievement of work is rewarded.

The additional mitigation tools are presented below:

- **Risk sharing:** the additional costs in budget overruns are shared with the main contractor. This incentive can increase the sense of responsibility for main contractors. The exact distribution of responsibility has to be defined in the tender phase. However, main contractors can recalculate the loss in the Bouwteam phase in their cost specifications for the construction phase. it not advised to transfer this mitigation tool towards third parties.
- **Risk pot:** a joint risk pot is set up between the client and the main contractor. The remainder of the risk pot is shared between the client and the main contractor. However, this tool can stimulate strategic behaviour for main contractors, as they can decide not to report additional work. Additional work will have a direct effect on profit. It is not advised to transfer this mitigation tool towards third parties.
- **Budget margin:** main contractors submit their cost specifications in different phases of the Bouwteam phase. The total costs of the design may deviate within the specified margin. If the actual costs exceed the specified margin, the main contractor are held responsible for the remaining costs. This incentive motivates parties to design more in depth. It is not advised to transfer this mitigation tool towards third parties.
- **Incentive fee:** a fee is granted, based on the implemented KPI's.

Lastly, the KPI's are added as an additional tool for project evaluation, weekly project control and in combination with an incentive fee. The following indicators are suggested:

- **Quality:** in case of an incentive fee, a fee is granted for meeting the required quality level. Quality can be measured by the number of defects in the design.
- **Design costs:** in case of an incentive fee, a fee is granted if the design costs are lower than the budget. An incentive fee based on design costs can have a negative impact on the quality, as a third party is rewarded for spending less costs on a design.
- **Design planning:** in case of an incentive fee, a fee is granted if the design time is lower than the estimated planning. An incentive based on design planning can have a negative impact on the quality, as a less time spent on a design is rewarded.
- **Satisfaction (client or main contractor):** in case of an incentive fee, a fee is granted if the party meets the satisfaction of the client and main contractor.
- **Realisation requirements:** this category consists of the following: risk management, constructability and maintainability.
- **Amount of staff:** in case of an incentive fee, a fee is connected to the amount of staff included in the Bouwteam.

Part II: Contract (main contractor & third parties)

The second part of the final framework aims at the main contractor to implement non-monetary incentives in contracts (between the main contractor and third parties). The application of these incentives are included in contracts between the main contractor and their third parties. First, the main contractor evaluates, which contractual incentives from the Bouwteam agreement are passed on in the contracts towards their third parties. The client can set requirements for the acquisition of contractual incentives in contracts between the main contractor and third parties. It is of great importance that the main contractor set up an agreement on risk and profit division with their third parties. As stated in part I, it is not advised to transfer the risk sharing, risk pot and budget margin towards third parties. As there is a high level of dependency between third parties in a Bouwteam, is becomes complex to appoint a risk to one third party.

Secondly, the main contractor evaluates the involvement of third parties in the Bouwteam. The following options can be applied:

- **Direct vs Indirect involvement:** Based on the expertise of the third party, the main contractor can decide to include a third party in Bouwteam meetings. Third parties can directly share their knowledge with the client in a direct involvement. This becomes important for decision making. However, direct involvement will affect the design costs, as third parties are spending more time in Bouwteam meetings. It is also possible for third parties to have an indirect involvement with the client. In this case, the main contractor functions as an intermediary between the client and the third party. A disadvantage is, that there is a risk for information loss.
- **Early vs In-Time involvement:** Based on the expertise and responsibility of the third party, the main contractor can decide to include the third party in the tender phase. in an early involvement, knowledge is retained in the Bouwteam. The involvement of third parties in a Bouwteam have an influence on the design costs.
- **Third party defines the level of detail:** in order to tune the expectations of different parties, the main contractor can appoint the third party do define the level of detail. Afterwards, the main contractor approves this proposal. This incentive is sensitive to the different motives of the parties in a Bouwteam. Both the main contractor as third parties would prefer a design with a high level of detail, as the main contractor can mitigate risks. A high level of detail will ensure a greater amount of work for third parties, which translates in more payment, in case of a cost reimbursable payment method.

The contribution of the third parties in the future can be evaluated during the Bouwteam phase. The main contractor can apply the following contractual incentives for future works:

- **Contract extension:** the main contractor can decide to extend the contract with their third parties in the construction phase. For instance for the detailed design phase or environmental management in the construction phase.
- **Network:** main contractors mainly hire third parties, based on their network relation. This incentive stimulates third parties to deliver qualitative work as they desire to maintain their reputation for future work.

Part III: Incentive control

A third part is added to the framework for incentive control, the aim is to monitor the incentives and to make adjustments if needed. The main contractor is responsible for weekly incentive control and guards the project scope of his third parties. The main contractor also shares the responsibility for project control with his third parties and organise periodic incentive control sessions. The KPI's are of great use in incentive control.

Chapter 7 Discussion

In this qualitative research, the different perspectives on contractual incentives and performance in a Bouwteam, are studied. This is done by conducting a multiple case study, in which the client, main contractor and third parties shared their knowledge on contractual incentives and performance. Previous studies in Bouwteam, mainly focussed on the collaboration between the client and the main contractor. This research provides new insights, on the influence of contractual incentives between the main contractor and his third parties on the performance of third parties (employed by the main contractor).

The discussion is presented in this chapter. In section 7.1, the research validity is addressed. Followed by section 7.2, which covers the different research limitation. Section 7.3, describes the research contribution. Lastly, section 7.4, presents the additional findings.

7.1 Research validity

According to Yin (2009), case study designs needs to maximize their quality through the following four critical conditions: construct validity, internal validity, external validity and reliability. The internal validity is valid for explanatory studies (Yin, 2009). The remaining three conditions are described below.

Construct validity

According to Yin (2009, p. 41), the construct validity is evaluated through the use of multiple sources, the establishment of evidence and the implementation of key informants to review the case study.

A final framework was developed as a result of the literature study, case study and an expert evaluation. This research starts with a literature study. The resources mainly consisted of academic papers, master thesis, legal documents, lectures and books. These resources were derived from the repository of TU Delft, google scholar, research gate and web of science. The literature study terminated with a theoretical framework, which was applied as a structure for the interviews conducted in the multiple case study. The case study consisted of a document research and interviews of thirteen participants. The contractual incentives and the performance of different parties (the client, main contractor and third parties) were compared. A further explanation of the case study method is presented in Chapter 3.

Four experts within W+B participated in sessions. These experts evaluated the preliminary framework, which was based on the case study results. An analyses was conducted with findings from the literature study, case study and the expert evaluation. Thereafter, a final framework was developed.

External validity

Yin (2009, p. 41), indicates that a replication logic should be applied for a multiple case design. First, a selection criteria was set up in the case study method, presented in Chapter 3. Each case had the following characteristics:

- A Bouwteam
- A substantial part of the design responsibility was transferred towards the main contractor and his third parties
- The recent Bouwteam models (DG2020 and BN2021) were applied as a guideline, and was based on the TNR 2011
- The Bouwteam consisted of a client, main contractor and at least one third party (employed by the main contractor)
- The Bouwteam phase was finalized

Furthermore, the participants fulfilled the role of a contract manager, project manager, technical manager, design/ project leader and project coordinator.

Lastly, the interview set up was consistent for all the interviews. Every interview had the following categories: general questions, monetary incentives, KPI's, non-monetary incentive and project goal and project evaluation. However, a semi structured interview method was chosen. Several additional questions were asked based on the course of the interview. The main goal of the interviews was to compare the different perspectives on contractual incentives and performance in the Bouwteam.

Reliability

Lastly, Yin (2009, p. 41), indicates that a case study protocol and the development of the database should be defined properly. Yin (2009), further explains that the purpose of the reliability is to minimize the errors and biases in the research.

Prior to each interview, the purpose of this research was explained verbally an through the informed consent form, presented in appendix VII. Sub section 3.4.2, gives an elaborate explanation on the interview protocol. Furthermore, the ATLAS.ti application was applied to code anonymised statements of the participants. An overview of the coding system is given in section 3.5.

In one Bouwteam case, a main contractor and third party (sister company) were interviewed. When, the participants were asked on contractual incentives to improve performance, it became clear that there were no points of improvements between the main contractor and this third party. Therefore, an additional interview was planned with an independent third party.

7.2 Research limitations

There were several limitation in this research. The following limitation applied to the research:

- **Design phase:** the contractual incentives in this research are limited to the design phase of a Bouwteam project. It was stated during the expert evaluation that aspects such as costs and planning should be focussed on the duration of the construction project (Bouwteam phase and construction phase, and in some cases also the maintenance).
- **Strategic behaviour:** in one Bouwteam case, there was a high level of sensitivity. The participants were cautious with their statements on the performance of other parties. They wanted to make sure that the interview would not jeopardise their reputation. Furthermore, the nature of the research prevented participants to be open on their own performance. In many cases, it was stated that there were no points of improvement when it came to performance of their own work. Therefore, the questions of the same nature was asked to other parties. After which the comparison was made in contractual incentives.
- **Unequal knowledge and experience in the Bouwteam concept:** during the interviews and the expert evaluation it became clear that the knowledge and experience with the Bouwteam concept differed.
- **Availability of documents:** the case study consisted of a document research and the interviews. It was planned to conduct a document research prior to the interviews. In many cases the documents were send after the interviews. The Bouwteam agreements were available for research. Due to confidentiality, the contracts between the main contractor and their third parties and the plan of requirements were not shared. The interview questions were adjusted accordingly to inform about the applied contractual incentives in the contracts between the main contractor and his third parties.

7.3 Research contribution

Although existing literature addresses the collaboration in Bouwteam projects, this study focusses on the relation between the main contractor and his third parties. This research contributed to a wider understanding of how contractual incentives could impact the performance of third parties in a Bouwteam. The final framework was a combination of findings from the literature study, case study and the expert evaluation. The findings of the different phases are described in this section.

Payment method

The payment methods are presented differently in the theoretical framework and the results of the case study. Literature shows that the cost reimbursable payment method and the different variants, are suitable for an ECI project (Bakker et al., 2014; Leijten, 2020). The different variants were: Cost Plus Fixed Fee (CPFF), Cost Plus Incentive Fee (CPIF) and Cost Plus Award Fee (CPAF) (Leijten, 2020). The variants were a combination of a payment method and a mitigation tool. In the case study the payment methods were separated from the mitigation tools. For example: CPIF became a cost reimbursable payment method in combination with an incentive fee. The CPAF, however, is based on a cost reimbursable payment method in combination with an award fee, which is based on the client or main contractor's satisfaction (Stukhart, 1984). The client and main contractor's satisfaction was not mentioned during the interviews. It is possible that "satisfaction" is not mentioned, as it is an indicator which is subjective and complex to measure. The client and main contractor's satisfaction is included in the final framework, as literature shows the importance of this indicator (Molaei et al., 2021; Rose & Manley, 2010; Shenhar et al., 2001; Yan et al., 2019).

