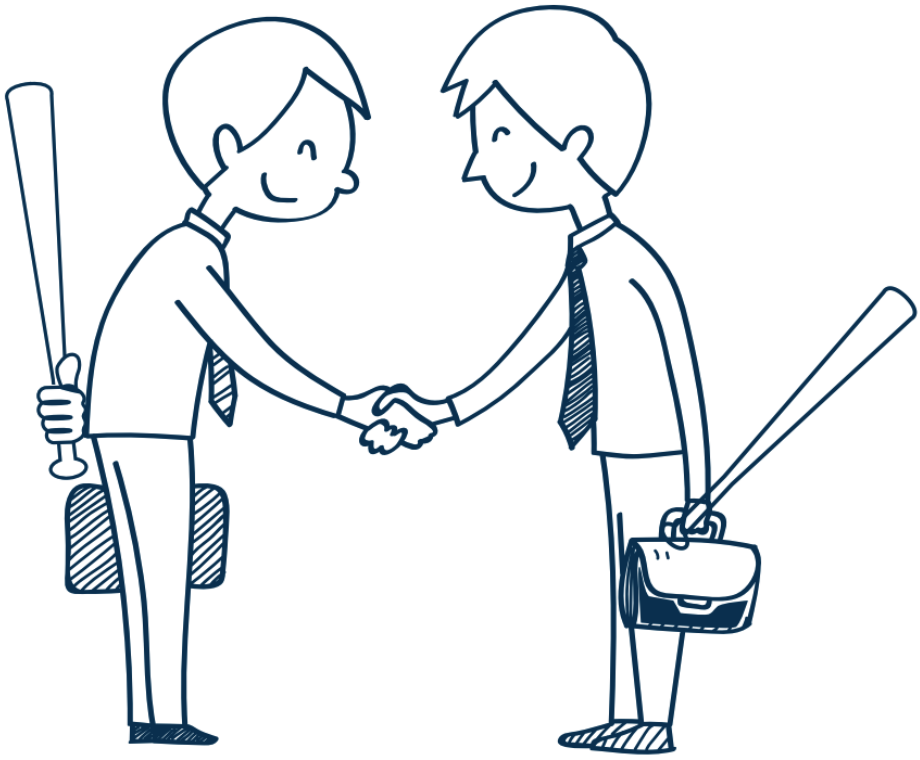
Improving collaboration between client and contractor in integrated contracts in the Dutch construction sector

A study into the possibilities and opportunities of the NEC4 ECC contract and Project DOEN to improve collaboration between client and contractor in integrated contracts in the Dutch construction sector

Master of Science thesis



Gijs ten Hoeve

November 27th, 2018

Faculty of Civil Engineering and Geosciences (CEG)
Delft University of Technology

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Colophon

Document

Document title — *Improving collaboration between client and contractor in integrated contracts in the Dutch construction sector*

Subtitle — *A study into the possibilities and opportunities of the NEC4 ECC contract and Project DOEN to improve collaboration between client and contractor in integrated contracts in the Dutch construction sector*

Status — *Public version*

Place and date — *Delft, 27-11-2018*

Personal information

Author — *Gijs ten Hoeve*

Student number — *4300858*

E-mail — *gjtenhoeve@gmail.com*

Master programme — *Construction Management and Engineering*

Graduation committee

TU Delft

Chair — *Prof. mr. dr. M.A.B. (Monika) Chao-Duivis*

First Supervisor — *Ir. L.P.I.M. (Leon) Hombergen*

Second Supervisor — *Dr.ir. M.G.C. (Marian) Bosch-Rekveldt*

Witteveen+Bos

First Supervisor — *Ir. R.A.J. (Rob) Rijnen*

Second Supervisor — *Ir. J. (Jelmer) Kooij*

Graduation institution

University of Technology Delft

Civil Engineering and Geosciences

Stevinweg 1, 2628 CM Delft

Graduation company

Witteveen+Bos

Group chain collaboration and contract management

Koningin Julianaplein 10, 2595 AA The Hague

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Preface

This report is written as a master thesis research that concludes my Master Construction Management and Engineering at the University of Technology Delft. The research is conducted at Witteveen+Bos in The Hague who provided me with resources and support that enabled me to conduct this research.

This research is relevant for client, contractor and engineering organisations that work with integrated contracts in the Netherlands. This research can provide these parties with new possibilities to stimulate collaboration. The research provides an overview of methods that can influence collaboration in different ways. Due to this organisations can implement a method that stimulates an aspect of collaboration that they find important or that needs extra attention in the project.

Over the past months, I was able to develop myself both professionally and personally. Nevertheless, conduction the research was not always easy. I have to thank my graduation committee (Monika, Marian, Leon, Jelmer and Rob) for their time, support and guidance during this process. They provided the focus I needed to complete this thesis. I would also like to thank my Witteveen+Bos colleagues for providing me with cases needed for this research, their expertise and feedback. Further, I would like to thank all interviewees and experts for their time and co-operation. Finally, I would like to thank my family and friend for their support during this period.

Gijs ten Hoeve

Delft, November 20th, 2018

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Executive summary

There is a general understanding in the Dutch construction sector that the traditional relationships between client and contractor does not function as wanted. Currently, the main problems in the Dutch construction sector are a lack of trust, inequality, dishonest, egocentric and uncooperative behaviour. To counter this, major parties in the sector drafted the Marketvision 2016. The goal of this document is to guide the sector towards a culture of collaboration and mutual respect. Concrete measures how to achieve this are however still absent.

This research aims to identify methods of collaboration or clauses in general conditions that can stimulate collaborative behaviour. To do so, methods and clauses that can positively influence collaboration are explored. Within the scope of this research, methods and clauses from two sources are investigated: Project DOEN and the NEC4 ECC. Project DOEN is a new form of collaboration developed in the Netherlands. It is a form of collaboration without a contract. Instead, all aspects of the project are done together, in a joint project team based on trust and collaboration. The NEC4 ECC is a contract developed in Great Britain. The contract provides project management tools together with clear and strict clauses. Both emphasize collaboration between the client and the contractor. The research is scoped on the NEC4 ECC and Project DOEN because they both focus on collaboration between the client and the contractor, but have a different approach to collaboration.

The objective of the research is to give an insight into the possibilities for better client-contractor collaboration in the Dutch construction sector. To obtain this insight a research questions is drafted, which is:

Are there clauses in general conditions or methods of collaboration that can positively influence collaboration in integrated contracts in the Netherlands?

To define an answer to the research question, several sub-questions are drafted. Based on the answers to these question the research question is answered.

- SQ1: What does collaboration between client and contractor in integrated contracts in the Dutch construction sector entail?
- SQ2: What is the current state of collaboration in integrated contracts in the Dutch construction sector and what problems occur in the sector?
- SQ3: Which factors can positively influence collaboration between client and contractor in integrated construction projects according to literature?
- SQ4: What Project DOEN and NEC4 ECC methods and clauses can potentially improve collaboration and what are the possible drawbacks that come with these methods and clauses?
- SQ5: Are there methods or clauses in the NEC4 ECC and Project DOEN that can positively influence collaboration in case studies using integrated contracts in Dutch construction sector and if so how do they do this?

To answer the main and sub-research questions, three types of research methodology are used. These are a literature study, a case study and an expert validation. The use of these methodologies in the context of the research is shown in figure 1.

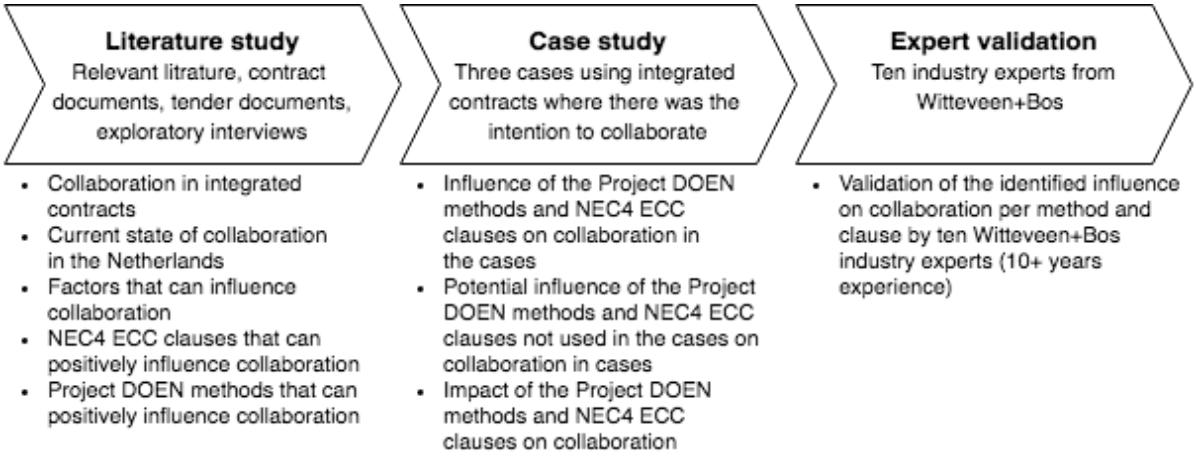

Figure 1: Used methodologies in the context of the research

In figure 1 the used data sources per methodology are stated inside the arrow. What is researched per used methodology is stated in the bullets below the arrow. Based on all three data sources, literature, case study and validation, the conclusion is drafted.

Literature study

Before researching collaboration, a definition for collaboration must be chosen. In this research collaboration is defined as follows: “Collaborative working is the joint working or working together of project stakeholders or different organisations to effectively and efficiently accomplish a project”. Effective collaboration between the client and the contractor can bring multiple benefits. The main benefits are openness in communication, organisational flexibility, quick and effective identification of problems and a reduction of disputes, time and cost overruns. Also, the working process can become more efficient.

Collaboration in itself is seen as a highly complex and challenging task. Projects in the construction sector are a unique entity containing interactions of complex factors by inter-disciplinary parties from different countries with varying roles, responsibilities, goal and objectives. To complete projects in this dynamic environment collaboration and teamwork are crucial. In the integrated contract the client and the contractor have different roles than in the traditional contract, this results in a different form of collaboration. Generally, in the integrated contract the contractor is more active and has to take the initiative and the client is more passive in comparison to the traditional contracts.

Collaboration in construction projects does not come without risks. Dependence on other parties forms one of the main risks. This dependence can become problematic when the goals of the different parties are not properly aligned, conflicting or competing. The deviation in goals among parties can result in conflict and thereby hinder collaboration. Furthermore, if collaboration fails it can result in a win-lose attitude which hinders project success.

Currently, the Dutch construction sector is faced with insufficient collaboration. There is a lack of trust and overall poor collaborative attitude from both the client and the contractor.

There is understanding by both the clients and contractors in the Dutch construction sector that change and improvement of the current collaboration culture is needed. To boost collaboration in the Dutch construction sector, the Marketvision 2016 has been drafted by influential organisations in the sector. The Marketvision contains ambitions for effective communication and increased collaborative behaviour by both client and contractor. This research aims to provide methods and clauses that can help fulfil these ambitions.

Several factors are identified which can influence collaboration positively in different ways. These factors are mutual objectives, gain and pain sharing, trust, no-blame culture, joint working, communication, joint problem solving, fair risk allocation, effective performance measurement and continuous learning. Clauses in the NEC4 ECC and methods in Project DOEN are identified that can potentially influence one or more of these factors positively and thereby have a positive effect on collaboration. Similar clauses and methods identified in the NEC4 ECC and Project DOEN are merged to prevent overlap in the research. The following 12 clauses and methods are identified:

- Early contractor involvement (NEC4 ECC & Project DOEN)
- Optimization incentive (NEC4 ECC & Project DOEN)
- Joint risk allocation & Compensation events (NEC4 ECC & Project DOEN)
- Joint problem or conflict resolution (NEC4 ECC & Project DOEN)
- Good faith obligation (NEC4 ECC)
- Communications (NEC4 ECC)
- Programme and planning (NEC4 ECC)
- Collaborative procurement (Project DOEN)
- Removal of financial pressure (Project DOEN)
- Joint project team (Project DOEN)
- Continuous process reflection (Project DOEN)
- Continuity (Project DOEN)

Case study and validation

The identified clauses and methods are further investigated in the case study. Three cases are investigated. In all three cases, integrated contracts are used and there was the intention to collaborate during the project. With the use of the case study it is researched what factors of collaboration the identified NEC4 ECC clauses and Project DOEN methods can influence. Based on this information an overview is made showing if and how each method or clause can positively influence collaboration.

After the case study, the identified connection between a method or a clause with a factor of collaboration is validated by industry experts. Not all found connections are validated due to overlap between certain connections. The results from the case study and the validation are combined in one overview, which is presented in table 1. The percentages in this table are the per case weighted average percentages of respondents that stated the connection. The higher the percentage, the more respondents stated the connection. The colours represent the outcome of the expert validation process. The meaning of each colour is explained in the legend. In the last two columns, the expected average impact of the method or clause on collaboration is presented for both the client and the contractor respondents.

Table 1: Overview showing the identified connections between NEC4 ECC clauses and Project DOEN methods with factors of collaboration based on the case study results combined with expert validation outcome

Factors stimulating collaboration / NEC4 ECC & Project DOEN methods and clauses	Mutual objectives	Gain and pain sharing	Trust	No-blame culture	Joint working	Communication	Joint problem solving	Fair risk allocation	Effective performance measurement	Continuous learning	Expected impact on collaboration	
											Clients	Contractors
Early contractor involvement	67%		75%	58%	100%	58%	100%				low	low
Optimization incentive & CS* & WLC* & CP* & BEC*			50%								low	low
Joint risk allocation & Compensation events					75%	92%	58%	92%			high	low
Joint problem or conflict resolution & EW* & RD (W3)*	58%		58%	92%	92%	100%	100%				high	high
Good faith obligation	50%			75%	67%	92%					high	high
Communications			67%	83%	58%	100%	83%		83%		medium	medium
Programme and planning	50%				50%	100%	67%		100%		low	low
Collaborative procurement	75%		83%	67%	100%	67%	58%				medium	medium
Removal of financial pressure				67%	67%						high	high
Joint project team					75%	100%	67%				low	medium
Continuous process reflection				92%		100%				67%	medium	medium
Continuity			100%			67%					medium	high

Legend
Green colour – confirmed connection in expert validation
Orange colour – unclear if the connection is confirmed in expert validation
Red colour – rejected connection in expert validation
Purple colour – confirmed connection in expert validation, but negative connection in case study
Black colour – connection is not taken into account in expert validation

The combined case study and validation results, presented in table 1, show that multiple of the identified NEC4 ECC clauses and Project DOEN methods can positively influence collaboration. Nine of the twelve researched methods and clauses can have a positive influence by stimulating one or more factors of collaboration. The impact of the methods differs indicating that not every method will boost collaboration on itself. Combining methods and fitting them to a project increases the chance of a high impact on collaboration.

Conclusion

Based on the findings in the literature regarding the NEC4 ECC and Project DOEN, the case study and the expert validation an answer is drafted to the research question:

Are there clauses in general conditions or methods of collaboration that can positively influence collaboration in integrated contracts in the Netherlands?

This question can be answered with a yes, clauses in general conditions that can positively influence collaboration in integrated contracts in the Netherlands have been identified in NEC4 ECC and methods of collaboration that can positively influence collaboration in integrated contracts in the Netherlands are identified in Project DOEN. The influence is potential of nature. This is because when looking at relations and collaboration it cannot be said that a method or clause will for certain show a particular influence. The following clauses and methods can influence collaboration positively:

- **Early contractor involvement**
- **Joint risk allocation & compensation events**
- **Joint problem or conflict resolution**
- **Good faith obligation**
- **Programme and planning**
- **Collaborative procurement**
- **Joint project team**
- **Continuous process reflection**
- **Continuity**

For the **optimization incentive**, **communications** and **removal of financial pressure** methods and clauses contradictions among the analysed data are found. Therefore, it cannot be said what the influence of these methods and clauses on collaboration is.

The methods and clauses **early contractor involvement**, **joint risk allocation**, **good faith obligation**, **collaborative procurement** and **joint project team** focus on the early phases of the project. These 'early phase' methods enable the parties to set a basis for collaboration at the start of the project, increasing the chance of a collaborative project kick-off. By doing so, these methods can reduce the two most common causes of collaborative failure being an improper alignment of goals and lack of mutual understanding about expectations. These methods and clauses can also be used to align the visions, processes and expectations of both teams at or before the start of the project. This enables the teams to work and solve problems together which can result in trust among the teams, the formation of a no-blame culture and a fair distribution of risks.