Next, the lump sum payment method, was introduced as a suitable payment method in case IV. This Bouwteam project proved the possibility to use a lump sum payment method for a project delivery method with a relative high level of uncertainties. Main contractors and third parties are less in favour of the lump sum payment method in a Bouwteam. The reason can be substantiated from Figure 8. A lump sum payment method forms a high level of risks for the main contractor and his third parties (David King, 2015). However, this payment method is included in the final framework as parties are stimulated to work more efficient. The risks of a lump payment method can be mitigated with a milestone payment, which was applied in case IV.

Mitigation tools

Three mitigation tools were shared in the literature study: Bonus Malus, risk pot and target pricing. The Bonus Malus concept was suggested twice in the case study results. This concept was first mentioned in case I, as the Bonus Malus concept was used in the tender phase. Secondly, the Bonus Malus concept was suggested in a combination with the extension of liability period for third parties. In contrary, the experts were not in favour to implement a Bonus Malus concept in a Bouwteam. According to them, penalties (negative incentives) can damage future collaboration between the parties after the Bouwteam phase. Therefore, the Bonus Malus concept is excluded from the final framework.

The risk pot was mentioned several times in the case study and was also considered as an incentive in the literature study (Ooms, 2021). However, the experts were not in favour to implement this mitigation tool, as the risk and profit division of third parties are different from the main contractor. The risk pot is included in the final framework, as this mitigation tool stimulates main contractors to improve their project control.

Target pricing was included in the theoretical framework, but is excluded from the final framework, as this incentive aims at the design and construction phase (Molenaar et al., 2007). This research is solely focussed on the Bouwteam phase. the nearest incentives which can be used in place of target pricing, is a task budget in combination with a risk pot.

The incentive fee was mentioned in the payment methods (Cost Plus Incentive Fee) presented in the literature study and is also mentioned in the case study (Leijten, 2020). This incentive fee is included in the final framework and is based on the KPI's, which are described below.

KPI

In contrary with the literature study, quality was mentioned once in the case study results, to use as a KPI. An interviewee, mentioned that quality was a complex indicator to measure during the Bouwteam phase. Secondly, one of the reasons to work in a Bouwteam, is to meet a certain level of quality. It is possible that the interviewees stated quality as an obvious factor, that this was not mentioned separately. The literature shows that quality is an important performance indicator and that it can be measured by the number of defects in the design (Molaei et al., 2021; Rose & Manley, 2010; Yan et al., 2019). For this reason, quality is included as a KPI in the final framework.

The following indicators were included in the theoretical framework, but were not addressed during the case study: risk management, constructability and maintainability. As mentioned in the literature study, an advantage of a Bouwteam is that the main contractor shares his knowledge from the construction phase in the design phase (Chao et al., 2020). Early involvement of the main contractor has an advantage as risks are mitigated in the design phase (Chao et al., 2020). Which results that the constructability and maintainability of the design is of great importance in Bouwteam projects. Therefore, risk management, constructability and maintainability are included in the final framework.

As it is already explained in the payment method, the client and main contractor's satisfaction is included in the final framework, as the literature study shows the importance of this indicator (Molaei et al., 2021; Rose & Manley, 2010; Yan et al., 2019).

The limitation of staff is a new finding compared with the literature study. The experts were not in favour of using this incentive to minimize staff, as this incentive limits their flexibility. However, in all the Bouwteam projects, it is mentioned that the Bouwteam size impacted the project control. Therefore, the incentive to minimize the staff in a Bouwteam, is included in the final framework.

Involvement

Early involvement was mentioned in the literature study (Rose & Manley, 2010). However, this incentive was not included in the theoretical framework, as it was unknown how third parties would be involved in an earlier stage. During the interviews, it was explained that early involvement mainly referred to the tender phase. The interviewees also mentioned direct and indirect involvement, which was not yet mentioned in the literature study. Furthermore, Bouwteam partners was mentioned as a combination of early and direct involvement.

In addition to the literature study, an interviewee mentioned to let third parties define the level of detail. This incentive is suggested to improve the level of expectation between the main contractor and his third parties. Therefore, this incentive is included in the final framework.

Future work

The future work in the theoretical framework consisted of a network relation and is also used in Bouwteam projects (Rose & Manley, 2010). The contract extension was excluded from the theoretical framework, as no information was available how this incentive was applied for third parties in a Bouwteam. The case study results show that there are various tasks for third parties after the Bouwteam phase. The third party can be hired for the detailed design phase, environmental management or for executing other tasks. Therefore, the contract extension is included in the final framework.

Back-to-Back contracting
Main contractors are willing to implement monetary incentives in contracts towards their third parties if these incentives were included in the Bouwteam agreement. This form of contracting is called Back-to-Back contracting. Main contractors use Back-to-Back contracting as the risks can be transferred back to the client.

Project control
In addition to the literature study, an extra category is added to the final framework. The function of this framework is to monitor incentives and to make adjustments if needed. This category was suggested by the interviewees and an expert. More attention is needed in project or incentive control as it is mentioned in an interview that budget overruns are reported late, as a result of a lack of project control.

7.4 Additional findings
The following additional findings were brought up during the process of this research:

- **Mindset:** this research was based on finding contractual incentives to influence the performance of third parties. During the expert evaluation it became clear that many contractual incentives can stimulate strategic behaviour. Therefore, it is important to focus on incentive control.
- **Lack of trust between parties:** during the expert evaluation and several interviews, it became clear that many key figures (personal from the client and main contractor), were involved during the Bouwteam meetings. It is stated that double functions were deployed in the Bouwteam. According to one expert this is caused by the lack of trust between the client and the main contractor.
- **Different Bouwteam compositions:** according to an interviewee, the Bouwteam agreement should be an agreement between the client, the main contractor and an engineering firm. This was suggested as these parties have different interests.
- **Framework contracting:** it was mentioned that the implementation of framework contracting can have a positive influence on the performance in a Bouwteam. As mentioned in the literature study, this research aims on single Bouwteam projects. However, contractual incentives from the final framework can be used in a framework contract. Future, research should show how the final framework can have an effect on the performance of third parties in a Bouwteam.

Chapter 8 Conclusion & Recommendations

This chapter provides a conclusion of the main research question by first answering the sub questions, with information gathered from the literature, empirical study and expert evaluation. This chapter further includes recommendations for practice and future research.

8.1 Conclusion

The aim of this research is to study, how contractual incentives can be employed by main contractors, to influence the performance of third parties in a Bouwteam. Furthermore, this research is focussed on the design phase of a construction project. First, the contractual incentives in an Early Contractor Involvement (ECI) project, are studied. Which leads to the first sub question:

Sub question 1: Which contractual incentives can be used during the design phase of an ECI project?

Contractual incentives are applied to influence parties within the ECI project to meet the following project goals: quality, cost, time and main contractor's satisfaction. Contractual incentives can be divided into monetary and non-monetary incentives. The monetary incentives refer to the payment method and risk sharing concepts. Literature shows, that the cost reimbursable (or cost plus) payment method is suitable for an ECI project, the payment is based on the expenses in the design phase. The following variants of the cost reimbursable payment method, can be used in an ECI project:

- **Cost Plus Award Fee (CPAF):** a payment based on the expenses made in the design phase and a fee is granted, based on the main contractor's satisfaction.
- **Cost Plus Fixed Fee (CPFF):** a payment based on the expenses in the design phase in combination with a fixed fee.
- **Cost Plus Incentive Fee (CPIF):** a payment based on the expenses made in the design phase and a fee is granted, based on a predefined criteria.

Furthermore, different options are available for risk sharing:

- **Risk pot:** a joint risk pot made in case of budget overruns. The residual amount is shared between the parties.
- **Bonus Malus:** a fee is granted, if third parties meet the main contractor's satisfaction. In contrary, a fine is granted if third parties, do not satisfy the desire of the main contractor.
- **Target price:** a target price is estimated in the tender phase, the price is based on an invoice of third parties and is based on the design costs and costs of the construction phase.

The network relation is presented as a non-monetary incentive, which stimulates parties to deliver qualitative work, to be able to keep their reputation. Furthermore, literature shows, that Key Performance Indicators (KPI) are additional tools for project evaluation, the following indicators are of importance in the design phase of an ECI project: quality, cost management and time management, risk management, constructability, maintainability and innovation.

Sub question 2: Which contractual incentives are currently used in practice in the design phase of Bouwteam projects?

A multiple case study is conducted with four Bouwteam projects. Thirteen interviews were done with practitioners as a client, main contractor and a third party. The following monetary incentives, are applied in the Bouwteam phase:

- **Cost reimbursable payment method:** a payment based on the expenses made in the Bouwteam phase.
- **Lump sum payment method:** a payment based on a fixed price.
- **Task budget:** a target price based on function rates.
- **Price ceiling:** a hard budget. The main contractor and third parties are held responsible for costs above the price ceiling.
- **Milestones:** a payment based on the achieved milestones.

The following non- monetary incentives, are applied in the Bouwteam phase:

- **Network:** the third party is hired by the main contractor through their network relation.
- **Contract extension:** the third party is granted a contract extension to execute work in the detailed design phase or the construction phase.

Sub question 3: How can contractual incentives affect the performance of third parties in a Bouwteam?

After conducting the comparison of cases in Chapter 5, a brief summary can be given on the influence of contractual incentives on the performance of third parties in a Bouwteam. These contractual incentives are divided in monetary and non-monetary incentives. The monetary incentives consists of the payment methods and mitigation tools. Non-monetary incentives consist of the involvement of third parties and future work.

The following payment methods can have an influence on the performance of third parties:

- **Cost reimbursable payment method:** a payment is based on the expenses made during Bouwteam phase. This payment method is applied in undefined projects scopes, with a high level of uncertainty. This payment method stimulates qualitative work, as the focus is on the technical work rather than the modifications in the project scope. However, this payment method is sensitive to budget overruns.
- **Lump sum payment method:** applied in defined project scopes, with a low level of uncertainty. This payment method stimulates efficiency, as parties are required to stay within budget. However, every additional work leads to discussions, which can affect the design planning and the quality of the design products.