When the project enters the execution phase, the methods and clauses **joint problem resolution**, **programme and planning**, **joint project team**, **continuous process reflection** and **continuity** can be used to maintain and develop the collaboration in the project. These methods and clauses stimulate the formation of (a higher level of) trust, a no-blame culture, joint working, joint problem solving and effective performance measurement. Continuous process reflection enables the parties to stay aligned on their goals and expectations. The parties can learn from their past mistakes and thereby improve the process. In short, these 'execution-phase' methods and clauses can create or further stimulate collaboration, depending on if the parties created a basis of collaboration in the early project phases.

Recommendations for the Dutch construction sector

Based on the conclusion, several recommendations for the Dutch construction are drafted. These recommendations are divided into three project phases: the early project phase, the execution phase and the project end phase. An overview of the recommendations is shown in figure 2.

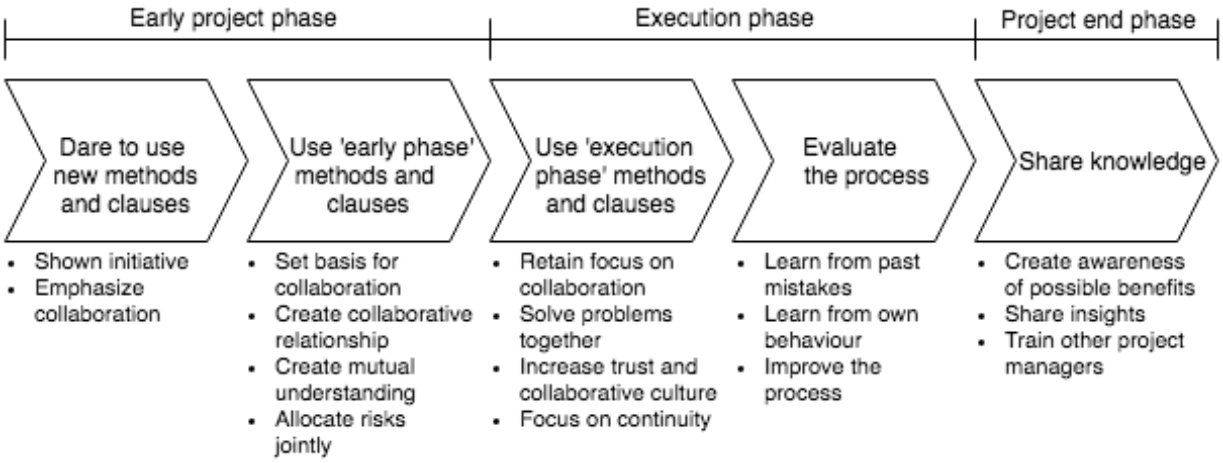

Figure 2: Overview of recommendations per project phase

Firstly, project managers must dare to use new or unknown methods and clauses. They need to show initiative in the use of the identified methods and clauses. By the use of the 'early phase' methods and clauses, the project managers can emphasize collaboration in the early stages of the project. Enabling visions and expectations of both teams to be aligned. By doing so, a basis of collaboration and mutual understanding can be created resulting in a collaborative start of the project. The formation of these collaborative relations can be beneficial during all project phases. Problems and risks can be dealt with together and by jointly creating solutions it is more likely that better and/or more innovative solutions are created. Furthermore, allocating risks jointly early on in the project can result in a fair risks allocation. Therefore, it is highly recommended to use the 'early phase' methods and clauses.

Retain focus on collaboration during the project execution phase. It is essential to keep focussing on collaboration in order to obtain all its benefits. Using the 'execution phase' methods and clauses can result in better and more effective problem solving, the reduction of conflicts, and the creation or enlargement of trust and a no-blame culture. Also, by focussing on continuity trust relations stay within the project and by evaluating how the process is going the parties can learn from past mistakes. These learnings allow the parties to improve or change the process to ensure it meets everyone's expectations and ambitions. Developing the process and changing it to meet different needs during the project phases is likely to effectively improve the collaboration in the project.

Create awareness of the methods and clauses among organisations in the Dutch construction sector and their project managers. Trainings in which NEC4 ECC or Project DOEN experts come to talk can help to create the needed awareness of the methods and clauses. By spreading and exchanging knowledge about these methods the chance of successful implementation of the methods and clauses in the Netherlands increases. Therefore, it is highly recommended to organise events or trainings that can facilitate the needed knowledge exchange.

Table of Contents

List of Figures

List of tables

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1. Introduction

The construction sector is currently faced with several problems. The main problems include poor collaboration, limited trust and ineffective communication (MohammadHasanzadeh et al., 2014). A cause of this poor performance is the fragmentation in the sector (Rahman & Kumaraswamy, 2004a; Ospina-Alvarado & Castro-Lacouture, 2010; Harper, 2014), work is distributed across different stakeholders and sub-processes. The fragmentation often results in adversarial working relationships. As a result of these adversarial relationships, projects have an increased chance of facing time delays, cost overruns, difficulty in resulting claims, litigation and a win-lose climate (Chan et al., 2008).

Next to the fragmentation, construction projects are faced with increasing complexity due to high uncertainty (Stark et al., 2014). Due to the increasing project complexity and adversarial relationships conflicts have become common in the construction sector (Chen et al., 2014; Wu, 2013). As a result, the construction sector received criticism in many countries for its poor performance such as time and cost overruns, low productivity, poor quality, and poor customer satisfaction (SOU, 2000; Yasamis et al., 2002; Chan et al., 2003).

The Dutch construction sector faces similar problems as the international construction sector. The sector has been faced with insufficient collaboration for a significant amount of time (Noorderhaven et al., 2006). After the revelation of the building fraud in 2002 this only became worse according to crucial participants in the sector (Koenen, 2015, p. 10). In the Netherlands, it became clear that there is the need to move away from the old relationships and way of collaborating (Rijkswaterstaat et al., 2016). To move towards a collaborative and respectful culture in the Dutch construction sector the Marketvision 2016 (Marktvisie) has been drafted (Rijkswaterstaat et al., 2016). This document is based on the input of several major client and contractor organisations. The goal of this document is to guide the sector towards a culture of collaboration and mutual respect. This goal is formulated in the primary ambition of the Marketvision which is as follows: "*We excel, as 'builders of the Netherlands', by being trustworthy, approachable and inspiring and we work for civilians and companies together on a save, liveable and accessible country".*

The Marketvision was drafted in 2016; currently there is still a lot of improvement possible in the Dutch construction sector because this ambition is not yet reached (Wisse & Arends, 2017). From a study by CROW (2017) it was concluded there is a lack of trust and overall poor collaboration from both client and contractor in the Dutch construction sector.

The Marketvision made it clear that there often is willingness to work closely together in the sector, however, there is often still conflict in projects due to falling back into 'old behaviour' of poor collaboration (Dronkers J. H., 2016). This is because the construction sector is a more challenging sector than most other sectors due to its dynamic, fragmented and complex nature. In order to have project success, involvement of different parties and proper project management is required (Demirkesen & Ozorhon, 2017).

Two forms of collaboration are identified. These two are Project DOEN and the NEC4 ECC. Both methods try to stimulate collaboration differently. Project DOEN is a project initiated by the Opdrachtgeversforum and further developed by Rijkswaterstaat to improve collaboration. DOEN (act) stands acting in a wat that makes sense in a project. This entails

proper collaboration and thinking logically (Projectteam DOEN, 2017). The goal of project DOEN is to establish a new form of collaboration between the client and the contractor based on intensive collaboration instead of extensive contracts. By doing so, it mains to create maximum value for the client while paying a fair price to the contractor (Dronkers, 2015). The initiators of Project DOEN stated that contact is more important than the contract. Therefore, the decision was made to work without a contract and with a manual containing only agreements on a high level of abstraction. The underlying idea is that when parties work intensively together, higher quality projects can be delivered for a better price (Projectteam DOEN, 2017).

The philosophy of establishing successful projects through good collaboration can also be found in the British contract form New Engineering Contract 4 (NEC4). This contract form has recently been updated to better facilitate the needs of the market (Peckett et al., 2017). This resulted in an improved contract form that is further focussed on collaboration to enlarge the changes of project success (Backler & Woodward, 2017). In the NEC4 contract suite, the Engineering and Construction Contract (ECC) focusses on construction projects. Therefore, only this contract is included in the research. Due to the NEC ECC's successful track record worldwide (Wright & Fergusson, 2009), it might bring possible solutions for the problems in the Dutch construction sector. In this contract, the need for collaboration is expressed in core clause 10.2, here it states that the parties must work in *"a spirit of mutual trust and collaboration"*. The NEC ECC can provide proper project management tools, clarity in the contract and strong contractual relationships (Wright & Fergusson, 2009). This is due to the forward-looking and proactive environment which the NEC ECC provides.

1.1 Problem, objective, scope and context

Problem

The main problem that sparked this research is the insufficient collaboration between client and contractor in the Dutch construction sector. Currently, the major organisations in the Dutch construction sector actively stated they want to work more collaboratively. This study aims to provide methods and clauses that can help these organisations to work more collaboratively.

Objective

The primary objective of this research is to provide methods and clauses that can be used in the Dutch construction sector to improve client-contractor collaboration. The goal is to provide an overview of the possibilities to positively influence collaboration based on methods and clauses identified in the NEC4 ECC and Project DOEN. This overview can help project managers that want to stimulate collaboration in certain aspects. The result can contribute to better collaboration in the sector resulting in a shift towards collaborative behaviour.

Scope

The objective of this research is scoped on methods and clauses found in the NEC4 ECC and Project DOEN that can possibly enable better client-contractor collaboration. This research is scoped to Project DOEN and the NEC4 ECC for two reasons. First, both are focused on collaboration in projects in the construction sector (Garrat, 2017; Projectteam NU DOEN, 2017). Because of this focus on collaboration, they might contain possible solutions to the

collaborative problem in the Dutch sector. Second, the combination of these two possible solutions can provide a broad insight into the possibilities to improve collaboration. This is because the NEC4 ECC and Project DOEN each have a different approach to collaboration. Project DOEN is focussed on collaboration with few rules and with no contract, only a manual (Projectteam DOEN, 2017); the NEC4 ECC is a contract that manages collaboration based on project management tools and extensive incentives for collaboration (Chao, 2016; Garrat, 2017). By investigating these two different forms of collaboration, one with as few rules as possible and one with extensive rules and procedures, is to obtain an insight into different possibilities for collaboration. Combining and comparing the methods can result in an broad overview of clauses and methods that can positively stimulate collaboration.

The research is scoped on construction projects in the Netherlands in which an integrated contract is used. The scope of integrated contracts is chosen because in the Dutch construction sector integrated contracts are used more and more (Rijksvastgoedbedrijf, 2012). In integrated contracts collaboration is regarded as one of the main aspects needed in order to successfully complete a project (Ma et al., 2018). Also, the NEC4 ECC is an integrated contract and in Project DOEN the same contractor is used for the design and construction. Therefore, it is more likely that the methods and clauses identified in the NEC4 ECC and Project DOEN can be used in integrated projects.

Also, only client-contractor collaboration in investigated. Collaboration with other parties is outside the scope of this research. The study is scoped to client-contractor collaboration because of three reasons. The first reason is that in the initial literature study it became clear that the main problem with collaboration is in the client-contractor relationship. Second, the NEC4 ECC and Project DOEN are both mostly focussed on the client-contractor agreements and collaboration. Lastly, Witteveen+Bos has mainly experience with client-contractor relationships. Because of this, more suitable cases and applicable experience is available regarding client-contractor collaboration which improves the feasibility of the research.

Context

This research in conduct in the following context. The researcher is a student from the University of Technology Delft who is conducting the research at Witteveen+Bos. Witteveen+Bos is one of the larger engineering companies in the Netherlands with over 1000 employees. They provide consultancy and engineering services worldwide in the fields of infrastructure, water, the environment, spatial development and construction. Witteveen+Bos is currently experiencing the problem described above and is looking for new innovative ways to stimulate good client-contractor collaboration. Witteveen+Bos provided the guidance during this research along with the cases for the case study.

1.2 Research question

The research is done based on a research question. The primary objective is translated into the following research question:

Are there clauses in general conditions or methods of collaboration that can positively influence collaboration in integrated contracts in the Netherlands?

To define an answer to the research question, several sub-questions are drafted. When these questions are answered to satisfaction, it will be possible to draft the answer to the primary research question. The following sub-questions are drafted:

- SQ1: What does collaboration between client and contractor in integrated contracts in the Dutch construction sector entail?
- SQ2: What is the current state of collaboration in integrated contracts in the Dutch construction sector and what problems occur in the sector?
- SQ3: Which factors can positively influence collaboration between client and contractor in integrated construction projects according to literature?
- SQ4: What Project DOEN and NEC4 ECC methods and clauses can potentially improve collaboration and what are the possible drawbacks that come with these methods and clauses?
- SQ5: Are there methods or clauses in the NEC4 ECC and Project DOEN that can positively influence collaboration in case studies using integrated contracts in Dutch construction sector and if so how do they do this?

Already several studies are conducted with the aim to improve collaboration in the construction sector. Currently, partnering, alliancing and proper communication are mainly investigated to tackle the problem. Also, research has been conducted into the NEC3 ECC. It was concluded that the contract is capable of increasing best-for-project behaviour (Stam, 2016), trust (Cheung L., 2015) and cooperation (Häsler, 2014). Thus far only the possibilities in a general sense of NEC3 ECC are defined. This study aims to provide an insight into the (updated) NEC4 ECC, Project DOEN and in its separate methods and clauses that can be practically applied in the Netherlands. The identification of methods and clauses from the NEC4 ECC and Project DOEN that can improve collaboration the Dutch construction sector has not yet been conducted. This study can therefore provide new insights and fill the existing knowledge gap about the NEC4 ECC and Project DOEN.

1.3 Research methodology

Three research methods will be used to answer the research question. First, a desk research and literature study are conducted to obtain a good understanding of the current situation in the Dutch construction sector. Also, an understanding of the current knowledge regarding factors that have a positive influence on collaboration is gathered. Next, a literature study into methods and clauses that can improve collaboration scoped to Project DOEN and the NEC4 ECC is conducted. To obtain a better insight in the methods used in Project DOEN and its possibilities and opportunities experts that are conducting the project are interviewed in an exploratory interview. Methods and clauses identified in the NEC4 ECC and Project DOEN will be linked to factors that can influence collaboration. By doing so, an insight will be obtained that shows in what way the methods and clauses can have a positive influence on collaboration.

After the exploration of Project DOEN and the NEC4 ECC, three case studies are conducted. The objective of the case studies is to obtain an insight if the connections made between the methods identified in the NEC4 ECC and Project DOEN and the factors that positively influence collaboration are valid for the Dutch construction sector. By looking at cases in which similar or the same methods are used an insight will be obtained if these methods work in practice. A case study is a suitable approach to investigate this because its purpose is to identify how something happened (Yin, 2009). By knowing how the methods work in practice an insight can be obtained if the identified methods can potentially be used in the Netherlands. After the case studies, the results are compared in a cross-case analysis. By means of the analysis, an insight into the possible methods and clauses that can positively influence collaboration is provided. Based on these findings a preliminary conclusion is drafted.

Because the preliminary conclusion is based on a theoretical linkage between the literature and case studies the conclusion will be validated by Witteveen+Bos industry experts. These experts must have 10 years or more experience with project management in integrated contracts to ensure that they a comprehensive insight into the current state of collaboration in the sector and are able to translate the preliminary conclusions into practice. By validating the conclusion, it is more likely that the final conclusion consists of methods and clauses that can bring benefits the Dutch construction sector. The experts can state if he agrees with the proposed possibilities of the methods and clauses to positively influence collaboration. Based on the outcome of the validation the final conclusion is drafted. In figure 3 the entire process of this research is displayed.

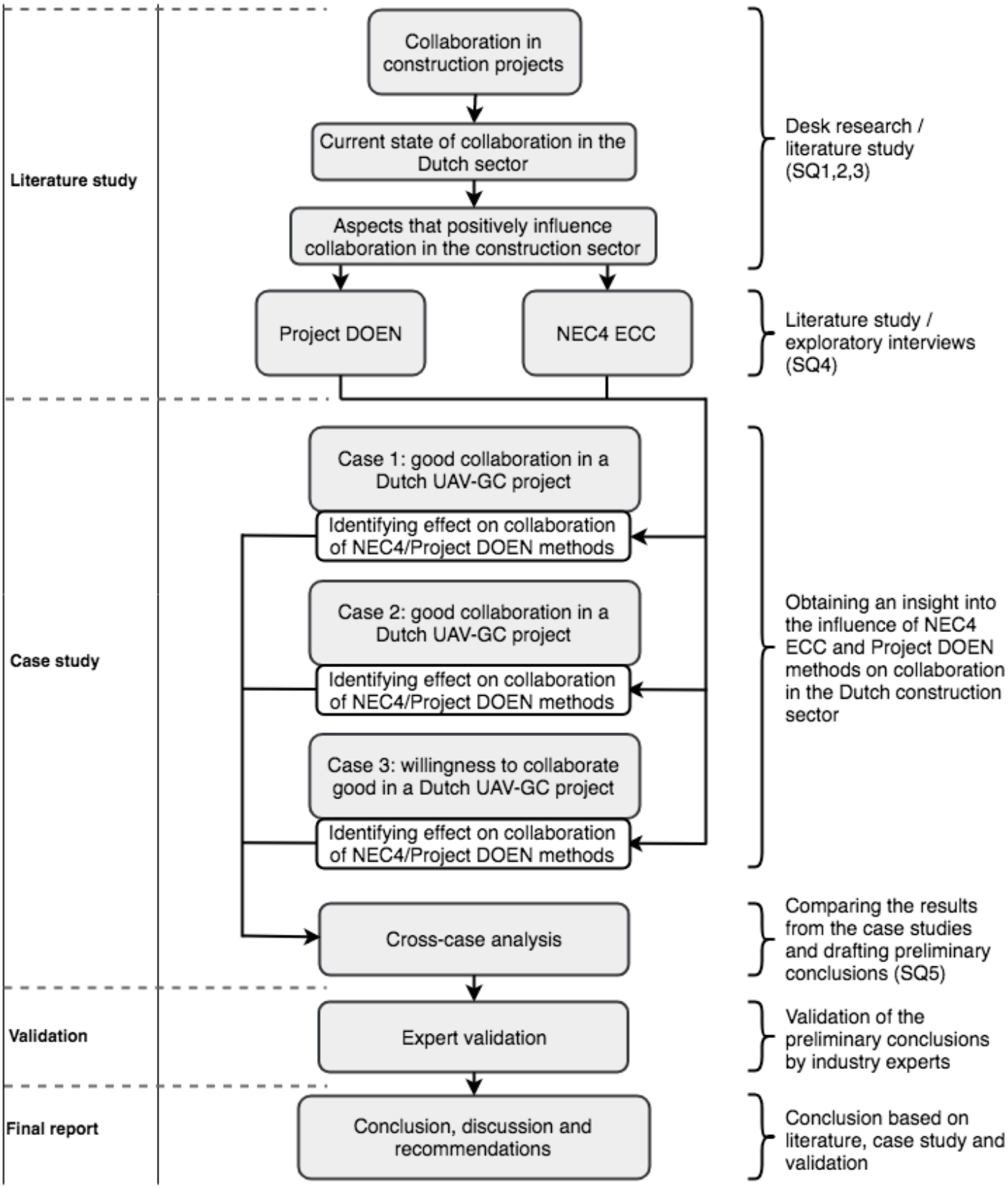

Figure 3: Research methodology

2. Literature study – Collaboration

The literature study is used to gain an understanding of the core aspects related to collaboration and the current state of collaboration in the Netherlands. First, the methodology used to conduct the literature study is elaborated upon. Thereafter, several aspects that require exploration to gain a proper understanding of the context of the research are investigated. These aspects are all related to the research question and are collaboration in contraction project, current state of collaboration in the contraction sector and factors that positively influence collaboration. For each of the subjects, a conclusion with the most critical findings is drafted. Based on these conclusions sub-questions 1-3 are answered.

2.1 Literature study methodology

By means of a literature study, the author aims to gain an insight into what collaboration entails, what its current state in the Netherlands is and what factors can influence collaboration. The literature study is conducted with the use of the ScienceDirect database. In this database, the researcher searched for relevant papers with the use of the following keywords: construction collaboration, collaboration, cooperation, building collaboration, construction cooperation, factors of collaboration, aspects of collaboration, client contractor collaboration, methods of collaboration, construction process management and construction project management. The author aimed to use as many recent papers as possible. If no recent papers are found on a subject and the subject is not time-bound, older papers are consulted. Other databases have also been consulted, LexisNexis and the TU Delft Library for relevant books and i-Law for relevant legal literature. In these databases, similar keywords are used as in the ScienceDirect database.

Also, the latest publications of the International Journal of Project Management have been scanned for papers regarding construction collaboration or cooperation. Because this journal is a source of many papers regarding collaboration, several papers are found that did not follow from the search using the keywords described above.

The literature study enables the author to obtain large quantities of data produced and processed by other researchers. By doing so, the author can gain an understanding of the subject without the need to obtain the data and insights that can be found in the literature. This comes with the disadvantage that the interpretation of data by other authors is adopted in this research. The perception of other authors on collaboration is hard to eliminate.

2.2 Collaboration in construction projects

To obtain an insight into collaboration, the chapter is divided into four parts. In the first part, a general exploration of collaboration and its definition is conducted. Next, benefits and risks (opportunities), integrated contracts and the collaborative culture in the Netherlands are explored. An overview of this chapter is presented in figure 4.

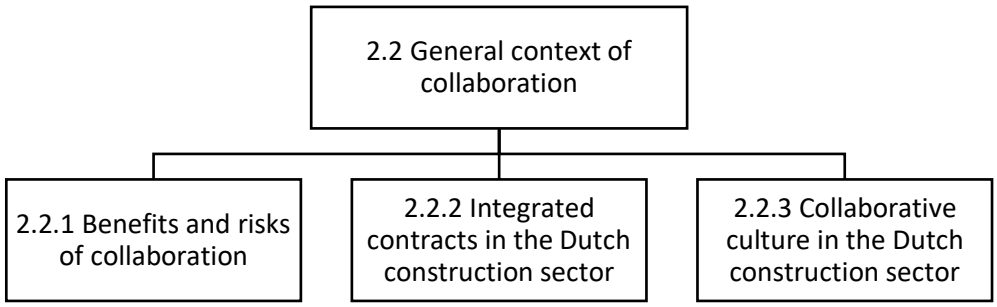

Figure 4: Structure chapter 2.1

Before exploring collaboration, a definition of collaboration is drafted which is used in this research to minimalize misinterpretation. There are few definitions of collaborative working in literature. Xue et al. (2010) provide the following definition: “Collaborative working is the joint working or working together of project stakeholders or different organisations to effectively and efficiently accomplish a project”. This definition is based on the simple definition of collaboration in the Oxford dictionary. Here collaboration is defined as “working jointly” (Dictionary, 1989). In the definition of Xue et al. (2010) “joint working” or “working together” means that the involved parties shall work with each other with a shared goal in mind resulting in solutions that create benefits for all. The words “effectively and efficiently” refer to the achieving of goals at the right place at the right time and at minimal costs in compliance with the working arrangements. The definition of Xue et al. (2010) is also the definition used in this research because it is the most used definition of collaborative working.

Collaboration in itself is seen as a highly complex and challenging task, which entails “the agreement among specialists to share their abilities in a particular process to achieve the larger objectives of the project as a whole” (Kalay, 2001). Projects in the construction sector are seen a unique entity containing interaction of complex factors by inter-disciplinary parties from different countries with varying roles, responsibilities, goal and objectives (Goodman & Chinowsky, 1996). To complete projects in this dynamic environment collaboration and teamwork are crucial because the sharing of knowledge leads to the reduction of errors, time delays and re-work (Rowlinson & Cheung, 2004). There are multiple forms of collaboration, The National Council for Voluntary Organisations (2007) drafted five main forms:

- Different organisations work jointly on an activity or function while maintaining their independence;
- Organisations with extensive resources or expertise offer assistance to another organisation;
- A new organisation is created to do the joint work on activities or functions;
- A group structure is formed in which a parent organisation oversees subsidiary organisations;
- Organisations form temporary merges in a new organisation, working as one body on all activities.

All these types of collaboration can occur in the construction sector. Within the scope of this research, the focus is placed on joint working on an activity and the assisting of other organisations as these types of collaboration mainly occur in integrated contracts. Collaboration can bring many benefits to organisations for example increased probability of obtaining business, faster, cheaper or better development or delivery of works (Xue et al.,

2010). Furthermore, it is not only distributing the work among different parties or individuals, but it also facilitates an information flow among the collaborative members (Li & Lai, 2005). By creating a collaborative working relationship and information flows with other organisations collaborative advantages can be obtained by achieving goals that an organisation by itself would not have been able to achieve (Lank, 2005).

Construction collaboration is a process in which the success of projects is depended on "a strong weave of owner, architect, engineer, contractor and supplier" (Harmon, 2003). Within the scope of this research construction collaboration is visualised in figure 5, here is the owner displayed as the client.

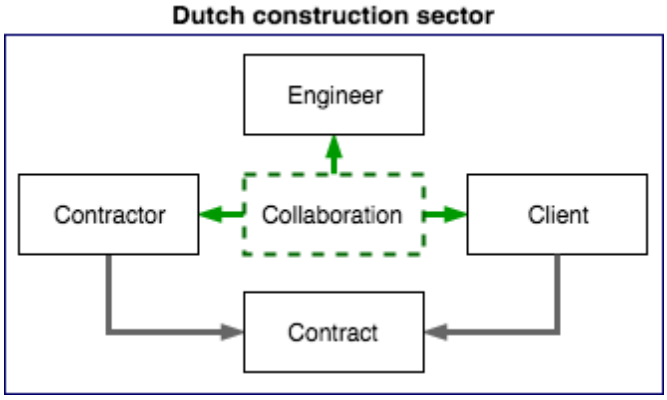

Figure 5: Collaboration in the construction sector (within scope of the research)

When an integrated contract is used the client and contractor have different roles than in the traditional contract, this results in a different form of collaboration. Generally, in the integrated contract the contractor is more active and has to take the initiative and the client is more passive in comparison to the traditional contracts (Bruggeman et al., 2007, p. 143). At the start of the project, the client has to draft a clear demand specification in a program of requirements ("programma van eisen"). By means of this demand specification, the client has to clarify and scope the works requested. The contractor uses these specifications for conducting the works independent of the client (Chao-Duivis & Koning, 2015, p. 67). In basis, the contractor is responsible for the quality of the works realised. However, this does not mean that the client should not intervene in the project and its quality assurance at all (Berg et al., 2010, p. 356). In the integrated contracts the client is involved in the project by means of review- and acceptation moments. This passive involvement enables the client to test if the contractor is conducting the works in a way and to the standards that are agreed upon in the contract (Chao-Duivis & Koning, 2015, p. 17). If this is not the case, the client can intervene.

The amount of client involvement can vary for each project since the client is free to define the amount of involvement for each project individually (Chao-Duivis & Koning, 2015, p. 9). This enables the client to choose the number of inspections and quality assurances as he sees fit to do. Condition to this process is that the client beforehand states in what way, how often and to what extent he plans to intervene during execution of the project. Due to this specification, the contractor knows what he can expect during the project. It is deemed undesired that the client can intervene with the project to an unlimited extent as this can result in an unclear task division and a shift from responsibilities from contractor to the client

(Chao-Duivis & Koning, 2015, p. 9). Next to this, the client must realise that extensive quality controls and interventions require a high level of expertise. In an integrated contract the client can have a more active role in the project by requesting change specifications (Bruggeman et al., 2007, p. 142). However, the client should act with due care if it wants to propose a change for two reasons (Chao-Duivis & Koning, 2015, p. 57). The first is that, in principle, all requirements and demands are explained before the project starts in the program of requirements. Intervening during the project is in contradiction with the idea that the contractor is independently responsible for the works constructed. Second, the request for change does not come without consequences. A change of specifications can lead to the need for a change of the agreement made between client and contractor resulting in the need for extra time or budget.

2.2.1 Integrated contracts in the Dutch construction sector

For many years the 'RAW-bestek' contract is used in the Dutch construction sector. This contract is seen as the traditional contract in the sector (Lenferin et al., 2013). The contract included a specification of the desired work with a detailed design and underlying calculations (see figure 6, 1). The contractor could choose to tender for this contract and based on the lowest price a contractor would be selected (Arts, 2007).

After 1990 Rijkswaterstaat started with more outsourcing towards the contractors. Instead of tendering specified product they tendered instead so-called performance-based contracts (Lenferin et al., 2013). The contractors received more responsibility in the new approach. Be means of the Engineering and Construct (E&C) contract the contractor was made responsible for the technical design of the works (see figure 6, 2). Positive experiences with this contract resulted in a further shift of responsibilities from the client to the contractor (Lenferin et al., 2013). This resulted in the Design and Construct (D&C) contract. In this contract the client no longer provides a detailed design, only specific output specifications are tendered (see figure 6, 3). D&C contracts became the standard integrated contract used by Rijkswaterstaat since 2008 (Rijkswaterstaat, 2008). Thereafter also maintenance was added to the contract in Design Build Maintenance (DBM) contracts (see figure 6, 4).

As can be seen from figure 6, integrated contracts reduce the number of interfaces. This is purposely done because the traditional segmentation of the design, construct and maintenance stages are poorly integrated resulting is sub-optimizations (Dorée, 2001).

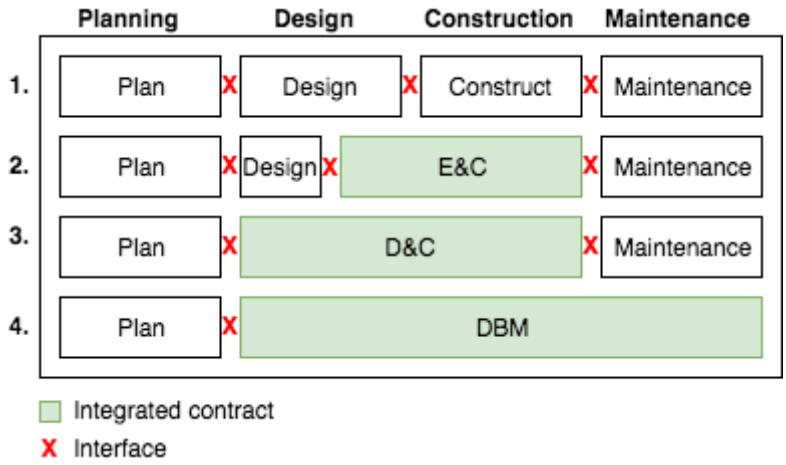

Figure 6: Integrated contract forms (Lenferink et al., 2013)

The most common contract model for integrated contracts in the Netherlands is the Uniform Administrative Conditions for Integrated Contracts 2005 or UAC-IC 2005. This contract model consists of two parts, the basic agreement and the general terms and conditions (Koning, 2013, p. 100). In the basic agreement project specific elements must be described, while the general terms and conditions provide a contractual base.

In figure 7 the structure of the UAC-IC contract is displayed. In this contract, the client and the contractor form an agreement. According to the contract standard, the contractor is responsible for the design and execution. By doing so, the contractor commits to deliver the project on time, within budget and in accordance with the client's specifications. The contractor can choose to do the works itself or hire sub-contractors, consultants or architects to do the work. The relationship and collaboration between the contractor and sub-contractors, consultants or architects is beyond the scope of this research as it focusses on client-contractor collaboration.

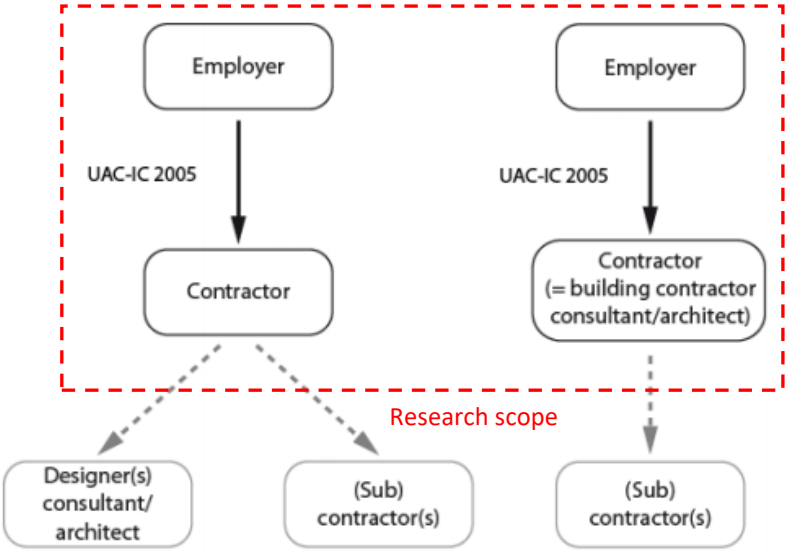

Figure 7: UAC-IC structure (Koning, 2013, p. 99)

2.2.2 Benefits and Risks of collaboration

Good collaboration between the two parties can still bring possible benefits to the project as integrated construction collaboration is linked to project success (Meng, 2012). Collaboration, however, not come without risks. In this sub-chapter, a brief overview is drafted of the possible benefits and risks of collaboration in construction projects.