The following standard mitigation tools can have an influence on the performance of third parties:

- **Task budget:** this tool is a provisional budget, determined by the client in the tender phase. This tool is mainly applied in combination with cost reimbursable payment methods, as this payment method forms a high risk for the client. The function of this tool is to limit budget overruns. However, the case results show that the application of this tool is not sufficient to limit budget overruns in the Bouwteam phase.
- **Price ceiling:** this tool is applied in combination with cost reimbursable payment methods, the client sets a hard limit for the budget spent during the Bouwteam phase. Main contractors and their third parties are held responsible, if they exceed this price ceiling. This tool stimulates efficiency, as a limit is set for design costs. The case results show that this tool is mainly applied as a last resort for a task budget.
- **Milestones:** this tool can be applied for both the cost reimbursable and lump sum payment method. The main contractors and their third parties are paid, based on their achieved performance.

The following additional mitigation tools can have an influence on the performance of third parties:

- **Risk sharing:** the additional costs in budget overruns are shared with the main contractor. This incentive can increase the sense of responsibility and awareness for main contractors for better project control of their own costs and the costs their third parties. The exact distribution of responsibility has to be defined in the tender phase.
- **Risk pot**: a joint risk pot made between the main contractors and their third parties in case of budget overruns. This incentive can increase the sense of responsibility and awareness for the main contractors for better project control.
- **Budget margin:** the actual expenses in the design phase, may deviate within the specified margin. If the expenses are higher than the specified margin, main contractors and their third parties are held responsible for the additional costs. This incentive, motivates both the main contractor and their third parties to improve their cost estimations.
- **Incentive fee,** the variants are based on the following:
    - **Design costs:** a fee is granted, if the actual costs for the design are lower than the budget. This incentive stimulates efficiency. However, the quality of the design can be affected, as a fee is granted for limiting the design costs.
    - **Design planning:** a fee is granted, if less time is spent on the design planning. This incentive stimulates efficiency. However, the quality of the design can be affected, as a fee is granted for limiting the time spent on the design.
    - **Limiting staff:** A fee is granted for limiting staff. This incentive is applied for better project control, as "bigger" Bouwteam projects are more complex to financially manage. However, the design planning and quality can be affected, as there is less staff to finalise the design.

The non-monetary incentives are divided in the involvement of third parties in Bouwteam projects and future work. The following options of involvement, have an influence on the third parties in a Bouwteam:

- **Direct vs Indirect involvement:** based on the expertise of the third party, the main contractor can decide to include a third party in Bouwteam meetings. In a direct involvement, third parties can directly share their knowledge and expertise with the client. This becomes important for decision making. In case of an indirect involvement, the main contractor functions as an intermediary, where there is a risk for information loss. Direct involvement of third parties in a Bouwteam, can lead to higher design costs, as third parties are present at Bouwteam meetings.
- **Early vs In-Time involvement:** based on the expertise and responsibility of the third party, the main contractor can decide to include the third party in the tender phase. An advantage of early involvement is that knowledge is retained in the Bouwteam. The involvement of third parties in the tender phase can have an influence on the design costs. The main contractor can also decide to include a third party in later phases.
- **Third party defines the level of detail:** in order to tune the expectations between the main contractor and third parties, the main contractor can appoint the third party do define the level of detail. The main contractor approves the proposal after a review is done.

The contribution of third parties in the future works, can have influence on their performance. The following incentives can have an influence on the performance of third parties in a Bouwteam:

- **Contract extension:** main contractors can decide to extend the contract with their third parties in the construction phase. For instance for the detailed design phase or environmental management in the construction phase. The contract extension can stimulate third parties to meet the project requirements, as they desire to maintain their reputation.
- **Network:** main contractors mainly hire third parties, based on their network relation. This incentive stimulates third parties to deliver qualitative work as they desire to maintain their reputation for future work.

Lastly, the KPI's are added as an additional tool and can create structure for project evaluation, weekly project control and incentive fees. The following indicators are applied: design costs, design planning, and the amount of staff.

Sub question 4: How can the main contractor incorporate contractual incentives in contracts with their third parties?

The majority of monetary incentives in contracts between the main contractors and his third parties are taken over from the Bouwteam agreement. This form of contracting is called Back-to-Back contracting and is attractive as the risks in the Bouwteam phase can be transferred back to the client. A framework is set up in three parts. In part I the client applies the suitable monetary incentives (payment method and mitigation tools). After the first part of the framework is completed, the main contractor can evaluate which monetary incentives from the Bouwteam agreement are transferred towards his third parties. The client can also set requirements, which monetary incentives should be transferred towards third parties of the main contractor. Based on the monetary incentives, the main contractor should define the risk and profit division with his third parties. This division should be based on the responsibility of these third parties. Furthermore, the main contractors define the desired involvement of their third parties in the Bouwteam. Followed by the incentives for future works.

The function of the third part is to monitor incentives and to make adjustments if needed. The main contractor uses the KPI's for weekly incentive control and guard the project scope of his third parties. The KPI's are additional tools which can also be used for project evaluation or as a reward criteria for incentive fees. The main contractor also shares the responsibility in incentive control with his third parties and periodic sessions are organised for project control.

Main research question: How can contractual incentives in the design phase of Bouwteam projects be employed by main contractors to influence the performance of their third parties in such a way that Bouwteam goals are met?"

In the recent Bouwteam models (DG2020 and BN2021), more design responsibility is shifted towards the main contractors and their third parties. The case study results, show that the third parties execute a substantive part of the design. Hence, research is done how contractual incentives can be employed by the main contractor, to influence the performance of their third parties, in such a way that the Bouwteam goals are met.

Contractual incentives can be divided into monetary and non-monetary incentives. The monetary incentives consist of payment methods and mitigation tools. The non-monetary incentives are mainly focused on the reputation of third parties.

Main contractors apply monetary incentives in contracts towards their third parties, if these monetary incentives were included in the Bouwteam agreement. This is done, as the main contractor can transfer the risks back to the client. This form of contracting is called the Back-to-Back contracting.

Therefore, it is recommended that the client first implements the suitable monetary incentives, after which the main contractor evaluates, which incentives are applied in contracts towards his third parties. The client can apply a cost reimbursable or a lump sum payment method.

Next, the client defines a risk profile based on the applied payment method. The following mitigations tools can be applied: task budget, price ceiling, milestone payment, risk sharing, risk pot, budget margin and an incentive fee. The incentive fee is based on the applied KPI's. The following indicators can be used in the Bouwteam phase: quality, design costs, design planning, satisfaction (client and main contractor), realisation requirements (risk management, constructability and maintainability) and amount of staff. These KPI's can also be used for incentive control and project evaluation.

The non-monetary incentives are divided in the involvement of third parties in Bouwteam projects and future work. The involvement of third parties in a Bouwteam, consists of the following options:

- Direct vs Indirect involvement
- Early vs In-Time involvement
- Third party defines the level of detail

The contribution of third parties in the future works, can have influence on their performance. The main contractor can grant his third party a contract extension for the detailed design or to execute other activities in the construction phase. The main contractor can also use the network relation as an incentive towards his third parties. These incentives stimulate third parties to deliver qualitative work to keep their reputation.

Lastly, the category of incentive control is added to the final framework, the function of this category is to monitor incentives and to make adjustments of needed. The main contractor is responsible for weekly incentive control and guard the project scope of hist third parties. The responsibility in incentive control is shared with third parties and periodic sessions are organised between the main contractor and his third parties. The KPI's presented in the final framework are also used for incentive control.

The final framework for contractual incentives between the main contractor and his third parties is presented in Figure 14.

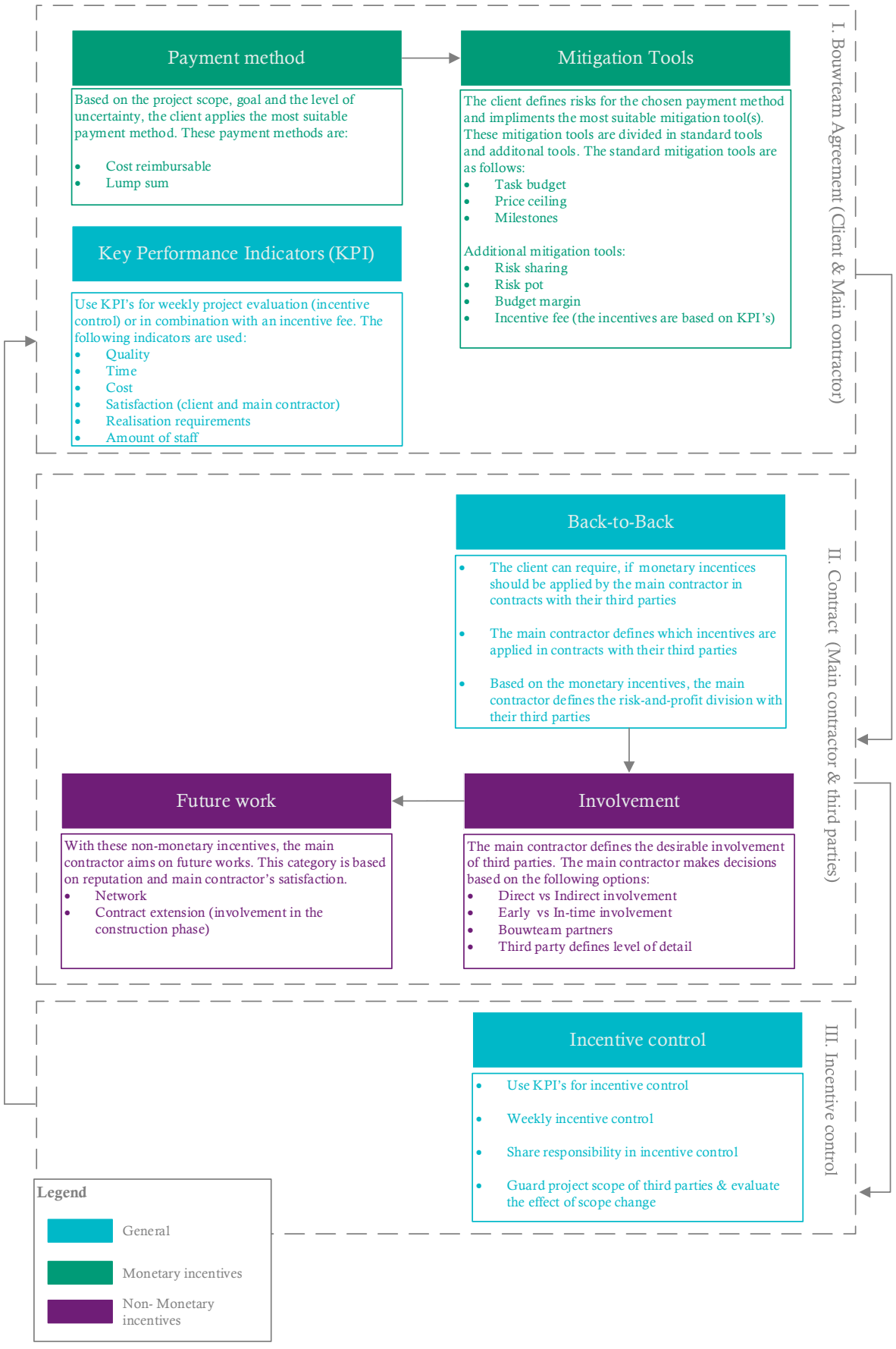


Figure 14 Final framework for contractual incentives between main contractors and their third parties

8.2 Recommendations

During the theoretical and empirical study, different topics are mentioned, which can be applied in practice or in future research.