Benefits

In literature, many benefits of collaboration can be found. Here a brief overview is given of the most commonly mentioned ones. Examples of possible benefits brought by a collaborative relationship are the minimisation of waste, improvements in operational efficiency and productivity, and improved supply chain coordination (Hamza et al., 1999). Collaboration also encourages openness and communication (Cook & Hancher, 1990). This can increase the mutual understanding between the parties because each partner is aware of the other's needs, concerns and objectives. As a result, the working process can become more efficient (McGeorge & Palmer, 1997). Collaboration is also seen as an elaborator of innovation and learning, and a promotor of organisational flexibility (Bennett & Jayes, 1995). Furthermore, in a collaborative environment the amount of disputes, litigations and claims is significantly reduced due to the open communication and extensive teamwork (Akintoye & Main, 2007).

Collaboration also can reduce the costs of a project. Bennett and Jayes (1995) found that collaboration can result in savings up to about 10% of total costs. It also can reduce the risk of budget overruns through improved cost control due to better communication and clear project goals (Albanese, 1994). As a result of intensive collaboration and constant communication, parties are less likely to be surprised by budget and time overruns (Moore et al., 1992). Furthermore, overall project quality can be increased as collaboration enables the parties to identify potential problems and quality uses in an earlier stage (Arntzen et al., 1995; Albanese, 1994). Overall it can be said that there is a consensus that collaboration has the potential to bring benefits and better project results than the traditional non-collaborative approach (Akintoye & Main, 2007).

Risks and opportunities

Collaboration can bring many benefits, it does however not come without risks. A good example of this is that approximately 60% of the highly collaborative construction alliances fail (Anderson et al., 2006). Causes of this failure are often due to the risks of collaboration such as lack of cooperation between the involved parties. There are however also project performance failures despite full cooperation (O'Connor, 2009). Hold-up by a project partner is one cause of this problem, another is the risks associated with the inadequate allocation of collaboration methods due to the inability to do so in current contracts.

Dependence on other parties also forms a major risk (Anderson J., 2017). This is especially the case when the goals of one party are dependent on the goals of another party. It can become problematic when the goals of the different parties are not properly aligned, conflicting or competing. Furthermore, it can be the case that the success of one party is not dependent on the success of another party. Anderson (2017) provides an example of this: a mechanical system can have a dismal failure, while its structural design is award winning. In this case, the mechanical engineer failed to deliver a properly working system while the structural engineer achieved his goals. This situation can result in an overall project failure even though the structural engineer fulfilled his goals. Proper communication and collaboration are needed between all involved parties to create a mutual understanding of the expectations of all parties. If this is not the case ultimately claims or financial losses are likely to occur (Anderson J., 2017).

Collaboration does not always achieve its goals (Akintoye & Main, 2007; Patching, 1994). Patching (1994) states that the deviation in goals among parties can result in conflict and thereby hinder collaboration. Furthermore, when collaboration fails it can result in a win-lose attitude which hinders project success (Lenderum, 1998). Collaboration can thus be dangerous (Merchant, 2011). When collaborating one places certain activities outside its own immediate control, if the other party fails to conduct these activities it can influence the success of both parties. Merchant (2011) identified 8 specific reasons why collaboration can be dangerous:

- Unaware of the answer – collaboration is often focused on the solving of complex problems that one cannot solve by itself. As a result, each participant must be comfortable with a certain level of ambiguity;
- Unclear or uncomfortable roles – in a collaborative environment the roles are often not on a hierarchical basis and can differ in each phase of the project. This might need

some getting used to by senior team members, especially when they do not have the leading role;

- Talking instead of doing – because collaboration focusses on thinking and developing ideas together instead of alone there is likely to be a lot of talking in the beginning of a project. This can result in many debates and in ongoing discussion about all sort of ideas. Resulting in a time consuming frond-end process which seems to never end;
- (Over)sharing of information – collaboration can only work if information is often shared. This can result in an information overload for some. On the other hand, the sharing of information can be seen a threatening to others as the withhold of information gives them power;
- Fear of fighting – as a result of the many opinions, goals and opportunities collaboration is often also about making trade-offs. This can cause conflict, which according to many collaborative approaches must be avoided. However, avoiding conflict and not debating about the trade-offs is very risky as it can result in unsatisfied parties and poor decision making;
- More work – collaboration focussed activities often come on top of the other work. When people are already very busy this can result in stressful situations. Collaboration can be overwhelming and is often pushed aside when there is limited time. This is also because collaboration is not always pleasant, it requires making trade-offs and new ways of working. Leaders have to do more than only tell people what to do and initiative is required from all staff;
- More hugs than decisions – when collaborating extensively there is the risk that people behave emotionally. This must be avoided since collaboration is not about feeling good, it is about making the best business results. Decisions must not be made on an emotional basis which requires tough decisions calls by the leaders;
- Unclear who to praise and who to blame – collaborative projects are often more judged on the outcome than on the individual effort. This is because if collaborative projects it is hard to get an understanding of who did what. This creates the problem that it can be difficult to praise the right people or to make the right people responsible when things go wrong.

It is clear that collaboration has risks. This is however necessarily not a bad thing. Knowing the risks enables effective management of collaboration and creates an understanding that collaboration is not a naturally occurring and an easy aspect of the project. Collaboration needs sufficient management to work, otherwise it can be counterproductive.

2.2.3 Collaborative culture in the Dutch construction sector

The Dutch construction culture is different from the other international sectors (Hoezen et al., 2006). It is found that human factors play an even more significant role in the Dutch construction industry. Also, many professionals in the Dutch sector carry bad experiences from the period of the building fraud in the Netherlands and the period thereafter (Koenen, 2015, p. 10). After the building fraud, the construction sector entered a period of poor and cumbersome collaboration, and the sector is faced with increasing project complexity and a receding client involvement (Jacobs et al., 2012, p. 11). The expectations are that the traditional project management approach is no longer suitable for the sector. There is a clear need for new project management methods in the Dutch sector that focus more on the 'soft' aspects such as collaboration, flexibility, trust and common goal setting (Jacobs et al., 2012,

p. 12). This transformation to new methods has already been put into motion in the Dutch sector. This is however mostly on small incidental projects; the traditional approach is still the most seen method.

The Dutch construction sector is home to several cultures with as dominating culture the "task culture" (Jacobs et al., 2012, p. 100). This culture is characterised by putting the higher goal central. Within this culture, there is a tension between 'stubborn' professionals on the one hand and on the other hand the urge for carefulness in procedures and checklists, which is seen as typical for the construction sector in the Netherlands. Controlling the process is seen as a necessary evil, it is done, but little is done with it. In theory, there should be few problems with collaboration in the sector because there is one dominant culture (Jacobs et al., 2012, p. 101). However, the small differences in culture in the sector appear to have a significant influence on collaboration and often cause incomprehension among the parties. It is stated that the communication is far from optimal in the Dutch culture and that when things go wrong, it often results in pointing fingers on both sides resulting in an overall lack of collaboration (Hoezen et al., 2006).

2.3 Current state of collaboration in the Dutch construction sector

An insight into the state of the Dutch construction sector of a decade ago is provided by Noorderhaven et al. (2006). The study explains that the sector is faced with poor 'old' behaviour. Distrust and an uncollaborative culture dominate the sector. This study is still relevant today, as major players in the industry indicate that the needed change in collaborative behaviour is still absent (Wisse & Arends, 2017; Koenen, 2015). A more extensive explanation of the study by Noorderhaven et al. (2006) is provided in appendix A.

Also, the international construction sector is faced with opportunistic or 'old' behaviour by the involved parties over the past decades (O'Connor, 2009; Eriksson & Westerberg, 2011; Harmon, 2003). This is defined as "behaviours by a contractor that are motivated to pursue its self-interest with deceit to achieve gains at the expense of the owner" (Das & Rahman, 2010; Lu et al., 2016). This behaviour often results in conflict (Consoli, 2006; Chan & Suen, 2005), confrontational relations between client and contractor (Jelodar et al., 2015) and poor project performance (Flyvbjerg B., 2014; Matta & Ashkenas, 2003; Shenhar & Dvir, 2007). The full extent of the problems and a further identification of opportunistic behaviour can be found in appendix B.

The problems follow from this opportunistic or 'old' behaviour are more and more recognised in the Dutch construction sector. To counter this behaviour and to boost collaboration in the Dutch construction sector, the Marketvision 2016 has been drafted by Rijkswaterstaat, Rijksvastgoedbedrijf, ProRail, Bouwend Nederland, NL Ingenieurs, de Vereniging van Waterbouwers, MKB Infra, Uneto VNI and Astrin. These parties together formulated the ambition for construction sector as a whole for the year 2020. This ambition is as follows (Rijkwaterstaat et al., 2016): *"builders of the Netherlands", by being trustworthy, approachable and inspiring and we work for civilians and companies together on a safe, liveable and accessible Country".* To fulfil this ambition, the drafters formulated three sub-ambitions, these are:

- Having a collective ambition (direction) for civilians and companies. This entails working sustainably, working with a vision for the future and creating value for money;

- Excel, pride and craftsmanship. Put quality central. As a result of the delivered quality appreciation is obtained from the public, anticipate and learn continuously;
- Proper collaboration. It is desired to work in respectful relationships to realise the Marketvision together, as the sector as a whole.

Even though there are no concrete actions in the Marketvision, there is a clear new way of thinking that the drafters promote through the document. All organisations are free to implement the ideas presented in the Marketvision in a way they see fit. To facilitate organisations to do this as best as possible the drafters of the Marketvision present an overview of the main ambitions for the future. These ambitions are focused on creating more and intensive collaboration by effective communication and collaborative behaviour by both client and contractor. The complete set of ambitions can be found in appendix C.

According to Dronkers (2016), ex-director-general of Rijkswaterstaat, there is understanding by both the clients and contractors in the Dutch construction sector that there is a need for change and improvement of the current collaboration culture. Therefore, the need to give a strong impulse to the collaboration culture is seen as necessary (Rijkwaterstaat et al., 2016). Lack of cooperation is even seen as one of the leading causes of inefficiency in the construction industry (Cheung et al., 2003). Cheung et al. (2003) state that many active participants in the sector stress that the contracts are designed to favour the clients while the risk burdens are placed on the contractor. This creates an imbalance in the market that limits collaboration. A result oriented collaboration approach with the common goal in mind is needed. To reach this, it is necessary to invest in each other's interests. In a good relationship between the client and contractor, it is possible to steer each other on attitude and behaviour. This must be done with respect for the interest of the other party. By sharing knowledge, extra value can be added to the project and the chances of creating a successful contractual relationship increase (Rahman et al., 2014).

The Marketvision started a transition from the period of poor collaboration referred to as 'old behaviour' towards a new period of collaboration between clients and contractors. Guidelines have been drafted to direct the sector to be respectful and effective way of collaborating. The question is whether the sector is succeeding to implement these ambitions in practice with the currently available methods and contracts. Knowledge platform CROW investigated in May 2017 the status of the Dutch construction sector at that time. They questioned 148 employees of a client organisation and 123 employees of a contractor organisation on their view of the Dutch sector. The following results stand out, with in brackets the percentage of total respondents that made the statement (CROW, 2017):

- Both clients (73%) and contractors (69%) state that the other party places their own interests above the shared interest;
- Both clients (61%) and contractors (69%) state that the other party focusses mainly on the contract and not on attitude and behaviour;
- The clients (59%) state that the contractor behaves opportunistically while the contractors state that the clients miss the bigger picture (61%) and improvident transfer to many risks to the contractor (86%);
- The clients (68%) state that the contractor deliberately neglects to warn for errors in the specifications and conditions or juridical loopholes in the contract, while the contractors (77%) state that the clients hides behind the contract;

- Few clients state that contractors are trustworthy (17%) or honest (10%). The contractors state that the client does not treat they as equals (57%) and that clients are mostly defensive instead of cooperative (70%).

Assuming that these results display a correct overview of the Dutch construction sector, it can be said that there is still a lack of trust and overall poor collaboration from both client and contractor. An insight into methods to improve collaboration can help overcome this non-collaborative behaviour.

2.4 Factors that positively influence collaboration

In literature, many factors that can cause an efficient and effective relationship consisting of proper collaboration can be found. Factors that are regarded as most important for the enabling of good collaboration are summed up; also an explanation of the factor will be provided to get an understanding of the relevance and applicability of the factor. The factors that can positively influence collaboration will be used in the exploration of the possibilities and opportunities of methods from Project DOEN and the NEC4 ECC. By knowing what factors influence collaboration methods can be identified in the NEC4 ECC and Project DOEN that have the potential to influence one or more of these factors. By doing so the method might positively influence the overall collaboration in the project.

Even though this study is scoped on the Dutch construction sector these factors are identified with the use of international literature. The purpose of the identification is to provide a framework for collaboration which is regarded as internationally comparable. Therefore, the use of international sources is applicable. The exact impact of each factor on collaboration can differ internationally and consequently no comprehensive effect scheme of the factors is provided.

- **Mutual objectives** – it is vital for proper collaboration to develop mutual objectives and set aside self-interest (Meng, 2012). The development of mutual objectives sets common goals and creates a focus of the parties' efforts in the same direction (Thomas & Thomas, 2005). By doing so, a win-win situation can be created that achieves the goals of both parties (Eriksson, 2008a). This is a situation in which all parties have benefits by focusing on the overall project success (Bennett & Jayes, 1995). By including specific criteria about the mutual objectives in the procurement phase, extra emphasis is placed on these aspects, with makes it clear that these aspects are essential. This will likely increase the chances that the parties success on the mutual goals (Swan & Khalfan, 2007). Mutual benefits can also be obtained through shared responsibilities regarding the project objectives (Walker et al., 2002).

- **Gain and pain sharing** – gain and pain mechanisms can be used as an incentive to achieve mutual projects goals (Bayliss et al., 2004). The Chartered Institute of Building (CIOB, 2010) has defined gain/pain sharing as an agreement between parties in which the parties agree to share unexpected profits or costs savings (gains) of losses (pains) during on some aspects of the project. Next to financial benefit, a gain/pain mechanism can also result in non-monetary rewards such as satisfaction and recognition (Walker et al., 2002). The mechanism can provide a process that incentivises the parties to achieve the mutual project goals and effective collaboration

(Bayliss et al., 2004). Gain and pain sharing is not easy; difficulties can arise due to disagreements on the gain and pain agreements during the project (Bresnen & Marshall, 2000).

- **Trust** – to obtain a good working relationship, and thereby good collaboration, trust among the parties is needed (Pinto et al., 2009). Distrust is seen as one of the leading causes of poor collaboration in projects (Akintoye & Main, 2007). Trust is something that is hard to create through a contract, it has to exist independently of it. It is however not irrelevant to the contract. A good contract with appropriate incentives and reasonable sharing of risks can enlarge the mutual trust, while a contract with no incentives and fair risk allocation will likely do the opposite (O'Connor, 2009).

- **No-blame culture** – in the traditional (old) construction sector it is often seen that parties do not look for a solution together, but start blaming the other party when problems arise (Bramble et al., 1990). If a no blame culture is adopted, parties can save time and energy on allocating the blame. Instead, they can focus on finding the best solution for all parties involved. This can help create an environment in which the parties can effectively work together to tackle problems (Bennett & Peace, 2006).

- **Joint working** – joint working entails working in an integrated team (OGC, 2003). This generally includes joint decision making based on mutual objectives (Chan et al., 2004), joint problem solving (Cheng et al., 2000) and joint effort for continuous improvement (Larson, 1997) which all stimulate collaboration. Joint problem solving can result in new innovative solutions that can be beneficial to all involved parties and thereby help achieve the mutual objective (Cheng et al., 2000).

- **Communication** – during the period of traditional behaviour contractors were often selective in their communication to create a commercial advantage over the client and other contractors (Wood, 2005). This is unwanted since lack of effective communication is identified as one of the main causes of collaborative failure in projects (Ng et al., 2002). Effective communication can result in an open exchange of information which facilitates the sharing of ideas and visions, and it can result in a decrease in misunderstandings (Cheng et al., 2000). Face-to-face encounters facilitated by a joint project office encourages communication and can increase innovation (Alderman & Ivory, 2007), environmental performance and work performance (Cole, 2000).

- **Joint problem solving** – during construction projects it is inevitable that problems will occur. Joint problem solving stimulates collaboration, when parties are able to effectively solve problems together it indicates that the parties have a positive working relation (Meng, 2012). When there are methods in place to effectively deal with these problems jointly, it is more likely that these problems will not form a big issue (Jones et al., 2003). Problems can be best handled at the lowest level. when a problem is discussed at an early stage, it can be tackled before it becomes a big dispute (Ogunlana, 1999). When there is no proper problem solving method in place, small issues can develop into significant disputes that are difficult to solve (Bennett & Jayes, 1995).

- **Fair risk allocation** – in traditional contracts one of the main causes of claims and disputes is the inadequate allocation of risks due to a lack of contract clauses or queries about the fair distribution of these risks (Wang & Chou, 2003). Risks were often transferred to the party with the weakest power position (Fewings, 2005). To overcome this poor risks allocation responsibilities and risks should be divided equitably by explicit contractual agreements (Zaghloul & Hartman, 2003). In the ideal situation, risks should be allocated to the party who is best able to manage the risk (Jones et al., 2003). In construction projects, it is common that not all risks can be foreseen at the start of a project. Joint risk managing can facilitate the distribution and tackling of risks that are hard to foresee in the early stages of the project. This can reduce the negative impact of the risks on the project performance (Rahman & Kumaraswamy, 2004b).

- **Effective performance measurement** – effective measurement of the project performance at agreed times in agreed areas enables the teams to identify opportunities and possibilities for improvement (Thomas & Thomas, 2005). Without doing so, it is hard to get an understanding of how well the project team is doing and where improvements can be made; disusing findings jointly enlarges the changes of finding new opportunities (Cain, 2004). However, it must be noted that too close monitoring of the contractor's behaviour may encourage opportunistic behaviour which hampers collaboration (Ruuska et al., 2009). Giving the contractor self-control in the performance measurements can instead save costs and time due to earlier identifications of problems (Eriksson & Nilsson, 2008). Self-control by the contractor can also enlarge the contractor's concern and commitment to the quality of the conducted works (Chua et al., 1999).

- **Continuous learning** – By continuously learning, the parties can jointly identify which aspects are essential and need focus, and which aspects are irrelevant and should be eliminated (Thomas & Thomas, 2005). It incentivises the parties to deliver an increasing value. This improves the chances of reaching the mutual objective of project success (Jones & O'Brien, 2003). Without continuous learning parties can become too comfortable with their situation, this can result in ineffective ways of working (Kululanga et al., 1999).

The above factors are elements that can facilitate collaboration between client and contractor, however if the client does not select a contractor that is willing to cooperate and is willing to focus on the mutual objective none of the above factors will help to facilitate collaboration (Caldwell et al., 2009; Kumaraswamy & Anvuur, 2008). Therefore, is it crucial that the client selects a suitable contractor who is willing to commit to a collaborative relationship with the client.

Traditionally public clients focused mainly on the price specification (Eriksson, 2008b). Currently, parties start to focus more on the soft parameters during the selection process (Kumaraswamy & Anvuur, 2008). The understanding is growing that a suitable partner and a pro-active attitude is necessary to successfully collaborate and reach project success (Eriksson & Westerberg, 2011).

2.5 Conclusion

Based on the literature research sub-research questions 1, 2 and 3 are answered.

Sub-question 1: What does collaboration between client and contractor in integrated contracts in the Dutch construction sector entail?

Collaborative working is defined as the working together of different organisations to effectively and efficiently accomplish a project. Collaboration is seen as a highly complex and challenging task. Due to better working relations, information flows and collaboration, goals can be achieved that an organisation by itself would not have been able to achieve. Furthermore, the sharing of knowledge can result in a reduction of errors, time delays and re-work.

In an integrated contract collaboration is different than in a non-integrated contract. In an integrated contract the contractor is more active and has to take the lead, the client has a more passive role. This means that the contractor is responsible for the execution and quality of the works while the client oversees the contractor. The most used integrated contract form in the Netherlands in the Design and Construct (D&C) contract. The commonly used contract form for this type of contract in the Netherlands is the UAC-IC. The purpose of the integrated contract is to reduce the number of interfaces and thereby poorly integrated sub-optimisations.

Many benefits can be achieved by collaborating in these contracts. The main benefits are the minimisation of waste, improvements in operational efficiency and productivity, improved supply chain coordination, open communication, increased mutual understanding, more efficient working process, innovation, increased learning, organisational flexibility and reduction of disputes. The risks that come with collaboration are mainly due to dependence on the other party and deviation in goals between the parties during project execution. This can be dangerous because a failed collaboration can cause poor project performance. Collaboration should thus be done with due care.

The Dutch construction culture is under pressure. This is mainly due to bad experiences from the past and increased project complexity combined with a receding client. Within the Dutch construction culture, there is a tension between ‘stubborn’ professionals and the urge for carefulness in procedures and checklists.

Sub-question 2: What is the current state of collaboration in integrated contracts in the Dutch construction sector and what problems occur in the sector?

A study in 2006 showed that opportunistic or ‘old’ behaviour played a large role in the Dutch construction sector. Currently, major players in the industry indicate that the needed change in collaborative behaviour is still absent. Therefore it can be said that opportunistic or ‘old’ behaviour is still present in the current day construction sector in the Netherlands.

At the moment, however, the need to change is recognised more and more in the sector. There is a general understanding that changing the culture and the role of the client is seen as necessary to increase collaboration and thereby enlarge the chances of project success. To counter uncollaborative behaviour and to boost collaboration, the Marketvision 2016 has been drafted by major client and contractor organisations in the sector. The Marketvision does not contain concrete actions but it clearly embodies the need for change towards a culture focused on more and intensive collaboration by effective communication and

collaborative behaviour by both client and contractor. The Marketvision started a transition from the period of poor collaboration referred to as 'old behaviour' towards a new period of collaboration between clients and contractors.

From research by CROW, it followed that there is currently still a lack of collaborative behaviour in the sector. It followed that both client and contractor state that the other party does not treat them as equivalent, the other party focusses too much on the contract and not on the relation, and that the other party does not behave in a best-for-project way. The current state of collaboration in the Dutch construction sector is thus still troublesome. The goal of this research is to provide methods that can help to positively stimulate collaboration and thereby increase the overall collaboration in the Dutch construction sector.

Sub-question 3: Which factors can positively influence collaboration between client and contractor in integrated construction projects according to literature?

From literature, factors are identified that can positively influence collaboration. When these factors can be stimulated by a method, the methods can have a positive influence on the overall collaboration in the project.

The identified factors that have an influence on collaboration are mutual objectives, gain and pain sharing, trust, no-blame culture, joint working, communication, joint problem solving, fair risk allocation, effective performance measurement and continuous learning. Based on these factors of collaboration, methods will be identified from the NEC4 ECC and Project DOEN in the next chapter.

Collaboration has several boundary conditions. It is needed that both the client selects a contractor that is willing to cooperate and the client itself is willing to invest in a good relation. This means that it is crucial that a willing contractor is selected and the client has a pro-active attitude. To do so other procurement criteria must be drafted. This is realised in the sector. As a result, clients often create soft-parameters (collaborative skills) next to the hard-parameters (costs, time quality) to select a contractor. Next to this, within client organisations more and more emphasis must be placed on collaboration. In short, both client and contractor must be willing to collaborate in order for collaboration to fully succeed. The following chapters will further investigate how this willingness can be created or stimulated.

3. Identification NEC4 ECC and Project DOEN

Collaboration is not something one can buy a ticket and it is obtained. It requires continuous investment from both parties. When the right methods and process for collaboration are in place, it can be used as a mean to increase the chances of project success due to innovations, time and budget improvements or quality increase. Therefore, it is important that there are methods available that can facilitate collaboration. In this chapter, the NEC4 ECC and Project DOEN are explored. This exploration is done based on available documentation, literature or interviews. The used methodology for NEC4 ECC and Project DOEN is slightly different. This difference is further elaborated in the NEC4 ECC and Project DOEN sub-chapters. The goal is to identify methods from these standards that can facilitate collaboration in integrated contracts in the Netherlands. This will be done by answering the fourth sub-question of this research, being:

"What are the opportunities and possibilities of the Project DOEN and NEC4 ECC that can positively influence collaboration and what are the possible drawbacks that come with these opportunities and possibilities?"

3.1 NEC4 ECC

The New Engineering Contract (NEC) is introduced in 1993 by the Institution of Civil Engineers (ICE). The first publication of the contract form adopted a direct and straightforward drafting method in contradiction to the existing contracts at that time (Gould, 2008). It did this by strongly focussing on project management principles. In this period the Latham report was also published. This report had a strong influence on the way the British construction sector operated (Gould, 2008). The report suggested that the NEC should be used as the national standard in both the public and private sector because of its clarity and project management procedures (Latham, 1994). The second version of the NEC was published in 1995 and the third in 2005. In July 2017 the fourth edition, the NEC4, has been published. Each new version further improved the existing project management methods and introduced new methods.

The NEC has been drafted as a response to a discussion in the British construction sector. One of the main issues at that time was that the traditional contracts often caused adversarial relationships (Wright & Fergusson, 2009). Parties often behaved in a way that only suited their interest instead of the shared interest of project achievement, which often lead to significant disputes (Bresnen & Marshall, 2000). Researchers concluded that ''Over the past 20 years, loss and expense (due to) contractual claims have attacked the British industry like a cancer" (Thompson et al., 2000). There was a need for a new contract form that would stimulate collaboration and limit confrontation by utilizing proper project management (Rowlinson M., 2011). There was also a need for more flexibility to ensure that the contract would suit the specific characteristics of a project (Chao, 2017). Next to this, there were requests from the market to make a contract form that was understandable for the people that needed to work with the contract on a daily basis. In other words, a contract written in a relatively simple language with few juridical terms (Eggleston, 2006).

The need for better collaboration and more flexibility in a contract that is understandable for the people that need to work with it has resulted in the NEC suite of contracts. This contract form was developed with three main aims (Wright & Fergusson, 2009):

- Clarity and simplicity;
- Flexibility of use;
- Stimulus for good management.

The NEC form of contract is seen as an enabler for change in the engineering sector towards a more collaborative sector (Latham, 1994; Egan, 1998). Because of the positive experiences, the NEC contract is the most popular contract for civil, infrastructure and utilities works for UK clients (RIBA, 2016). It also is increasingly used in other countries than the UK. Due to its positive track record, the standard is already used by over 20 countries (Barnes, 2002). The language of the NEC was received positively; some even described it as "beautifully simple" as it never uses more than 40 words in a sentence (Burrows, 2002, p. 17). Other positive feedback included that the contracts are easily translatable, increase mutual understanding among the parties and help reduce conflicts and disputes in comparison with the traditional design-bid-build contracts (Fox, 2006). Broome & Hayes (1997) found in a study among 81 ECC users that the main benefits of the NEC over traditional contracts are that the NEC:

- Is easier to understand;
- Contains clearer procedures, flowcharts make the procedures for all parties and events understandable;
- Increases the awareness of responsibility for the conducted actions;
- Clarifies risk allocations and thereby promotes active reduction and elimination of the probability of occurrence and impact of risks;
- Creates awareness of the risk allocation among the employees;
- Limits arguments regarding payment and entitlement of extra work.

Furthermore, it was found that the NEC improves communication and helps to create better relationships resulting in a decrease of disputes (Thompson et al., 2000).

The NEC4 Engineering and Construction Contract (ECC) is the contract in the NEC contract suite that focusses on engineering and construction activities. The core clauses of the NEC4 ECC contract embodies this need for better collaboration. For instance, in core clause 10.2 it states that the parties shall act *"a spirit of mutual trust and collaboration"*. The underlying meaning of this clause can be found back in many parts of the contract. For instance, the obligation to inform each other timely regarding the risks and the need for follow-up meetings to handle these risks. Also, there are options for partnering and the sharing of unexpected losses or profits (Chao, 2016). A benefit of the ECC contract is its high flexibility (Wright & Fergusson, 2009). The NEC standard provides the possibility to tailor the contract to suit many projects (Chao, 2017). The NEC4 ECC provides six main options (ICE, 2017a):

- Option A – priced contract with activity schedule;
- Option B – priced contract with bill of quantities, the contractor is paid tender prices (like lump sum);
- Option C – target contract with activity schedule;
- Option D – target contract with bill of quantities, financial risk is shared between client and contractor in agreed proportions;
- Option E – cost reimbursable contract;
- Option F – management contract.

Next to the six main options there are three options for dispute avoidance, being (ICE, 2017a):

- Option W1 – used when Adjudication is the method of dispute resolution and the United Kingdom Housing Grants, Construction and Regeneration Act 1996 does not apply;
- Option W2 – used when Adjudication is the method of dispute resolution and the United Kingdom Housing Grants, Construction and Regeneration Act 1996 applies;
- Option W3 – Used when a Dispute Avoidance Board is the method of dispute resolution and the United Kingdom Housing Grants, Construction and Regeneration Act 1996 does not apply.

From these options, option W2 is not applicable to the Dutch construction market since the United Kingdom Housing Grants, Construction and Regeneration Act 1996 does not apply in the Netherlands. Option W1 and W3, which can be used in the Netherlands are further explained in chapter 3.1.1.

To further tailor the contract there are 21 secondary options available in the NEC4 ECC. When these options cannot fully satisfy the needs of the client, he can add custom Z clauses. The use of Z clauses should, however, be avoided as much as possible because they are a primary source of conflict in NEC contracts (Norris, 2017). The NEC4 ECC added and changed clauses in comparison to the NEC3 ECC to reduce the need for Z clauses as much as possible (Fordham, 2017).

The NEC4 ECC has nine core clauses that apply regardless of which main, dispute and secondary options are chosen. The involved parties must always act accordingly to the core clauses. These clauses are (ICE, 2017a):

- General – the general clauses contain the definitions, interpretations, ambiguities and general introductory matters that need to be clarified. Furthermore, this core clause contains clause 10.2 that states that "the parties, the project manager and the supervisor act in a spirit of mutual trust and cooperation" and agreements regarding communication, the role of the project manager, early warnings and contractor proposals. These aspects will be further elaborated in chapter 3.1.1;
- The contractor's main responsibilities – this core clause deals with the responsibilities of the contractor such as the design, equipment, personnel and subcontracting;
- Time – the third core clause deals with all the time aspects of the project. The ECC contract is known for its use of key dates. These key dates are used to indicate timeframes in which certain works must be conducted. The use of these key dates make it possible for several contractors to work together on the site. This facilitates progression on the project as a whole;
- Quality management – in the fourth clause rules regarding inspections and tests are found. It deals with the way inspections and test are carried out, the rectification and acceptance of defects, and how to deal with defects that have not been corrected;
- Payment – this cause deals with the assessment of the (final) amount due. The project manager has to asses this amount at each assessment date. These dates are established in the contract data that must be provided by the client. If the contractor does not provide a programme a quarter of the payment is retained until a programme is submitted to the project manager. This incentivised the contractor to submit a programme of assessments. After assessment, the project has to certify payment within one week after the assessment date. Thereafter a certified payment

must be made within three weeks after the assessment date. The project manager has to make a final assessment due. This must be done four weeks after the defects certificate or thirteen weeks after the termination certificate. If the project manager fails to do this in time, the contractor can issue its own final assessment. The final assessment becomes conclusive if not challenged by the parties and is not referred to dispute resolution within four weeks after being issued.

- Compensation events – the compensation events clause deals with a wide variety of unexpected, unforeseen or scope changing events that can occur during the project. These events are treated as individual events and are thus assessed individually. For each event, a quotation must be made concerning time and money. The compensation events contain several methods that aim to increase collaboration between the client and contractor, these will be further elaborated in chapter 3.1.1;
- Title – this clause mainly deals with the client's title to the plant and materials. It also deals with equipment and the removal of this equipment of the site. This clause is mainly a formality.
- Liabilities and Insurance – in this clause the liabilities of both the client and the contractor are stated. Previously the contractor's liabilities where all liabilities other than the client's liabilities, but this has been revised in the NEC4 ECC in clause 81.1. An insurance table is provided that states the insurances that the contractor must provide together with the minimum amount that these insurances must cover. The contractor must submit certificates to the project manager to prove that insurances are in place. If the contractor fails to provide insurances the client may insure, the costs of this insurance are to be paid by the contractor. Reversed, if the client fails to insure his part the contractor may insure, the costs of this insurance are to be paid by the client;
- Termination – the final core clause deals with termination of the project. In short, either party can terminate the project in case of insolvency as described in clause 91.1. If the contractor is not paid in 13 weeks after the work certificate, he may terminate. The client can terminate if the contractor fails to meet its obligations, does not provide a bond or guarantee, hires a subcontractor for a substantial part of the works without consent of the project manager or breaks health and safety regulations. Both parties may terminate in case of suspension of the works and the works are not restarted within 13 weeks. Finally, the client has the right to terminate if an event occurs that makes it impossible for the contractor to finish the works and which neither parties could have prevented from occurring.