8.2.1 Recommendations for practice

- **The client**
  - Responsibility in implementing monetary incentives: the case results show that main contractors are less sensitive to implement monetary incentives towards their third parties, if these incentives were not included in the Bouwteam agreement.
  - Set requirements for the main contractor in acquisition of incentives
  - Include all designing parties in meetings that will have an effect on the design
- **Main contractors**
  - Use KPI's for improvement project control
  - The main contractor should be more involved in project control and should evaluate the estimated design costs for the Bouwteam. In this evaluation the expenses are compared with the budget on a weekly basis.
  - Guard the project scope of third parties and evaluate the effect scope change has on third parties
  - Share responsibility of project control with third party
- **Third parties**
  - Use KPI's for improvement project control
  - Evaluation of project control with the main contractor

8.2.2 Recommendations for future research

- **Project control:** this research aimed at contractual incentives to improve performance, however, it became clear that there is a main issue in project control in Bouwteam projects with a cost reimbursable payment method. Therefore a study is recommended to fully focus on project control in a Bouwteam project.
- **Bouwteam agreement between the client, main contractor and an engineering firm:** According to a third party, a Bouwteam should be an agreement between the client, the main contractor and an engineering firm. The suggestion was based on the fact that the three parties have different goals. The third party further explained that engineering firms have no benefits after the Bouwteam (construction phase). This topic is not included in this research, as this research was solely focussed on Bouwteam agreements between the client and the main contractor. Future research can be done on how this Bouwteam composition would work in practice. And how this would affect the overall performance of the parties in the Bouwteam.
- **Mindset:** it is recommended to do research how strategic behaviour can be minimized in a Bouwteam, as it became clear that the implementation of contractual incentives can stimulate strategic behaviour. In this study the focus can be on change management in an ECI or Bouwteam project.
- **Framework contracting:** the research was based on single Bouwteam projects. However, the contractual incentives, included in the final framework, can be applied in Bouwteam projects with framework contracting. Research has to be done how the final framework is applied in practice and if the contractual incentives can have a positive influence on third parties in a Bouwteam.
- **Third parties, hired by the client:** the scope of this research was on the third parties, hired by the main contractor. research can be done, how the final framework affects the performance of these third parties in a Bouwteam. Part II of the final framework will aim at the client to apply the suitable non-monetary incentives for their third parties.

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Appendix

I. Early Contractor Involvement (ECI) format

The exact role of the main contractor is based on the ECI format, presented in Figure 15. This figure explains the role of the main contractor in the following levels:

- **Level 1:** a consultation of multiple main contractors is formed, which have the role of a consultant prior to the tender phase.
- **Level 2:** this approach became popular in the Netherlands, a limited amount of main contractors (bidders) place a bid by submitting their design proposal and price.
- **Level 3:** this approach became popular in the United Kingdom. Based on a prior competition, a single main contractor is selected to execute the design together with the client. The price formulation is based on the open book method.
- **Level 4:** this approach is an extension of level 3. The client, main contractor and the supply chain are involved in the design phase.

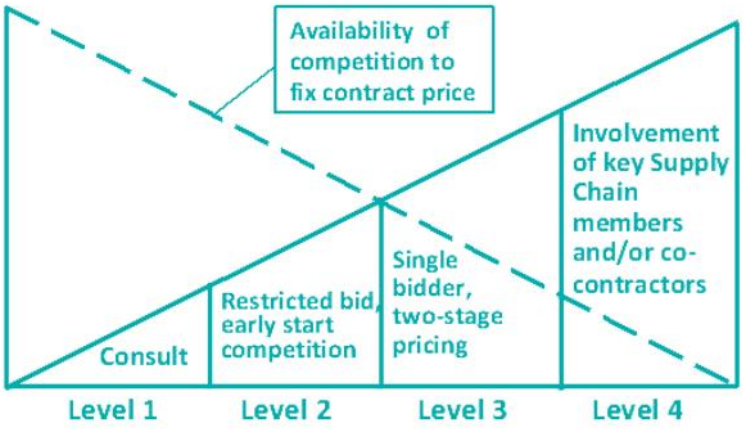


Figure 15 ECI formats (PIANC, 2022, p. 26)

II. UAC vs UAC-IC

This section further explains the difference between the Bouwteam + UAC and Bouwteam + UAC-IC variant. The information used in this section is provided by Bouwmeesters (Bouwmeesters, 2021). The Uniform Administrative Conditions (UAC) is a contract for the construction phase and are conditions for how the main contractor should execute the design. In a Bouwteam + UAC contract the client or his consultant execute the following, prior to the involvement of the main contractor; the preliminary design , program of requirements, detailed design and cost specifications. Thereafter, the main contractor enters the Bouwteam to finalize the design. The client, main contractor and third parties, work on the final design, detailed design, the time schedule and cost specifications.

The Uniform Administrative Conditions for Integrated Contracts (UAC-IC) is a contract, where the design and construction phase are integrated into one contract. In the Bouwteam + UAC-IC, the main contractor enters the Bouwteam in an earlier stage when compared with the Bouwteam + UAC. The client or his consultant prepares a programme of requirements (functional requirements) and budget specification prior to the involvement of the main contractor. Thereafter, the client, main contractor and third parties work together in finalizing the following; detailed design, execution plan, etc. The main contractor carries a part of the liability for the design. The difference between Bouwteam + UAC and Bouwteam+ UAC-IC are presented in Figure 16.

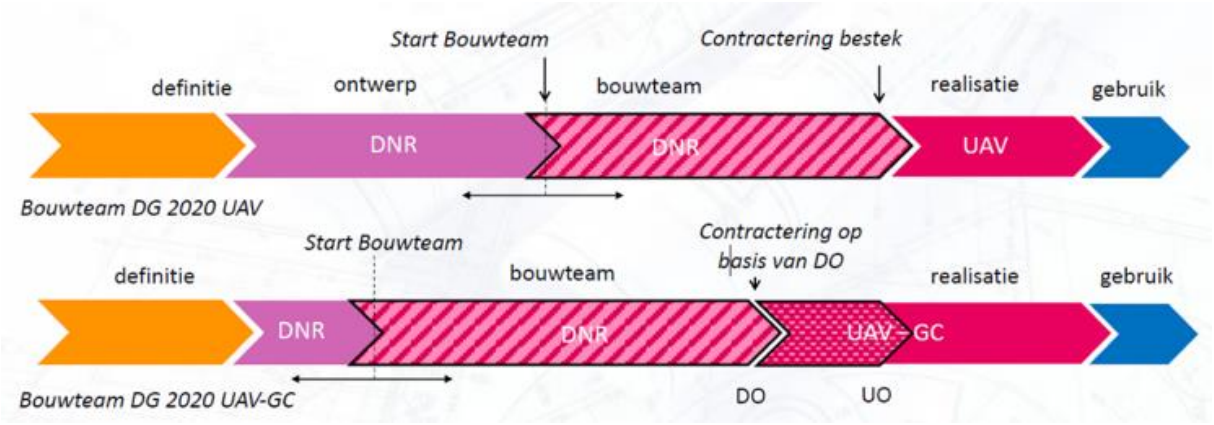


Figure 16 Difference between UAC and UAC-IC (Bouwmeesters, 2021)

III. Schematic representation of payment methods

The schematic representation of the payment method are given in this section, Figure 17. The illustrations bellow are based on the lecture of the course project management (Leijten, 2020, p. 18 & 19).

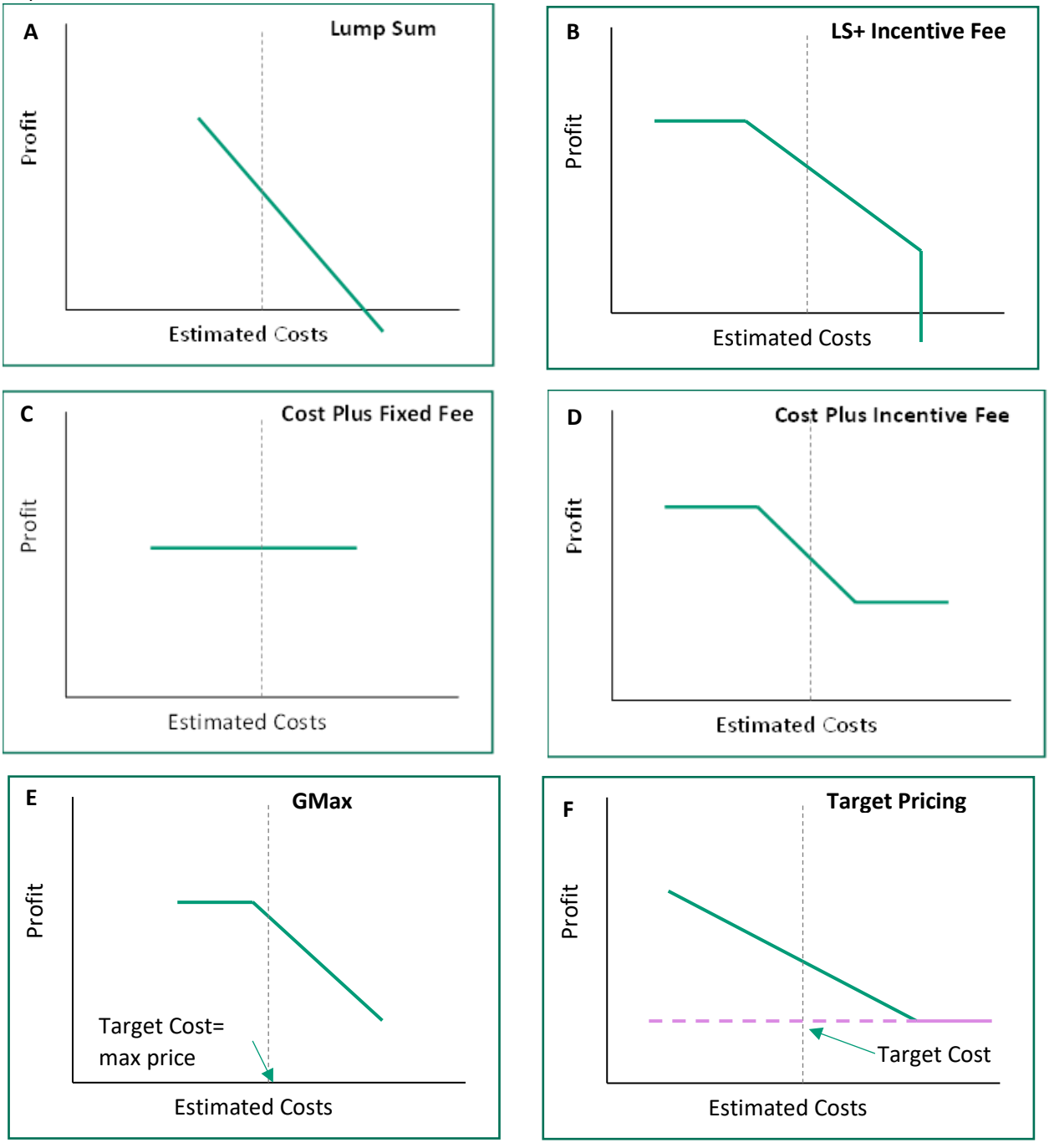


Figure 17 Schematic representation of A) Lump sum. B) Lump Sum Plus Incentive Fee. C) Cost Plus Fixed Fee. D) Cost Plus Incentive Fee. E) Guaranteed Maximum Shared Savings. F) Target Pricing. Based on (Leijten, 2020, p. 18 & 19)

IV. Typical Key Performance Indicators

Chan (2012), conducted a literature review from 2000-2010 and defined and categorized KPI's. These KPI's are categorized in eight different groups and are presented in the table below.

Table 7 Summary of KPI's from (Chan, 2012)

		Key Performance Indicators (KPI)	KPI Working Group[50]	Nicolini et al[51]	Cox et al[52]	Swan and Kyng[53]	Cheung et al[54]	Menches and Hanna[55]	Lam et al[56]	Kaluarachchi and Jones[57]	Jones and Kaluarachchi[58]	Luu et al[59]	Rojas and Kell[60]	Tennant and Langford[61]	De Marco et al[62]	Toor and Ogunlana[63]	Chan et al[64]	Chan et al[65]	Haponava and Al-Jibouri[66]	*Total number of hits for each KPI identified*
			2000	2001	2003	2004	2004	2006	2007	2008	2008	2008	2008	2008	2009	2010	2010	2011	2012	
Time	1	Time for construction	√	√	√	√	√	√	√	√	√	√			√	√	√	√		14
	2	Time predictability – design and construction	√			√	√			√	√			√					√	7
	3	Time to rectify defects	√								√									2
Cost	4	Cost for construction	√		√	√	√	√	√	√	√	√			√	√				11
	5	Cost exceeding GMP / target cost or not		√									√				√	√		4
	6	Cost predictability – design and construction	√			√	√			√				√					√	6
	7	Occurrence and magnitude of disputes and conflicts							√							√	√	√		4

		Key Performance Indicators (KPI)	KPI Working Group[50]	Nicolini et al[51]	Cox et al[52]	Swan and Kyng[53]	Cheung et al[54]	Menches and Hanna[55]	Lam et al[56]	Kaluarachchi and Jones[57]	Jones and Kaluarachchi[58]	Luu et al[59]	Rojas and Kell[60]	Tennant and Langford[61]	De Marco et al[62]	Toor and Ogunlana[63]	Chan et al[64]	Chan et al[65]	Haponava and Al-Jibouri[66]	*Total number of hits for each KPI identified*
			2000	2001	2003	2004	2004	2006	2007	2008	2008	2008	2008	2008	2009	2010	2010	2011	2012	
	8	Cost of superstructure								√	√									2
	9	Development fee								√	√									2
	10	Consultant fee								√	√									2
	11	Cost per m^2			√															1
	12	Number of change orders generated	√				√	√												3
Quality	13	Quality					√		√									√	√	4
	14	Defects (Number / Severity)	√	√	√	√	√			√	√					√		√		9
	15	Quality issues at end of defect rectification period	√							√	√									3
	16	Quality management system										√								1
	17	Aesthetics							√	√										2
Satisfaction	18	Client's satisfaction	√			√				√	√	√		√					√	7
	19	Contractor's satisfaction								√	√									2
	20	Conformance to stakeholders' expectations								√				√		√	√	√	√	6
Health, Safety and Environment	21	Safety				√	√		√	√	√	√				√	√	√		9
	22	Reportable accidents	√	√			√											√		4
	23	Lost time accidents	√				√													2
	24	Environmental performance					√		√	√	√							√		5
	25	Quantity of waste generated					√			√	√							√		4

		Key Performance Indicators (KPI)	KPI Working Group[67]	Nicolini et al[68]	Cox et al[69]	Swan and Kyng[70]	Cheung et al[71]	Menches and Hanna[72]	Lam et al[73]	Kaluarachchi and Jones[74]	Jones and Kaluarachchi[75]	Luu et al[76]	Rojas and Kell[77]	Tennant and Langford[78]	De Marco et al[79]	Toor and Ogunlana[80]	Chan et al[81]	Chan et al[82]	Haponava and Al-Jibouri[83]	*Total number of hits for each KPI identified*
			2000	2001	2003	2004	2004	2006	2007	2008	2008	2008	2008	2008	2009	2010	2010	2011	2012	
Others	26	Contractor involvement								√	√						√	√	√	5
	27	Productivity performance			√	√	√													3
	28	Staff turnover			√															1
	29	Training days												√						1
	30	Profit predictability (project)	√			√														2
		Total number of KPIs identified from each publication	12	4	6	9	13	3	7	17	15	5	1	5	2	6	6	11	6	128

THaponava and Al-Jibouri (2009) conducted a literature study and listed KPI's in the design phase of a construction project.

Table 8 Summary of KPI's from (Haponava & Al-Jibouri, 2009)

Source	Design KPIs	
Gann et al. [14] DQI_buildings	➢ Functionality (use, access, space, character & innovation) ➢ Impact (form &materials, internal environment, urban & social integration) ➢ Build quality (construction, engineering systems, performance)	
Hansen & Vanegas, [12]_buildings	➢ Contextual compatibility & response ➢ Functional performance ➢ Physical performance ➢ Cost ➢ Time ➢ Quality / reliability	➢ Safety / security ➢ Risk ➢ Constructability ➢ Maintainability ➢ Health and ➢ Sustainability
Anderson, D.K. & Merna, T. [2]	➢ Scope ➢ Concurrency ➢ Specifications ➢ Technical validation	➢ Commercial validation ➢ Practicality ➢ Quality ➢ Innovation
CIRIA [8]	➢ Design process ➢ Integration of design with supply chain ➢ Internal time/cost management ➢ Risk ➢ Reuse of design experience ➢ Innovation ➢ Client/user satisfaction	
DETR [9]	➢ Predictability-cost ➢ Predictability-time ➢ Waste (product was designed for minimum waste materials) ➢ Energy use (designed) ➢ Main water use (designed) ➢ Impact on biodiversity	
Ugwu and Haupt [21] _infrastructure	➢ Environmental impacts ➢ Innovative solutions that optimize the use of resources including design for durability, constructability and deconstruction ➢ Material reuse ➢ Recycle and waste management ➢ Impact of design decisions on the wider ecosystem ➢ Innovative construction methods and technology	

V. Summary of literature reviewed

Table 9 Summary of literature reviewed about contractual incentives

	MONETARY INCENTIVES			NON- MONETARY INCENTIVES			TARGET AUDIENCE	
	Payment methods	Risk Sharing	KPI	Involvement	Contract extension	Network	C vs MC	MC vs TP
(BAKKER ET AL., 2014)	X						Not defined	Not defined
(LEIJTEN, 2020)	X						Not defined	Not defined
(THRONÆS, 2018)	X						X	
(NDIHOKUBWAYO ET AL., 2014)	X						X	X
(DAVID KING, 2015)	X						X	
(MENG & GALLAGHER, 2012)	X						X	
(OOMS, 2021)		X					X	
(SCHOL, 2008)		X					X	X
(KLOK, 2020)						X	X	
(MOLENAAR ET AL., 2007)		X			X		X	
(ROSE & MANLEY, 2010)		X		X	X		X	X
(HUGHES ET AL., 2007)		X					X	
(Tennant & Fernie, 2010)					X		X	
(CHAN, 2012)			X				X	
(GIRTH, 2017)		X					X	
(HAPONAVA & AL-JIBOURI, 2009)			X				X	
(SWAN, 2004)			X				X	
(SAKA ET AL., 2021)	X	X						
NR OF HITS	7	7	3	1	3	1	-	-

VI. The effect of contractual incentives

An overview of the monetary incentives is presented in Table 10. The table presents the contractual incentives which were implemented and recommended in the Bouwteam projects. The contractual incentives are suggested by different interviewees, this is indicated with codes: Client (C), Main contractor (MC) and Third party (TP). Furthermore, the definition and the effect on the performance is given. Lastly, the table indicates which project goal is influenced by the contractual incentives. Several incentives are indicated with the colour "red", as the practicability and influence on performance remain unknown. These incentives will receive extra attention during the expert evaluation. A short disclaimer is given in Table 12 for the monetary incentives, indicated in "red".