Previous studies into the NEC3 ECC contract with regards to the Dutch construction sector showed that the contract can be a facilitator of best-for-project behaviour (Stam, 2016) and that the contract can positively influence cooperation due to the contracts philosophy, language, flexibility, guidance and specified cooperation (Häsler, 2014). Furthermore, it was found that the NEC3 ECC promotes trust among the involved parties, which is seen as a necessity for collaboration (Cheung L., 2015). Therefore, a more detailed exploration of how the contract facilitates this is conducted in the next sub-chapter.

3.1.1 Possibilities and opportunities to improve collaboration

In this sub-chapter clauses are explored that can help improve collaboration in the Netherlands because the clauses stimulate factors of collaboration which are defined in

chapter 2.4. Firstly, the contract is quick-scanned for clauses that focus on or deal with collaboration and can influence these success factors. This resulted in 12 clauses that are potentially interesting to explore because they can stimulate one or more of the success factors of collaboration. For the exploration of these clauses the following resources are used:

- the NEC4 ECC contract;
- the guidance notes of the NEC4 ECC contract provided by the Institute of Civil Engineers;
- webinars about the use of NEC available on the NEC website;
- relevant literature.

Based on these findings an initial overview showing the possible influence of these clauses on collaboration is made. This overview will be tested in the case studies.

Good faith obligation – clause 10

The NEC standard is known for its good faith obligation. This obligation in incorporated in the first core clause of the NEC4 ECC contract. Here it is embodied in two clauses, clause 10.1 and clause 10.2. Clause 10.1 states that all involved parties shall act as stated in the contract and clause 10.2 states that these involved parties shall act in a spirit of mutual trust and cooperation. This division is made to emphasise that there are two obligations and not one. These obligations do not mean that the parties should fully set aside self-interest, the obligations of the parties, project manager and supervisor remain as stated in the contract (ICE, 2017b). From cases conducted in the United Kingdom, it became clear that this clause meanly embodies conducting projects with good business behaviour whilst not improperly exploiting or blaming any other party (Downing et al., 2017). The concept of working in good faith is recurring in many methods used in the NEC4 ECC such as early warning, payment, programme and compensation events (ICE, 2017b), these are further elaborated in the next paragraphs of this chapter.

It is however questionable if such a clause adds value in the Dutch sector. In the Netherlands, there is under the Dutch Civil Code (DCC) the concept of reasonableness and fairness (redelijkheid en billijkheid) that automatically applies as stated in sections 6:2 and 6:248 of the DCC. The question arises whether this core clause of the NEC4 ECC extents this concept or that it adds no value. Chao (2017) argues that it can add value because it creates an understanding among the parties that the goal is to conduct the project collaboratively. Explicitly stating that the parties shall act in a spirit of mutual trust and collaboration and that the parties shall act as stated in the contract gives a clear signal from both parties that they are willing to collaborate during the project. This can help focus on the mutual objective of the project as both parties express their willingness to conduct the project in an honest, fair and cooperative way. By stating this desire early on, the project can be approached from a two-sided perspective that satisfies both parties and creates the foundation for trust, fair risk allocation and a strong relationship (Chao, 2017; Cheung L., 2015).

Communications – clause 13

As became clear from researches of Cook & Hancher (1990), Akintoy & Main (2007), Albanese (1994) and Moore et al. (1992) proper communication is vital for effective collaboration. Without proper communication effective collaboration is impossible. The drafters of the NEC4 ECC understand this importance. This resulted in an extensive clause on communication. Clause 13 starts with the requirement that all communication can be read,

copied or recorded and that it is in understand language (like the contract itself). To facilitate this, the NEC provides eight neutrally written forms that can be used by both client and contractor for communications such as instructions, notifications and acceptances. These forms can help to communicate clearly about project changes, early warnings, compensation events and disputes (ICE, 2017b).

There are no explicit rules in the NEC4 ECC concerning what type of communication system should be used, this is because each project is different and requires a different communications system. For instance main option A, where there is a need for a well written and clearly defined scope, often fewer problems arise in the early warning system resulting in the need for a less extensive and intensive communication model than main option E with a developing scope. In this option, there are probably constant changes which cause problems that arise in the early warning process (ICE, 2017b). Here extensive communication is necessary to stay up-to-date with the process and to deal with the changes and problems that arise. The NEC4 ECC stimulates clear and consisted communication by motivation the parties to use simple communications systems that include aspects such as date, relevant clause, description and reply. The NEC4 ECC provides a basic form for this system that can be used by any party. By providing different types of communication forms and stimulating clear communication systems, the NEC4 ECC tries to facilitate proper communication among the parties during the whole project. Which ensures that the parties are up-to-date of the process to reduce the changes of conflict due to unexpected events (Wu G., 2013; Harmon, 2003).

Early warning – clause 15

The Early Warning procedure can be used as a reciprocal but straightforward management tool. The procedure deals with risks from both client and contractor. Both parties are required to notify the other party as soon as either party becomes aware of any matter that could increase the total costs, delay completion, delay meeting or key dates or impair the performance of the works (clause 15.1). Several researchers found that Early Warning can be a powerful tool. Shaw (2002) states that it can ensure that both parties have a good understanding of the state of the project at any time in during the project which enables the parties the possibility to intervene early on and can measure the performance. This reduces the change that events escalate in significant problems (Shaw, 2002) and thereby aims at one of the primary goals of the NEC4 ECC to minimise the amount of conflict (Forward, 2002, p. 24). It enables parties to resolve the problem at an early stage in the most effective manner, which reduces the changes of relational conflict (Gould, 2008). Due to its clear process both client and contractor know what to expect from the other party, this can help create trust among the parties (Cheung L., 2015). As a result, the Early Warning is referred to as the "jewel in the crown" of the NEC standard (Forward, 2002; Gerrard, 2014).

When the project is started the project manager must prepare an initial Early Warning Register and issue this register within the first week of the project (clause 15.2). Thereafter, the continuous process starts of notifying early warnings, capturing them in the register, communicating these warnings and conduction early warning meetings. The intended result is to solve the early identified problems for the parties that will be affected by it (ICE, 2017b). The first early warning meeting must be held within the first two weeks of the project. Later early warning meeting can be requested by both parties when they see it necessary to have one. Both parties are obliged to notify early warnings as early as possible and to keep the

Early Warning Register up-to-date. If the contractor fails to do so he is sanctioned with a reduced payment of the related compensation event (clause 61.5 & 63.7). Also, under option C, E and F the payment can be reduced as the disallowed cost increase (clause 11.2). The project manager is incentivised to give early warnings as it maximises the time to deal with the problem with the contractor and thereby increase the chances of finding a solution that meets the clients' interests the most (ICE, 2017b). The thought behind the Early Warning process is that when the parties think about threats and opportunities in a collaborative way it can only be good for the overall mutual goals and the people and organisations working on the project (ICE, 2017b).

Concerning the Early Warning process, there is one important note. Gao (2017) found that the Early Warning systems cannot immediately be implemented in the Dutch construction sector. This is because under the UAC-IC first clauses must be adjusted to make its use possible and second that it does not fit well within the Dutch construction culture. This is mainly due to the lack of trust in the sector. Therefore, it can be said the Early Warning system cannot be used as a stand-alone method, other methods must be used to increase the overall trust. Thereafter, the method can possible bring many benefits to the sector.

Contractor proposals – clause 16

This clause makes it possible that the scope provided by the client is changed due to the initiative of the contractor. This is limited to changes that result in a reduction of costs that the client must pay the contractor for the works conducted. These scope changes can include using different types of plants and materials or changing the design life of a part of an asset (ICE, 2017b). This can result in a safer and simpler construction than initially proposed. The project manager must decide on the proposed change within four weeks after the contractor made the proposal as stated in clause 16.2. The project manager has according to the contract three types of decisions he can make:

- The proposal can already be considered by the client in the past and the decision was made that it is not interesting, therefore the proposal is not accepted;
- The proposal is deemed interesting but the client would like to know more about its effects on budget and time. To obtain this the client can request that the contractor provides this information through clause 65. The client is responsible for the costs of this quotation;
- The proposal is accepted straight away resulting in a scope change. This leads to the compensation event process under clause 60, 64 and 66 to value the change. When option A or B are used this requires a value engineering percentage under clause 63.12 and when option C or D is used the target price can remain the same under clause 63.13 to allow the parties to share the benefit that resulted from the change in the contractors share stated in clause 54. This clause is further elaborated in the pain/gain paragraph.

This clause provides incentives for the contractor to collaborate with the client early on and behave in a best-for-project way because it increases the focus on the mutual objective of project success by encouraging to share ideas as soon as possible (Van Wassenaer & Thomas, pp. 131-132). Because the contractor is actively stimulated to optimise the scope mutual project goals can be defined early on. This can help stimulate early team formation. Both team formation and early defining project goals are indicated as important aspects for

achieving project success (Kent & Becerik-Gerber, 2010). When the contractor is rewarded for its positive input a win-win situation can be created. The client obtains the works in a shorter period or for a lower price, and the contractor has a higher profit margin.

Programme and planning – clause 31

The NEC4 authors state that a proper planning is "at the heart of good project management" (ICE, 2017b). As a result, the program is seen as a vital component of the NEC4 ECC. The planning and programme of the NEC ECC are seen as one of the strengths of the contract (Bennett & Baird, 2001). Bennet and Baird (2001) state that the detailed programme and planning enable the project manager to manage the project in an effective, active and cooperative manner. Strict time agreements ensure that the programmes are regularly updated. Both parties must agree to these updated programmes. If this does not happen, it is likely that the parties will get into disputes about the time needed to conduct the works (ICE, 2017b). In other words, the project manager has to accept or not accept, and if he does not accept he has to provide a reason for not accepting the change otherwise it will become a compensation event. As a result, the programme and planning is an active tool that ensures that the parties are aware of the liability of delays as they occur concerning the completion date and set milestones (Hide, 2009). By regularly updating the programme and planning it reflects all activities at any point in time which provides a clear overview of how the project is proceeding. This in contrast to the more traditional planning "that people stick on the wall and forget about" (Hide, 2009). Due to this active management, the programme and planning facilitate continuous communication throughout the project.

There are no obligations regarding how often the programme must be updated. This can be done as often as the parties see fit. During the project, the frequency of updates can be increased if the parties feel that this is beneficial for the project (clause 31.2). There are however strict time provisions in the contract. In total are there 24 clauses that have a time provision. This makes it possible to manage events in a timely fashion and monitor the process ensuring that the parties communicate potential problems timely. This facilitates collaborative problem solving as problems are communicated promptly to each other and by creating time provision in the programme for the joint solving of problems (Barnes, 2002).

Compensation events – clause 60-66

Clause 60 to 66 deal with compensation events that can occur during the project. Compensation events are events that entitle the contractor to be compensated for extra time or money with the exclusion of events that are caused by the contractor. Compensation events are dealt with on individual basis and valued before they occur. As a result, the parties have an early awareness of the cost and time implications of the events, this allows for effective planning and reduction of conflicts (Thompson et al., 2000). The NEC4 ECC provides the parties with an extensive list of 20 events that are defined as compensation events. This list increases clarity of the contract and makes it clear for the client and contractor what their risks are (Broome & Hayes, 1997, p. 258).

There are two types of compensation events. Events that originate from the client (like extra work or scope change) and events that originate from contractor's fault or unexpected events he encounters. These two types of events follow a different procedure. If an event originates from the client, the project manager should notify the contractor as soon as he instructs the

event. There are no time provisions for these compensation events as it is regarded that the client wants to deal with these events as soon as possible from a good management perspective (ICE, 2017b). Along with the instruction of work the project manager should instruct to the contractor to submit a quotation. For compensation events that originate from the contractor, there are strict time provisions. By encouraging timely communication dealing with compensation events long after they occurred is limited. The contractor has a time-bar of eight weeks after the event occurred to notify the project manager of the compensation event. The project manager has a time-bar of one week to reply to this notification unless otherwise agreed with the contractor. This protects the contractor against delays by the project manager. If the project manager fails to respond in time the contractor has to warn him of his failure to respond. If the project manager still does not reply after two weeks, the quotation of the contractor is seen as accepted under clause 61.4.

Quotation assessments of compensation events are based on the defined costs of the compensation event plus the fee which has been agreed upon in the contract data. As a result, the contractor is fairly compensated for the event (ICE, 2017b). This is deemed a wanted situation because compensation events that require a quotation are not at the contractor's fault, therefore a fair compensation is appropriate. Disputes about compensations are as a result more likely to be avoided.

Contractors share – clause 54 (option C, D)

In options C and D, the target price options of the NEC4 ECC, there is a clause for a contractors share also knows as a pain/gain mechanism. The purpose of this clause is to encourage effective management of the total defined costs. Under the clause, the contractor receives a share of savings (gain) if there are any and pays a share of budget overruns (pain) if there are any. It was found that this mechanism can increase the trust among parties because it creates an atmosphere in which the parties are treated according to their performance which is deemed fair (Cheung L., 2015). It is recommended to use this option when (Broome & Perry, 2002):

- There is a risk in the project that both parties can have an influence on. This risk can be both a threat and an opportunity. If only the contractor can have an influence on the risks, it is recommended that a price based option is used;
- There is a high chance of a significant number of compensation events. High transparency in the costs of these events can help the client manage these events and asses them quickly. If it is expected there will be a lot of scope change this method is not recommended, a cost reimbursable contract is more capable of managing scope changes.

When this method is used, the client will define the percentage of the contractors share which can depend on the amount of savings or overruns on the target price. The way in which the sharing mechanism is used must be provided in the contract data by the client at the start of the project. In this mechanism, ranges must be defined that state the share percentage for a certain range of budget cuts of overruns. The client must decide a share percentage for each range and give motivation for this percentages as it must suit the mutual objectives of the project (ICE, 2017b). Broome and Perry (2002) provide an extensive overview of possible frameworks for pain/gain sharing that can be used for the sharing of extra costs or benefits. This method encourages both client and contractor to focus on the same goal, allocate risks

properly, tackle risks effectively and deliver on or under target price as it benefits both parties (Broome & Perry, 2002).

Resolving disputes – W1

Under option W1 adjudication is used to resolve disputes. When a dispute arises it first must be addressed by the senior representatives. The purpose thereof is that the parties must first jointly try to find a solution to the problem. If the senior representatives together with the project manager do not come to a solution, the dispute is escalated to the adjudicator. The parties must appoint an adjudicator at the start of the project. The adjudicator decides about the dispute as an independent adjudicator and not as an arbitrator.

Either party may refer to the adjudicator for a dispute about an action or interaction of the project manager and an assessment of the defined costs within four weeks after the event, and any other matter as soon as the dispute arises. The client may also refer to the adjudicator for a conflict about a programme, compensation or quotation for a compensation event within four weeks after the event; the contractor may not refer to the adjudicator for these events (ICE, 2017a). If any of the parties are not satisfied with the outcome of the adjudication they may escalate the conflict to a tribunal. This may only be done after adjudication. The tribunal makes the final decision concerning the dispute.

Even though option W1 may potentially improve the relationship between client and contractor in the Netherlands due to its way of resolving disputes, it is not further taken into account in this research. The main reason for this exclusion is that arbitration is a method that can already be used in the Netherlands as described in the Code of Civil Procedure (Wetboek van Burgerlijke Rechtsvordering) in article 1020 to 1076. This procedure of arbitration is highly similar to the W1 clause of the NEC4 ECC. In both methods, an adjudicator must be appointed in advance and the arbitrator is used to resolve a dispute when the parties themselves cannot come to a solution. Due to its similarity option W1 is no longer investigated in this research.

Resolving disputes – W3

Under option W3 the dispute avoidance board is used to resolve disputes. The dispute avoidance board consists of one or three members that are identified at the start of the project. The role of the dispute avoidance board is different from the role of the senior representatives in option W1. The members of the dispute avoidance board are expected to visit the construction site on a regular basis. The idea behind this is that the board members can, by visiting the site, identify possible areas of dispute or conflict as early as possible and instantly communicate these with the parties (ICE, 2017b). If they can do so, they can help the parties resolve the problem at an early stage before it becomes a dispute and considerable sums of money are spent on the dispute.

Both parties can refer any dispute to the dispute avoidance board. When this happens, the board will meet with both parties to try to resolve the issue in a joint way (ICE, 2017b). If the parties fail to resolve the issue the board will give a recommendation as to how the dispute can potentially be resolved. This recommendation is not binding, it only suggests a way to reach an agreement. When the parties agree with the recommendation, it will likely be the end of the dispute. If a party does not agree it has four weeks to notify the other party of its

disagreement. Thereafter the dispute can be escalated to the tribunal, similar to option W1. The tribunal will make the final decision concerning the dispute.