Table 10 Overview Monetary incentives

	Incentive	Mentioned in Case nr.	Definition	Effect on Performance	Effect on project goal
Monetary Incentives	**Payment method**				
	Cost Reimbursement	Applied in Case I, II and III	Payment based on expenses made	Less discussion, more focus for the technical work	Quality
	Lump sum	Applied in Case IV, preferred by MC3A and MC3B	Payment based on a fixed price	Clear agreements	Time & costs
	Lump sum for certain tasks/ subscription price for uncertain tasks	C4	A combination of lump sum and a subscription price. the main contractor submits a subscription amount for managerial tasks	Reduce design discussions	Time
	Lump sum for design/ cost reimbursable for managerial tasks	C4	A combination of lump sum and cost reimbursement	Less discussion for tasks with a high uncertainty. And clear agreements for design	Quality, Time and Costs
	Mitigation tools				
	Task Budget	Applied in Case I, II and III	The budget is safeguarded by the parties in the Bouwteam. In case of change in the budget, this will be discussed with the client	This tool is combined with the cost reimbursable method to limit the risk of budget overruns	Costs
	Price ceiling	Case I, II and III	Hard limit for financing all phases of a construction project (design-construction phase)	n.a.	Costs
	Milestones	Applied in Case IV	Payment based on performance	Stimulates parties to deliver qualitative work in time as they are rewarded for their completed work.	Quality, time
	Incentive fee based on: design costs, design planning, sustainability/ innovation and limiting staff	MC2, MC4	The third party receives an incentive for meeting certain goals	Reward for extra effort	Depends on the variant
	Joint risk sharing for budget overruns	C1	The client and the main contractor share the risk, in case of budget overruns	Stimulates financial management of the main contractor	Costs
	Risk pot	MC3B, counterargument by C4	A risk pot, the residual amount is shared between the client and the main contractor	n.a.	n.a.
	Budget margin	TP3	The actual costs should stay within the specified margin. Otherwise, the main contractor and third parties become responsible for additional costs	Stimulates structured work/ more detail	Cost

	Liability				
	Extend liability period + combine with Bonus Malus concept	MC3A	Extend the liability period for design errors towards the construction phase	Responsibility	Quality

Table 11 presents an overview of non-monetary incentives, which can be applied, to influence the performance of third parties. The incentives indicated in "red", will receive more attention during the expert evaluation. A disclaimer is presented in
Table 12, for the in "red" indicated non-monetary incentives.

Table 11 Overview Non-monetary incentives

	Incentive	**Mentioned in case nr.**	**Definition**	**Effect of performance**	**Effect on project goals**
	Future works				
	Network	Often used between the MC and TP.	When a party is hired based on an existing relation	Reputation	C, MC satisfaction/ Quality
	Contract extension	Applied in case I, MC3A (wanted to apply this method)	Third party is granted work for the subsequent design phase (detailed design phase or other tasks in the construction phase)	Reputation	Quality
	Evaluation				
	Third party defines the level of detail	MC1	Third parties define the level of detail of products, the main contractor reviews	Clarity on what can be expected by the third party, less discussion	Quality
	KPI	C1	Key Performance Indicators are used as an evaluation criteria and in some cases connected to bonus/ malus or an incentive fee	Evaluation of the deliverables	Time & Cost
	Dynamic				
	Direct involvement	TP1B and TP2	Third party present in meetings which concerns their work and they have direct contact with the client	Reduce line of communication, risk detection, share important information	Time and Satisfaction
	Early involvement	Mentioned by TP1B and TP4	Third party is involved in the Bouwteam prior to their contribution	Reduce uncertainties	Quality
	Bouwteam partners	Mentioned by MC2	Main contractor and third party jointly enter the tender phase and act as one party	Early inclusion of third parties and reduce uncertainties in design	Quality

Table 12 Reasoning of contractual incentives indicated in "red"

Contractual incentive	Reason
Lump sum for certain roles/ subscription price for uncertain tasks	This payment method is suggested by one interviewee and it is not proven that this combination in payment method is practical and has influence on the performance
Lump sum for design/ cost reimbursable for managerial tasks	This payment method is suggested by one interviewee and it is not proven that this combination in payment method is practical and has influence on the performance
Bouwteam partners	It is unknown how this incentive would work in practice. This also forms a high risk for the main contractor. If the third party does not meet the requirements in the tender phase, the main contractor will be contractually connected to this party.
Extend liability period	This forms a risk for engineering firms. The willingness of engineering firms are unknown, especially because their services and payment end after the Bouwteam phase.

VII. Inform Consent Form (in Dutch)

Beste genodigde,

Hierbij wordt u uitgenodigd deel te nemen aan een interview voor het afstudeeronderzoek genaamd: “Contractuele prikkels tussen hoofdaannemer en derde partijen voor betere prestatie in een Bouwteam”. Dit afstudeeronderzoek maakt deel uit van de masteropleiding Construction Management and Engineering (CME) aan de faculteit Civiele Techniek en Geowetenschappen aan de technische universiteit van Delft. Voorafgaand aan uw deelname aan dit interview, stel ik mij eerst voor en wordt het doel van dit onderzoek aan u toegelicht.

Dit interview wordt uitgevoerd door Eljoenai Gumbs. Ik ben een CME studente aan de technische universiteit van Delft, met als specialisatie “Projects and People”. De aankomende periode voer ik mijn afstudeeronderzoek uit bij Witteveen+Bos.

Dit onderzoek betreft het vinden van contractuele prikkels (financiële en niet- financiële prikkels) om de prestatie tussen de hoofdaannemer en derde partijen (in dienst genomen door de hoofdaannemer) te verbeteren in een Bouwteam. In dit onderzoek worden de contractuele prikkels opgenomen in een Bouwteamovereenkomst vergeleken met de opgenomen contractuele prikkels in contracten tussen de hoofdaannemer en derde partijen. Hierbij wordt er een casestudie gedaan waaruit een aantal Bouwteam projecten worden onderzocht met behulp van een documentenonderzoek en interviews. De interviews zijn gericht op de opdrachtgever, hoofdaannemer en derde partijen die deel uitmaken van <voer in de naam van de desbetreffende Bouwteam project>. Deze onderzoeksmethode is zorgvuldig gekozen, nadat er literatuuronderzoek is gedaan op contractuele prikkels en Bouwteams. Voorafgaand aan dit onderzoek zijn er verscheidene afstudeerrapporten gepubliceerd die voornamelijk gefocust zijn op de samenwerking tussen opdrachtgever en hoofdaannemer. Waarbij ik concludeer dat er geen onderzoek is gedaan op het gebied van contractuele prikkels tussen hoofdaannemer en derde partijen in Bouwteam projecten. Met de resultaten van dit interview wordt een conceptueel raamwerk samengesteld met de contractuele prikkels die de prestatie van derde partijen dusdanig beïnvloed dat project doelen daadwerkelijk worden behaald. Dit raamwerk wordt in de eindfase van dit onderzoek geëvalueerd door specialisten die niet eerder bijdrage hebben geleverd aan dit onderzoek.

Tijdens dit interview wordt gebruikgemaakt van beeldopname om een transcript te schrijven voor het analyseren van de resultaten. Deze beeldopname wordt zorgvuldig bewaard en wordt uitsluitend ter beschikking gesteld aan de afstudeercommissie. Het transcript wordt geanonimiseerd, maar er zal in het rapport gerefereerd worden naar de positie van de geïnterviewde binnen de desbetreffende Bouwteam. Het geanonimiseerde transcript maakt deel uit van het afstudeerrapport dat gepubliceerd zal worden op de opslagplaats van de TU Delft, dat uitsluitend gebruikt zal worden voor toekomstige onderzoeken. Persoonlijke informatie over de geïnterviewde wordt niet gepubliceerd.

Er zijn geen verdere risico’s verbonden aan dit interview. Deelname aan dit interview is vrijwillig en de geïnterviewde kan zich te allen tijde terugtrekken zonder reden op te geven. U bent vrij vragen onbeantwoord te laten. Dit interview wordt uitgevoerd in het Nederlands en zal ongeveer 60 tot 90 minuten duren. Dit interview zal online plaatsvinden via MS Teams. U wordt vriendelijk verzocht voorafgaand aan dit interview de onderstaande verklaringen aan te vinken en te ondertekenen. Met het doorklikken van de onderstaande verklaringen, gaat u akkoord met de openingsverklaring.

Met vriendelijke groet,

Eljoenai Gumbs

1. Ik heb de uitnodigingsmail gelezen en begrepen. Ik heb de mogelijkheid gehad om vragen te stellen over het onderzoek en mijn vragen zijn naar tevredenheid beantwoord.	☐	☐
2. Ik doe vrijwillig mee aan dit onderzoek, en ik begrijp dat ik kan weigeren vragen te beantwoorden en mij op elk moment kan terugtrekken uit de studie, zonder een reden op te hoeven geven.	☐	☐
3. Ik begrijp dat mijn deelname aan het onderzoek de volgende punten betekent [het nemen van een geluidsopname, transcript en notities]	☐	☐
4. Ik begrijp dat de resultaten van mijn deelname aan het onderzoek zorgvuldig worden bewaard	☐	☐
Gegevens gebruik		
5. Ik begrijp dat de persoonlijke informatie die over mij verzameld wordt en mij kan identificeren, zoals [*bijvoorbeeld naam, functie*], niet gedeeld worden buiten het afstudeercommissie.	☐	☐
6. Ik begrijp dat na het onderzoek de geanonimiseerde informatie gebruikt zal worden voor [rapporten, publicaties]	☐	☐
7. Ik geef toestemming om mijn antwoorden, ideeën of andere bijdrages anoniem te quoten in resulterende producten.	☐	☐
(Langdurig) Data opslag, toegang en hergebruik		
8. Ik geef toestemming om de geanonimiseerde data die over mij verzameld worden gearchiveerd worden in de TU Delft repository, opdat deze gebruikt kunnen worden voor toekomstig onderzoek en onderwijs.	☐	☐

Handtekeningen

_____	_____	_____
Naam deelnemer	Handtekening	Datum

Ik, **de onderzoeker**, verklaar dat ik de informatie en het instemmingsformulier correct aan de potentiële deelnemer heb voorgelezen en, naar het beste van mijn vermogen, heb verzekerd dat de deelnemer begrijpt waar hij/zij vrijwillig mee instemt.