Bonus for early completion – X6
This clause enables the client to give a bonus to the contractor when the works are finished before the agreed delivery date. This can benefit the client in projects in which it needs the works as soon as possible since this option can motivate the contractor to deliver the works as soon as possible ICE, 2017b). By doing so, the client can make his objective of quick project delivery a mutual objective as it now benefits both parties to deliver quickly. The contractor shares the gain if he can deliver the project early on. The bonus stated in this clause must be incorporated in the final assessment done by the project manager that follows after the client takes delivery of the works.

Whole life costs – X21
By means of this clause the contractor is able to submit proposals to change or adjust the scope of the project. Prerequisite for this is that the scope change reduces the lifetime costs of the project for the client. In contrast to clause 16 that only relates to the clients scope this clause can relate to both the contractors and clients scope. If the project manager is willing to consider the proposed scope change the contractor can submit a quotation. This quotation must include a detailed description, forecast of the costs reduction to the client, analysis of the risks, proposed changes to the price and a revised programme. If the project manager does not accept the proposal, he is not allowed to later in the project change the scope in a way that was proposed by the contractor (ICE, 2017b). If the proposal is approved the project manager will adjust the scope, price and key dates accordingly.

This clause provides a method that incentivises the contractor to take an active role in the optimization of the works over its lifetime and thereby focus on the mutual project goals. This can result in a higher quality product for a possible lower price (Kovacic & Zoller, 2015). This is mainly due to the importance of the early planning phases as they determine a large part of the performance of the works over its lifetime. Bogenstätter (2000) found that the early project stages determine up to 80% of the total costs, showing the importance of these early stages for the whole life costs and its “almost infinite” optimization potential.

Early contractor involvement – X22
This option allows for the involvement of the contractor early on in the design process. During these early stages the contractor shall help define budget, scope and the design. From literature it became clear that early contractor involvement in engineering projects can result in cost and time reduction because of an increased buildability due to the ability to use experience and expertise from both client and contractor (Rahman & Kumaraswamy, 2004b). By doing so, both parties can learn from each other and thereby create a better process and solution then they would have been able to create alone. It can also increase client satisfaction because the client keeps control over the design process but has the benefit of exploiting the expertise of the contractor (Eriksson, 2008a).

Furthermore, it improves mutual understanding among the client and contractor since the contractor obtains a better insight in the client’s needs and the client obtains a better understanding of the contractors stakes (Ahola et al., 2008). The joint problem-solving in the

early stages of the project can result in an improved health and safety design (Cameron & Duff, 2007), increased environmental performance of the design (Cole, 2000) and a boost to innovative solutions (Caldwell et al., 2009). It also enlarges the changes of a good relationship between the client and contractor and better risk allocation (Rahman & Alhassan, 2012). Eriksson and Westerberg (2011) state that the higher level of integration between the client and contractor in the early stages of the design the better the project performance because the parties are able to create mutual goals and create the process together.

The early contractor involvement clause in the NEC4 ECC knows two stages (ICE, 2017b). In the first stage, the contractor provides a detailed forecast of the defined costs of the works that must be done in that stage. The project manager can accept or reject these forecasts. If they are declined the contractor can submit an adjusted forecast. The contractor should also provide a forecast of the total project costs. Thereafter the contractor shall submit design proposals for stage two. If these design proposals are accepted, the budget is finalised and the client wishes to proceed the client and the contractor enter stage two. In stage two the design is finalised and the final project costs are assessed. If these are lower than the budget an incentive can be paid to the contractor, this must be agreed upon in the contract data.

In this period of early involvement, the contractor shall not replace key people in the process as the client is likely to have relied on these key people to make the most advantageous offer. The contractor can be financially incentivised to join this process. When for instance scope improvements can be made that reduce the costs, the reduction of these costs can (partly) be paid to the contractor. By doing so, a win-win situation can be created because the involved parties are striving to fulfil the same goal being the most optimal design and scope (Eriksson, 2008a).

3.1.2 Possible drawbacks of the NEC4 ECC clauses

Even though there are many possible benefits that the NEC4 ECC can bring for the Dutch construction sector implementing the identified clauses is not without risk. Several possible drawbacks come with the use of these methods. In this chapter possible drawbacks identified in literature and the cultural difference between the United Kingdom, where the contract originates from, and the Netherlands are discussed. There can always be additional drawbacks than the ones discussed here, this is because every project is different. The drawbacks discussed here are by no means a complete list of all the possible drawbacks and one should always consider the specific circumstances of the project at hand.

From cases in the UK it was found that the collaborative approach of the NEC does not come without effort. Several examples have been identified that showcase that it is essential to have adequate procedures in place and that parties follow these procedures. These examples are (Downing et al., 2013):

- In a particular case, there were many early risk warnings and compensation events. The project manager did not have the capacity to deal with all these warnings and compensation events raised by the contractor. This led to the failure to meet deadlines and irritation from the contractor's side. This shows that the project manager must have enough capacity to deal with the extensive project management tools as early warnings and compensation events;

- At the start of the project the early warning register was made in accordance with the contract, but the project manager failed to update this register during the project. As a result, the early warning register was of no use to the project as it did not identify risks that actually arose nor did it identify potential risks. This is another example of the need for willingness and expertise from the project managers side to use the more extensive tools that the NEC4 ECC describes;
- During a project, the contractor failed to keep the client up-to-date with the accepted programme of works. This eventually led to an overload of compensation claims due to the misalignment of objectives. The compensation events where not dealt with timely and the whole process that is described in the NEC ECC was put aside. This eventually led to disputes on time and costs. This is an example of what happens when one of the parties does not use the systems as it is intended and the other party does not intervene. The methods described in the NEC ECC need tight management and willingness of both parties to work properly, as this example illustrates;
- In a case where the target contract option was used the contractor was paid its actual costs instead of using the process of compensation events as described in the NEC ECC. As a result, the contractor also did not use the early warning method as it was not incentivised to do so and the client failed to demand its use. Eventually this led to disputes when it became clear that the target price would be exceeded. It was unclear which costs were made and who was responsible. This example shows that the methods of the NEC ECC require a more active role from the client. When this is not the case, it can happen that the contractor does not follow the methods of the NEC ECC and continuous to use more traditional methods.

All these cases show that the NEC ECC is a contract that needs a clear understanding of the responsibilities of both parties. Furthermore, it requires a higher level of involvement from the client through a project manager that must ensure that the methods are used properly. To do this sufficient capacity must be available. From literature several drawbacks to the NEC ECC contract are identified. These are:

- It is necessary to allocate responsibilities in a way that best suits the project. The NEC ECC contains many options to do so, but careful management is needed to select the right options for the right project (Fox, 2006);
- The client has substantial control over the project through the project manager. It should however be carefully considered how much the project manager intervenes since delays and increased costs that are caused by the project manager have to be paid by the client according to the compensation events method (Fox, 2006);
- The project manager has a more demanding role when using the NEC ECC contract which requires intensive use of resources (Building, 2006);
- In order to make many NEC ECC methods work pro-active management is required. Therefore, a capable and experienced project manager must be placed on the project that can make active decisions promptly and is capable of working with all involved parties in the project (Wilks, 2013);
- The NEC ECC contains many project management tools that are new (up to some extend) for many project managers. Training will be necessary to ensure that these tools are used as they are intended and are not for example used as a ‘weapon’ to obtain payment (Wilks, 2013);

- The NEC ECC requires more (professional) input from both client and contractor than standard forms of contract (Fox, 2006);
- The language in the NEC ECC is praised for its simplicity and clarity. However, this relatively simple language concerns legal advisers because it is unclear how the clauses must be interpreted from a legal perspective (Building, 2006);
- The language of the contract can result in ambiguities. By using relative simple language, the legal strength of the contract is decreased. This can form difficulties when conflict is escalated and the legal system must be used (Wilks, 2013);
- When using the contract internationally implementation must be done with due care. This is because the contract is written for use in the United Kingdom and can therefore conflict with local law codes (Wilks, 2013);
- The legal impact of clause 10.2 "spirit of mutual trust and cooperation" is uncertain, especially in the Dutch context (Building, 2006).

From this, it becomes clear the NEC ECC requires a stronger presence of the client and needs careful management. The procedures used in the contract often require more administrative work. Therefore, sufficient capacity must be made available. Also, attention must be placed on the legal impact of the simple language used in the clauses. The relatively simple language in the clauses can lead to ambiguities in a legal context, this should be avoided as much as possible. Finally, implementation of the methods in the Netherlands has to be done with due care. The contract is written for the United Kingdom and therefore some methods need careful implementation under Dutch law to ensure the methods comply with this law.

Next to this, it is likely that there also will be certain barriers that must be overcome to ensure that the NEC ECC methods can be applied in the Dutch construction sector. The main identified barriers are (Van den Berg, 2015):

- Inefficient knowledge about the NEC and it's benefits and procedures – in the Dutch market there is little awareness of the NEC ECC. Due to this, the benefits of the NEC ECC methods are unknown by many. Furthermore, the contract is very different than the commonly used UAC-IC contract with concerning the terminology and procedures used in its methods. Due to this, the implementation of NEC ECC methods requires a different mindset from the UAC-IC methods. This can result in difficulties because people often prefer to stay in their comfort zone and act is a way they are familiar with. Also, people need to take the team to get acquainted with these new methods. These boundaries may form difficulties during implementation;
- Resistance from the sector towards to adoption of new NEC ECC methods – as became clear from chapter 2.3 the interests in the Dutch construction sector are currently sometimes conflicting. This can reduce the willingness experiment and try new methods together with the other party. Also, influential Dutch institutions such as the CROW and PIANOo promote and offer training for the UAC-IC. Due to this, the NEC ECC is barely used in the Netherlands and no trainings are offered resulting in inefficient awareness of the possibilities and the reluctance to work with unknown methods;
- Project managers can have inefficient skills or capabilities required to effectively manage the NEC methods – from research it followed that the NEC ECC methods are regarded as advanced and that they can form a high administrative burden. From the same study, it followed that in-house employees of both government clients and

contractors had difficulties with implementing collaboration oriented methods. Furthermore, due to the little usage of the NEC ECC in the Netherlands, there are little to no knowledge exchange concerning best practices or lessons learned.

- An absence of case law in the Netherlands to test and show the NEC's effectiveness; because there no case law regarding the NEC ECC it is unknown if it is effective and what the legal procedures are. Next to this, large government clients and major contractors work according to processes that are structured around the UAC-IC. These processes have already been tested in the Dutch legal structure and thus provide more security to these organisations. Implementing these new NEC ECC methods will require that these organisations use an unknown process and invest money and time into its workings.

Cultural differences

Next to the drawbacks found in British literature there are also possible drawbacks that originate from culture differences between the United Kingdom and the Netherlands. The NEC4 ECC is written by a British Institute for (originally) the British market. It is necessary to explore if aspects from the NEC4 ECC can work in the Dutch Culture. According to Hofstede's Cultural Dimension Theory culture influences ways of thinking, social action and predictable behaviour (Hofstede, 1993). Therefore, certain aspects may not work in the Dutch culture. According to Hofstede's 6-D model there are both differences and similarities between the Dutch and British cultures, this is displayed in figure 8.

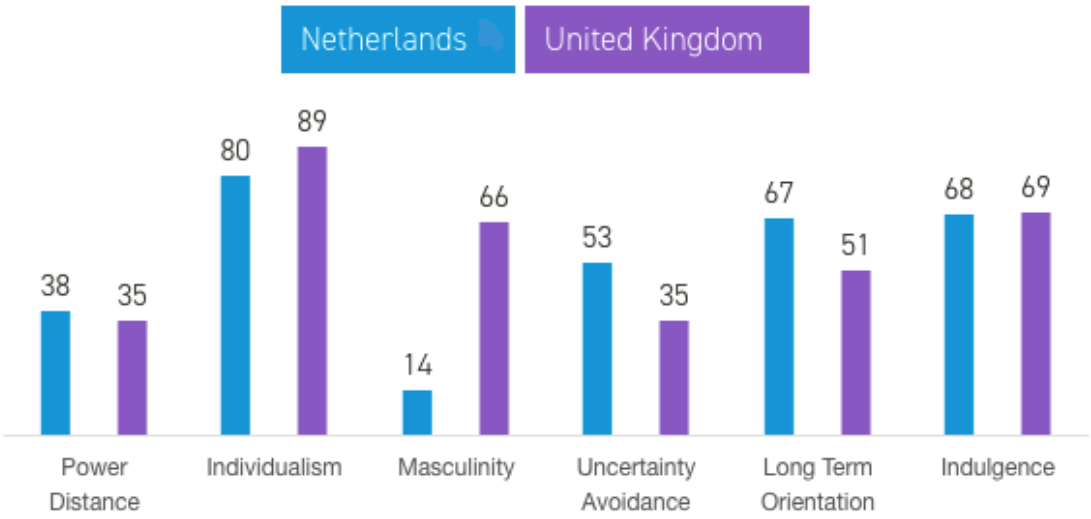

Figure 8: Cultural differences between the Netherlands and The United Kingdom according to Hofstede's 6-D model (Hofstede insights)

From figure 8 it becomes clear that there are differences in masculinity, uncertainty avoidance and long term orientation between the British and Dutch culture. Understanding these differences is needed to obtain an understanding if there are aspects that must be taken into account when implying methods of the NEC4 ECC in the Netherlands. Otherwise, it can be the case that these methods will not work in the Dutch sector due to cultural differences. Therefore, each of these cultural aspects are investigated to identify if they can form a problem when implementing NEC4 ECC methods in the Netherlands.

Masculinity
The most significant difference between the Dutch and British culture is in masculinity. The higher score in masculinity of the British culture indicates that the culture is mainly driven by competition, achievement and success (Hofstede Insights, n.d.). Success is defined in this case as being the best/winner in a certain expertise and project. In contrast, the Netherlands is identified by Hofstede as a feminine country. The most important value in a feminine country is the quality of life or liking what one does. Success and standing out are not values that are admirable.

In a feminine culture, it is important for a manager to support his team and decision making can be best achieved through involvement. People tend to strive for consensus and equality, solidarity and quality in life are valued. Conflicts are to be resolved by negotiation and discussions. From this cultural perspective, there seems to be no conflict with the identified NEC4 ECC methods. Most of these methods concern working jointly and having active discussions to reduce conflict (for instance the early warning reduction meetings). Therefore, no conflict is expected concerning this cultural aspect.

Uncertainty avoidance
The cultural aspect of uncertainty avoidance relates to the way people deal with the unknown. High uncertainty avoidance relates to the willingness to control the unknown. A low score to letting a process happen and see how it plays out. The British culture has a quite low score on this aspect which means that people in the UK are fine with not knowing what will happen and how the day will play out. People are often fine with ambiguous situations and there are not too many rules in the UK.

The Netherlands score slightly higher than the UK and has with 53 points a slight preference to avoid the uncertainties. What this means is that people often want to maintain rigid codes and there is a bigger need for rules. Criticism from British literature on the NEC ECC included that it has extensive rules and the need for intensive management (Eggleston, 2006, p. 337). These extensive rules might be welcomed in the Dutch culture due to the higher uncertainty avoidance. Therefore, no major drawbacks of the use of the NEC4 ECC in The Netherlands are expected with regard to uncertainty avoidance.

Long term orientation
Long term orientation relates to how a culture holds on to the past and how it deals with changes that occur over time. Countries that score low on this dimension prefer to stick with their traditions and do not welcome change. Countries that score high on the other hand often have a more pragmatic approach and encourage progress and education to develop the society. The British culture has an average score in this dimension meaning that is some aspects they remain traditional and in other are progressive, there is no dominant preference.

The Netherlands has a higher score on this dimension. This means that the Dutch culture is more pragmatic of nature, people tend to adapt traditions and change conditions easily. Furthermore, people are keen to save and invest and are persevering in the achieving of results. What this means for the implementation of the NEC4 ECC is that people are likely to accept the changes that it brings. The culture in the Netherlands allows change and people are willing to change when it improves the results. This comes however with the remark that

change often is difficult and that many changes in organisation and processes fail quickly (Boonstra, 2000). Therefore, that change must be done with due care. What this change process should contain, is outside the scope of this research.

3.1.3 Conclusion

Several clauses have been identified. Each of these clauses might improve collaboration as it is linked with one or more factors of collaboration described in paragraph 2.4. In table 2, an overview is presented of the identified clauses and the factors with which the clauses are linked. In this table, the identified NEC4 ECC clauses that potentially can influence collaboration are displayed on the vertical axis, within brackets the clause number is stated. On the horizontal axis the different factors of good collaboration are placed. The 'x' represents a connection between a clause and a factor of collaboration. The connection shows what factors the clause can have influence on and thereby potentially influence collaboration. A further insight into the basis of the connection can be found in appendix E.