___Eljoenai Gumbs _____	_____	_____
Naam onderzoeker	Handtekening	Datum

VIII. Interview Questions

Questions for the Client (In Dutch)

Introductie (2 minuten)	
Vragen	**Doelstelling & verwachting**
Bouwteam (2 minuten)	
1. Wat was uw rol binnen het Bouwteam project en wanneer was u betrokken in dit project?	**Doel:** Dit onderdeel richt zich op de functie van het individu binnen het Bouwteam. **Verwachting:** overheidsinstantie. naar verwachting heeft de OG een controlerende rol en worden meer verantwoordelijkheden geschoven naar de ON
Financiële prikkels (20 minuten)	
2. Reden gekozen betaalmethode: a. Waarom heeft uw partij gekozen om de aannemer te betalen met deze betaalmethode? b. Welke risico's brengt volgens u de betaalmethode met zich mee? c. Hoe heeft deze betaalmethode invloed gehad op de prestatie van de aannemer? 3. Zijn er verbeterpunten in de betaalmethode? Wat is uw voorstel? a. Hoe zal uw voorstel invloed hebben op de prestatie van de aannemer? b. Welke risico's brengt deze betaalmethode met zich mee? 4. Reden gekozen betaaltermijnen (OPTIONEEL): a. Waarom is er gekozen om in één of meerdere termijnen te betalen? b. In welke mate hebben de betalingstermijnen invloed gehad op de prestatie van de aannemer? c. Welke risico's zijn verbonden aan de aantal betaaltermijnen? d. Zijn er verbeterpunten in de aantal betaaltermijnen? Hoe zou u deze bepalen? 5. Wat verstaat u onder financiële prikkels? en zijn er andere financiële prikkels opgenomen in het Bouwteamovereenkomst die nog niet zijn benoemd?	**Doel:** Dit onderdeel is voornamelijk gericht op de financiële prikkels die opgenomen zijn in Bouwteamovereenkomsten. **Verwachting:** gebruik van betalen op regie (cost plus of cost reimbursement).
Risico verdeling (8 minuten)	
6. Omgang risico's: a. Hoe is uw partij omgegaan met risico? b. Waarom is er gekozen om op de deze manier om te gaan met risico? c. Hoe heeft deze omgang met risico invloed gehad op de prestatie van de aannemer? 7. Voorstel contractuele prikkels voor omgang risico's: a. Hoe zou u omgaan met risico's? b. Waarom zou u deze methode kiezen? c. Hoe zou deze methode invloed hebben op de prestatie van de aannemer?	**Doel:** dit is een onderdeel van financiële prikkels. ook risico kan invloed hebben op de houding van de aannemer in het Bouwteam. **Verwachting:** De verwachtingen zijn verdeeld. Tot nu toe is niet bekend welke concepten in het algemeen worden gebruikt. Door observatie zijn de volgende concepten te verwachten: - Risico stelpost namens de OG - Een gezamenlijk risico pot - Gezamenlijk financiële bijdrage aan risico, waarbij er vooraf wordt afgesproken in welk verhouding partijen schade vergoeden
Niet financiële prikkels (12 minuten)	
8. Welke niet-financiële prikkels zijn er gebruikt om de prestatie van de aannemer te verbeteren? 9. Waarom zijn deze niet-financiële prikkels gebruikt? 10. Welke niet-financiële prikkels zou u zelf gebruiken voor een goede prestatie en waarom?	**Doel:** Een betere schets kunnen maken van de niet contractuele prikkels die in praktijk worden gebruikt. Tot nu toe is de gelegenheid voor werken in de toekomst (future works) als enige prikkel gevonden uit de literatuurstudie. **Verwachtingen: Naar verwachting zal de ON zich richten op sociale ingrepen, zoals teambonding. Hier moet er gestuurd worden naar contractuele prikkels.** verder geen verwachtingen.
KPI's (5 minuten)	
11. Werd er gebruik gemaakt van KPI? Zo ja, ga verder met deze vraag. Zo nee, ga verder met vraag 17 a. Welke indicatoren zijn opgenomen in de Bouwteamovereenkomst? b. Welke van de opgegeven KPI's waren nuttig en zijn daadwerkelijk gebruikt? c. Hoe hebben deze indicatoren invloed gehad op de prestatie van de aannemer? d. Welke andere KPI's zou u inzetten, en waarom? 12. Indien er geen gebruik is gemaakt van KPI's:	**Doel:** om te achterhalen welke criteria er wordt gebruikt als meting van prestatie. Ook wordt er nagegaan of er gebruik wordt gemaakt van KPI's en welke gebruikelijk zijn in het ontwerpfase. **Verwachtingen:** OG maakt gebruik van KPI's vooral als er op regie wordt betaald met een gekoppelde bonus.

a. Waarom is er geen gebruik gemaakt van KPI's? b. Welke andere methodes zou u voorstellen voor prestatiemeting? En waarom? c. Hoe zou de door u opgegeven methode bijdrage leveren aan de prestatie van de aannemer?	
Project succes en evaluatie (10 minuten)	
13. Hoe werd project succes gedefinieerd en geëvalueerd? 14. Waarom waren deze succesfactoren zo belangrijk in het ontwerp? 15. In welke mate heeft de prestatie van de aannemer en de onderaannemer invloed gehad op projectsucces? 16. Welke leerpunten/ suggesties over contractuele prikkels zou u meenemen in toekomstige Bouwteamprojecten (OPTIONEEL)?	**Doel:** het definiëren van projectsucces. Het gebruik van iron triangle is uit literatuur onderzoek het meest gebruikt. **Verwachtingen:** geen verwachtingen
Sluiting (1 minuten)	

Interview Questions for the Main Contractor (in Dutch)

Introductie (2 minuten)	
Vragen	**Doelstelling & verwachting**
Bouwteam (2 minuten)	
1. Wat was uw rol binnen het Bouwteam project en wanneer was u betrokken in dit project? 2. Zijn er specifieke eisen gesteld aan de hoofdaannemer en onderaannemer in de Bouwteamfase?	**Doel:** Dit onderdeel richt zich op de functie van het individu binnen een organisatie en het Bouwteam. **Verwachting:** geen verwachtingen
Financiële prikkels (20 minuten)	
3. Reden gekozen betaalmethode: a. Waarom is er gekozen om de onderaannemer met deze betaalmethode uit te betalen? b. Hoe heeft deze betaalmethode invloed gehad op de prestatie van de onderaannemer? c. Welke risico's brengt de gekozen betaalmethode met zich mee? d. Welke verbeterpunten zou u meenemen in de volgende Bouwteam, betreffende de betaalmethode? 4. Reden gekozen betaaltermijnen (OPTIONEEL): a. Waarom is er gekozen om in één of meerdere termijnen uit te betalen? b. In welke mate hebben de betalingstermijnen invloed gehad op prestatie van de onderaannemer? c. Welke verbeterpunten zou u meenemen de volgende Bouwteam, betreffende de betaaltermijnen? En waarom? 5. Wat verstaat u onder financiële prikkels? a. Zijn er andere financiële prikkels opgenomen in de contract met de onderaannemer die niet zijn benoemd? b. Waarom werd deze financiële prikkel ingezet? c. Hoe zouden deze financiële prikkel invloed hebben op de prestatie van de onderaannemer? d. Welke risico's zouden deze financiële prikkels met zich meebrengen?	**Doel:** Dit onderdeel is voornamelijk gericht op de financiële prikkels die opgenomen zijn in de contracten. **Verwachting:** er wordt ervanuit gegaan dat de ON op regie wordt betaald, terwijl de ON zijn derde partijen met lump sum uitbetaald. Kortom, geen gebruik van financiële prikkels.
Risico verdeling (8 minuten)	
6. Omgang met risico: a. Hoe bent u omgegaan met risico? b. Waarom is er gekozen om op deze manier om te gaan met risico? c. Hoe heeft de omgang in risicoverdeling invloed gehad op de prestatie van de onderaannemer? 7. Voorstel contractuele prikkels voor omgang van risico's: a. Hoe zou u omgaan met risico's? b. Waarom zou u voor deze methode kiezen?	**Doel:** dit is een onderdeel van financiële prikkels. ook risico kan invloed hebben op de houding van partijen in het ontwerpfase. **Verwachting:** De verwachtingen zijn verdeeld. Tot nu toe is niet bekend welke concepten in het algemeen wordt gebruikt. Door observatie zijn de volgende concepten te verwachten: - Risico stelpost namens de ON - Een gezamenlijk risico pot - Gezamenlijk financiële bijdrage aan risico, waarbij er vooraf wordt afgesproken in welk verhouding partijen schade vergoeden
Niet financiële prikkels (12 minuten)	
8. Welke niet-financiële prikkels zijn er gebruikt om de prestatie van de onderaannemer te verbeteren? 9. Waarom is er gekozen voor de desbetreffende concepten? 10. Welke andere niet-financiële prikkels zou u zelf gebruiken voor een goede prestatie en waarom?	**Doel:** Een betere schets kunnen maken van de niet contractuele prikkels die in praktijk worden gebruikt. Tot nu toe is de gelegenheid voor werken in de toekomst (future works) als enige prikkel gevonden. **Verwachtingen: Naar verwachting zal de ON zich richten op sociale ingrepen, zoals teambonding. Hier moet er gestuurd worden naar contractuele prikkels.** Vooral bij de ON wordt er vanuit gegaan dat er sprake is van netwerken.
Gebruik van KPI's (5 minuten)	
11. Werd er gebruik gemaakt van KPI? Zo ja, ga verder met deze vraag. Zo nee, ga verder met vraag 17 a. Welke indicatoren zijn gebruikt? b. Hoe hebben deze indicatoren invloed gehad op prestatie van de onderaannemer? c. Welke andere KPI's zou u inzetten, en waarom? 12. Indien er geen gebruik is gemaakt van KPI's: a. Waarom is er geen gebruik gemaakt van KPI's?	**Doel:** om te achterhalen welke criteria er wordt gebruikt als meting van prestatie. Ook wordt er nagegaan of er gebruik wordt gemaakt van KPI's en welke gebruikelijk zijn in een ontwerpfase. Ook wordt gekeken welke indicatoren daadwerkelijk gebruikt werden.

b. Zou u als aannemer werken met KPI's? en waarom? c. Welke andere methodes zou u voorstellen voor prestatiemeting?	**Verwachtingen:** OG maakt gebruik van KPI's vooral als er op regie wordt betaald met een gekoppelde bonus. Bij ON wordt er niet verwacht dat KPI's worden gebruikt maar dat er naar algemene tevredenheid wordt gekeken.
Project succes en evaluatie (15 minuten)	
13. Hoe werd project succes gedefinieerd en geëvalueerd? 14. Waarom waren de desbetreffende succesfactoren zo belangrijk in het Bouwteam project? 15. Hoe heeft het presteren van de onderaannemer invloed gehad op het project succes? 16. Welke leerpunten/ suggesties over contractuele prikkels zou u meenemen in toekomstige Bouwteamprojecten (OPTIONEEL)?	Doel: het definiëren van projectsucces. Het gebruik van iron triangle is uit literatuur onderzoek het meest gebruikt. Verwachtingen: geen verwachtingen
Sluiting (2 minuten)	

Interview Questions for Third Parties (in Dutch)

Introductie (2 minuten)	
Vragen	**Doelstelling & verwachting**
Algemene Vragen (2 minuten)	
1. Wat was uw rol binnen het Bouwteam project en wanneer was u betrokken in dit project?	**Doel:** Meting van ervaring binnen een Bouwteam. Achterhalen of adviezen gebaseerd zijn op uitsluitend één project of ook te maken heeft met andere Bouwteam projecten. **Verwachting:** doordat het gebruiken van Bouwteam in de recente jaren populair is geworden kunnen de resultaten verschillen. Het kan zijn dat de deelnemer betrokken is geweest in 1 of 2 Bouwteamprojecten, maar het zou ook meerdere kunnen zijn.
Financiële prikkels (20 minuten)	
2. De gebruikte betaalmethode: a. Waarom denkt u dat uw partij met deze betaalmethode is uitbetaald? b. Hoe heeft deze betaalmethode invloed gehad op de prestatie van uw partij? c. Welke risico's brengt volgens u de gekozen bepalingsmethode met zich mee? 3. Welke betaalmethode zou volgens u een betere invloed hebben op prestatie? En waarom? 4. Hoe hebben de aantal betaaltermijnen invloed gehad op de prestatie van uw partij (OPTIONEEL)? 5. Hoe zou u de betalingstermijnen opdelen? En waarom (OPTIONEEL)? 6. Zijn er andere financiële prikkels opgenomen in de contract die nog niet zijn benoemd (OPTIONEEL)? 7. Welke andere financiële prikkels zouden volgens u een betere werking hebben op de prestatie van uw partij? En waarom?	**Doel:** Dit onderdeel is voornamelijk gericht op de financiële prikkels die opgenomen zijn in contracten. **Verwachting:** De derde partijen zullen hoogstwaarschijnlijk met Lump Sum uitbetaald worden, omdat zij specialistisch werk verrichten en mogelijk niet betrokken worden met de resterende taken.
Risico verdeling (8 minuten)	
8. Hoe heeft de omgang in risicoverdeling invloed gehad op de prestatie van uw partij? 9. Welke prikkels zou u inzetten voor de omgang met risico's? a. Waarom kiest u voor deze prikkels? b. Hoe zouden deze prikkels invloed hebben op de prestatie?	**Doel:** dit is een onderdeel van financiële prikkels. ook risico kan invloed hebben op de houding van partijen in het ontwerpfase. **Verwachting:** Er wordt verwacht dat er geen prikkels worden ingezet voor het omgaan van risico's, zoals eerder aangegeven zal de derde partij met lump sum zijn uitbetaald.
Niet financiële prikkels (12 minuten)	
10. Hoe hebben de niet- financiële prikkels invloed gehad op de prestatie van uw? 11. Welke niet-financiële prikkels zou u zelf gebruiken voor een goede prestatie en waarom?	**Doel:** Een betere schets kunnen maken van de niet contractuele prikkels die in praktijk worden gebruikt. Tot nu toe is de gelegenheid voor werken in de toekomst (future works) als enige prikkel gevonden. **Verwachtingen: Naar verwachting zal de ON zich richten op sociale ingrepen, zoals teambonding. Hier moet er gestuurd worden naar contractuele prikkels.** Er wordt er vanuit gegaan dat derde partijen met het netwerken worden geprikkeld om beter te presteren.
KPI's (5 minuten)	
14. Werd er gebruik gemaakt van KPI? Zo ja, ga verder met deze vraag. Zo nee, ga verder met vraag 17 a. Welke indicatoren zijn gebruikt? b. Hoe hebben deze indicatoren invloed gehad op de prestatie van uw? c. Welke andere KPI's zou u inzetten, en waarom? 15. Indien er geen gebruik is gemaakt van KPI's: a. Waarom is er geen gebruik gemaakt van KPI's? b. Welke andere methodes zou u voorstellen voor prestatiemeting?	**Doel:** om te achterhalen welke criteria er wordt gebruikt als meting van prestatie. Ook wordt er nagegaan of er gebruik wordt gemaakt van KPI's en welke gebruikelijk zijn in een ontwerpfase. Ook wordt gekeken welke indicatoren daadwerkelijk gebruikt werden. **Verwachtingen:** Er wordt ervanuit gegaan dat er bij de derde partijen algemeen wordt gekeken naar de tevredenheid van de aannemer en dat er geen gebruik wordt gemaakt van KPI's.
Project succes en evaluatie (20 minuten)	
14. Hoe werd project succes gedefinieerd en geëvalueerd? 15. Hoe heeft het presteren van uw partij invloed gehad op de project succes? 16. Welke leerpunten/ suggesties over contractuele prikkels zou u meenemen in toekomstige Bouwteamprojecten (OPTIONEEL)?	**Doel:** het definiëren van projectsucces. Het gebruik van iron triangle is uit literatuur onderzoek het meest gebruikt. **Verwachtingen:** geen verwachtingen
Sluiting (2 minuten)	

IX. Quotations Interviews

The coding is set up by the following:

- The category of the interview questions (defined by A,B,C,D,E or F)
    - Category A: General information Bouwteam
    - Category B: Monetary incentives
    - Category C: Non- monetary incentives
    - Category E: KPI
    - Category F: Project goals and evaluation
- The type of party (defined with C, MC or TP) and the case number
- The statement number, as defined in ATLAS.ti

Category A: General information Bouwteam

Statements of the interviewees on general information

Category B: Monetary incentives

Statements of the interviewees on monetary incentives

Category C: Incentives for mitigating risks

Statements of the interviewees on mitigating risks

Category D: Non-monetary incentives

Statements of the interviewees on non-monetary incentives

Category E: KPI

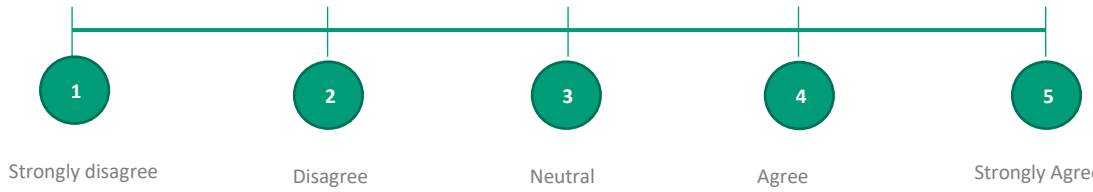
Statements of the interviewees on KPI's

Category F: Project goals and evaluation

Statements of the interviewees on project goals and evaluation

X. Evaluation sheet

The following incentives are evaluated on their: importance, willingness and practicability. Please rate (and state your opinion) the following incentives from 1-5:



Lastly, you are asked for points of improvements for the general framework (including the standard/ remaining incentives)

Incentive	Importance	Willingness	Practicability
2B. Incentive fee (variants)			
Based on costs			
Based on planning			
Based on innovation/ sustainability			
Based on limiting staff			
2B. Risk sharing			
The client and main contractor share budget overruns			
2B. Budget margin			
The main contractor and third parties become responsible for costs …% above the budget margin			
4A. Contract extension			
The main contractor extends the contracts of third parties after the Bouwteam phase Construction phase: environmental management etc.			
4. Third party defines level of detail			
The third parties define what is delivered in the Bouwteam phase, the main contractors do a review.			
Combining payment methods			
Lump sum for certain tasks & main contractor submits a price subscription for uncertain tasks			
Lump sum for certain tasks & cost reimbursable for uncertain tasks			
Bouwteam partners			
The main contractor and third party enter the tender phase as one party.			
Extend liability period			
The main contractor extends the liability period of the third party. The design errors are tested during the construction phase. Differ from the TNR 2011			
Bonus Malus concept			
Bonus is equivalent to incentive fee. Malus: third party receives a fine for not complying to the main contractor's satisfaction			
Legend			
	Monetary incentives (financial)		
	Non-monetary incentives (non-financial)		
	Point of discussion (not in framework)		

Expert 1

Incentive	Importance	Willingness	Practicability
2B. Incentive fee (variants) evaluate with KPI's			
Based on costs	1 /4	1 / 4	1/ 2
Based on planning	2	2	4
Based on innovation/ sustainability	3	4	1
Based on limiting staff	1 / 4	1 / 4	4
2B. Risk sharing			
The client and main contractor share budget overruns	1	1 (0)	2
2B. Budget margin			
The main contractor and third parties become responsible for costs …% above the budget margin	2	2/ 1	2
4A. Contract extension			
The main contractor extends the contracts of third parties after the Bouwteam phase. Roles in construction phase: environmental management etc.	3	3	5
4B. Third party defines level of detail			
The third parties define what is delivered in the Bouwteam phase, the main contractors do a review.	3	3	5
Combining payment methods			
Lump sum for certain tasks & main contractor submits a price subscription for uncertain tasks	4	4	1
Lump sum for certain tasks & cost reimbursable for uncertain tasks	5	5	1
Bouwteam partners			
The main contractor and third party enter the tender phase as one party. (a combination of early & direct involvement)	5	5	5
Extend liability period			
The main contractor extends the liability period of the third party. The design errors are tested during the construction phase. Differ from the TNR 2011	1	1	5
Bonus Malus concept			
Bonus is equivalent to incentive fee. Malus: third party receives a fine for not complying to the main contractor's satisfaction	1	1	3

*cost reimbursable/ lump sum

Expert 2

Incentive	Importance	Willingness	Practicability
2B. Incentive fee (variants) evaluate with KPI's			
Based on costs	4	5	5
Based on planning	4	5	5
Based on innovation/ sustainability	5	5	4
Based on limiting staff	2	2	2
2B. Risk sharing			
The client and main contractor share budget overruns	4	4	3
2B. Budget margin			
The main contractor and third parties become responsible for costs …% above the budget margin	4	4	4
4A. Contract extension			
The main contractor extends the contracts of third parties after the Bouwteam phase. Roles in construction phase: environmental management etc.	3	5	2
4B. Third party defines level of detail			
The third parties define what is delivered in the Bouwteam phase, the main contractors do a review.	5	5	3
Combining payment methods			
Lump sum for certain tasks & main contractor submits a price subscription for uncertain tasks	4	4	5
Lump sum for certain tasks & cost reimbursable for uncertain tasks	5	5	3
Bouwteam partners			
The main contractor and third party enter the tender phase as one party. (a combination of early & direct involvement)	3	4	4
Extend liability period			
The main contractor extends the liability period of the third party. The design errors are tested during the construction phase. Differ from the TNR 2011	4	2	2
Bonus Malus concept			
Bonus is equivalent to incentive fee. Malus: third party receives a fine for not complying to the main contractor's satisfaction	5	5	3