This table can provide an insight into what factors of collaboration the clauses can potentially influence. This is useful when a particular aspect of collaboration needs more attention in a project. From this table, it becomes clear what clause might positively stimulate collaboration according to the available documentation, literature and webinars.

Table 2: NEC4 ECC clauses that can improve collaboration

Factors stimulating collaboration / NEC4 ECC clauses	Mutual objectives	Gain and pain sharing	Trust	No-blame culture	Joint working	Communication	Joint problem solving	Fair risk allocation	Effective performance measurement	Continuous learning
Good faith obligation (10)			x	x		x				
Communications (13)						x			x	
Early warning (15)	x		x			x	x		x	
Contractor proposals (16)	x				x					
Programme and planning (31)						x	x		x	
Compensation events (60-66)						x		x		
Contractors share (54)	x	x	x					x		
Resolving disputes (W3)						x	x			
Bonus for early completion (X6)	x									
Whole life costs (X21)	x									
Early contractor involvement (X22)	x		x	x	x	x	x	x		x

This table provides a preliminary overview of the possibilities and opportunities of the NEC4 ECC. In the case studies and the expert panel, it will examined if the links between clauses and factors of collaboration in this table are valid for integrated projects in the Netherlands. Based on these findings a final table is presented in the conclusion of this report.

These methods do however not come without risks. From the cases in the United Kingdom, it became clear that when using methods of the NEC4 ECC enough capacity must be made available as the procedures used often require more administrative work than traditional methods. When this is not the case, it can happen that the methods cannot be updated or used properly. This can result in failure or the use of traditional methods that possible hinder collaboration. Also, the NEC ECC methods require a stronger presence of the client and careful management. Furthermore, implementation of the methods in the Netherlands has to be done with due care. The contract is written for the United Kingdom and therefore some methods need careful implementation under Dutch law to ensure the methods comply with this law. Next to this, barriers are found that must be overcome to ensure successful implementation of NEC ECC methods in the Netherlands. The main barriers are the unawareness of the possibilities and benefits of the NEC ECC, lack of training resulting in insufficient capabilities among project managers, unwillingness to change of the Dutch construction sector and the lack of experience with the NEC ECC in a Dutch context.

From the investigated cultural differences with the use of Hofstede's dimensions between the Netherland and the United Kingdom, there are no major problems identified. The cultures are different in some aspects, the aspects in which the cultures differ the most, being masculinity, uncertainty avoidance and long term orientation, have been investigated. It is likely that the difference in these cultural aspects will not hinder the implementation of the NEC4 ECC in the Netherlands.

3.2 Project DOEN

Project DOEN started as an initiative in 2013 to improve collaboration as a result of the insufficient collaboration in the sector at that time. It was first initiated by the Opdrachtgeversforum, a network organisation of (semi-)public originations, in 2013 and was thereafter adopted by Jan Hendrik Donkers (formal director general of Rijkswaterstaat) as a Rijkswaterstaat project. He gave the project team who were going to execute Project DOEN the following assignment: "Act like there are no rules and think what you would like to have. If you encounter rules that obstruct this, investigate if there are ways you can creatively deal with this. All rules can be put up for discussion, except for the law. Do not think too much in existing frameworks! Be open-minded, but not naive." (Donkers in Manual Project DOEN, 2017; translated).

The idea behind Project DOEN is proper collaboration, logical thinking and doing what is best for the overall project. This means that solutions must be found that serve the overall project goal while also fulfilling the interests of the parties involved. The project team from the client received freedom from Rijkswaterstaat to try this different approach in a project. The team from Rijkswaterstaat was not bound to all sort of rules and are free to try and explore new possibilities for project execution. The goal of the project is to contribute to a structural change in the Dutch construction sector. To achieve this the project team defined a purpose of the project, being: "learning how to conduct an infrastructure project in collaboration with the market, aimed at maximising the value for the customer and minimalizing waste due to juridical processes and unnecessary rules" (Projectteam DOEN, 2017). By doing so the team aims to obtain a work that better meets their needs while the contractor gets paid fairly, no time and money is wasted in conflicts and a positive relation between client and contractor can grow. This meaning is visualised in figure 9.

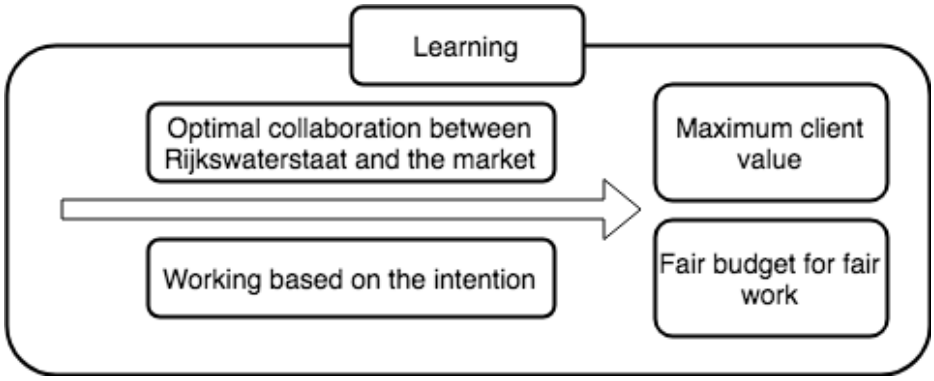

Figure 9: The meaning of Project DOEN (Projectteam NU DOEN, 2017; translated)

Figure 9 shows that from the meaning of Project DOEN one overarching goal, two project goals and two means to achieve these goals can be derived. One of the project goals is maximum client value. Maximum value is obtained when the quality of the delivered work meets the quality that is desired by the client, not more and also not less. In order to fulfil this goal, it is necessary to know what the desired quality is. To obtain this insight knowledge is needed about the requirements of the client but also expertise regarding the possibilities to fulfil these requirements. The idea is that by conducting meetings between the client and the contractor the desired quality can be defined in an iterative process (Projectteam DOEN, 2017; Projectteam DOEN, 2016). Involving the contractor early in such an intensive process can bring benefits to the project as a whole. For instance, the contractor can share his knowledge on the subject and promote innovation which ideally will result in more value for money (Mandell et al., 2013) and the contractor can help identify possibilities and flaws in the design (de Valence, 2010). This can increase the quality of the works, or the costs can be reduced while the same quality is delivered.

The second project goal is to deliver good work for a fair budget. This means that the contractor should get fairly compensated for the costs he needs to make. The made the budget proposal together with the contractor to reduce the risk of having high cost overruns in the execution phase. The reason for this is that the contractor should get a reasonable sum for the conducted works. This can be done using a method of open books and calculating the costs together in a spirit of trust. This should be done not only at the start of the project but also during the execution of the project since unforeseen factors result in a high inaccuracy

of the initial cost estimate (Flyvbjerg et al., 2002). Therefore, unforeseen costs are part of the 'fair budget' scope of Project DOEN. The idea is that when the contractors have high unforeseen costs and are not (partly) compensated for these there was an unrealistic budget, this should be prevented as it can cause conflict as cost overruns are one of the main causes of conflict in the construction sector (Swei et al., 2017). A project budget that allows the contractor to provide a realistic cost estimate and as it decreases the contractors uncertainty as he is not incentivised to take high risks. The contractors can benefit by having a higher financial certainty in the project and they do not have to take high risks to lower the tender price. It is likely that a fair project sum will increase client-contractor trust and collaboration and thereby help the construction sector as a whole (Amoa-Abban & Alletey, 2014).

There are two ways defined in Project DOEN to achieve these goals. The first is optimal collaboration, which is found when the involved parties work as one team. Every person should do what he or she is best capable of doing; it should not matter from which organisation the person comes. The idea is to fulfil the project together. When the expertise of each can be used during the project, the chances of creating a successful product increase (Orange et al., 1999). The second is working from the intention. It is deemed necessary to keep on asking: what is the goal, what do we want to achieve and what is the most logical way to get there. The same reflection holds for rules. A fundamental question in this reflection is what is the purpose of the rule and why is the rule in place. By having continuous reflection moments, the process can be optimised and unnecessary work is likely to be prevented due to increased collective expertise and knowledge (Orange et al., 1999).

The higher goal of Project DOEN is to learn from this new approach. This was deemed necessary because currently projects often turn into failures as a result of poor collaboration by the involved parties (van de Pol & van den Berg, 2017). There is the need for a change in attitude and behaviour because the current way of collaboration can and must be changed to improve the construction sector (Wisse & Arends, 2017). The ambition behind the learning process of Project DOEN is to contribute to a structural change to collaboration in the Dutch construction sector.

3.2.1 Possibilities and opportunities to improve collaboration

Project DOEN is explored with the goal to identify methods that can influence collaboration in the Netherlands because they stimulate the factors of collaboration defined in chapter 2.4. This identification is based on three sources:

- The manual provided by Project DOEN in which the project is broadly explained;
- The tender guidance (Aanbestedingsleidraad) provided by Project DOEN;
- Exploratory interviews with the project manager of the client and the project manager of the contractor.

The setup of the exploratory interview is elaborated in appendix D. No strict protocol is followed during these interviews as the purpose of the interviews is to gain a better understanding of the used methods. No conclusion is based merely on the data gathered in these interviews. The interviewees are:

- Project manager for the client. When a statement made by her is used the abbreviation PM1 is used to clarify she made the statement;

- Project manager for the contractor. When a statement made by him is used the abbreviation PM2 is used to clarify he made the statement.

The project managers are interviewed separately. Statements regarding the same method or subject are compared and explained in the course of this chapter. The abbreviations PM1 and PM2 are placed behind every statement to prevent confusion who made the statement. Statements are not combined to prevent misinterpretation. Based on these findings an initial overview of the possibilities and opportunities of these methods to improve collaboration is drafted. This overview will be tested in the case studies.

Collaborative procurement

The procurement phase in Project DOEN differs from the regular procurement phases in integrated projects. The Project DOEN team created their own custom procurement process in consultation with the market. The team from the client believed that collaboration has to come from two sides. Therefore, the team worked pre-commercially with the market to make this procurement process (Projectteam DOEN, 2015). After looking at many pros and cons of different procurement methods they made a final procedure which contains four stages, each representing a different aspect regarded as necessary for successful project delivery (Projectteam DOEN, 2016). These phases are displayed in figure 10. Each of these phases is further elaborated on below.

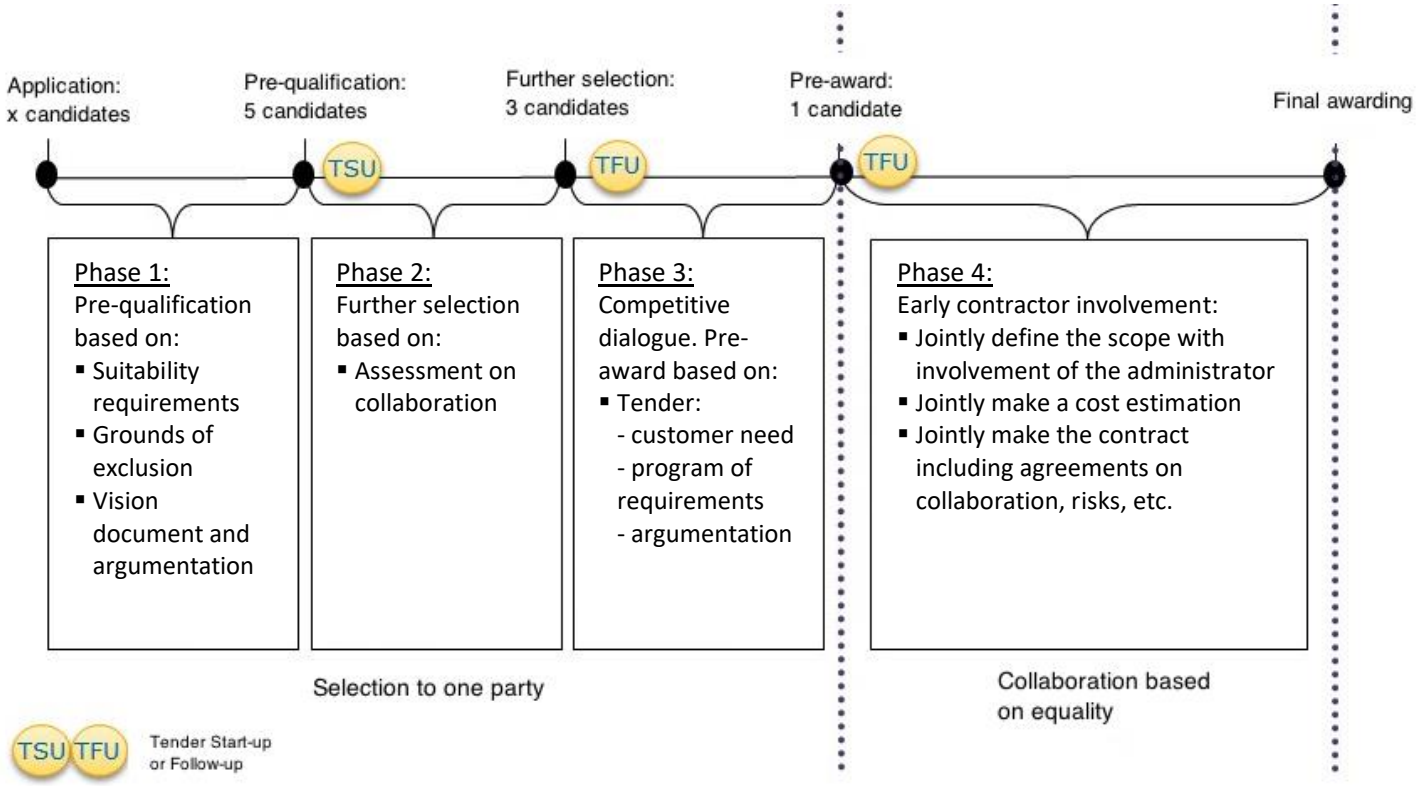

Figure 10: Procurement procedure Project DOEN (Projectteam DOEN, 2016; Projectteam DOEN, 2017)

- Phase 1: registration and pre-qualification – this phase is deemed necessary by the Project DOEN team because to have good collaboration, the parties must have a shared vision. Therefore, the contractor had to submit a vision document in this phase that explained his vision regarding what collaboration should entail, how he thinks about the processes that should be used and a critical reflection of himself and

possible pitfalls. The idea of a vision document was initiated by the participating contractors themselves and was therefore widely accepted as a means to select a contractor (PM1). Contractors found it a fair and understandable method, if a contractor was not selected he could only blame himself. Moreover, the client was able to explain to a contractor why he was not selected. There was no chance involved as in the regular drawing process. This phase can potentially have a different process that better meets the need of that project. For instance, a selection on the technical specification in a project where this is required for the first selection of contractors (PM1).

- Phase 2: selection based on assessment – this phase focussed on the collaboration between client and contractor. In this phase 5 contractor remain in the process that will be tested on their 'match' with the Project DOEN team. This is deemed necessary by the Project DOEN team because for a good process collaboration is required. In this phase, an EQ test and an assessment are made by both the client and the contractor. The goal of the EQ test is to gather information about the people on the team that can be used by the supervisors of the assessment. This assessment is conducted under the supervision of an independent and objective team of external supervisors. These external supervisors guide the assessment and judge the quality of the collaboration of the integrated team existing of client and contractor members.
- Phase 3: competitive dialogue, registration and pre-award – the idea behind this phase is that in to have a successful project a good process is required. In this phase the contractor is invited to have dialogues with the client and the costumer, being the administrator of the bridge. In these dialogues the contractor can ask questions to the client and the customer. The purpose is that the contractor can gain information about the needs of the client and customer and transfers these needs into a qualitative document (Projectteam DOEN, 2016, p. 16). Based on these documents the contractor will be judged. These document must contain an interpretation of the customer's needs and a description of the process the contractor thinks is ideal to use for the engineering, price definition, risk and a performance substantiation. This process is conducted in this way because the drafters want to create a satisfying result for the customer. The dialogues help the contractor to gain an understanding of the needs and interests of the customer. Parallel, the contractor can be judged on his ability to transfer this need into an approach plan in which he can show his expertise. It can be tested to what extent the contractor is has succeeded in understanding this need. Next to this interpretation, the process for phase 4 is jointly drafted. Based on the outcome of this draft the contractor will also be judged. Here the client and contractor discuss what they think is a good process. They look together how to tackle problems, what form of collaboration is used, how often they would like to have meetings, if there is a joint location, who has what role and if roles are mirrored or if there is integration into one team. PM2 states that the most important thing is that you make agreements with each other at the start how the works are done, how to prevent arguments and conflicts, and how to ensure that there is no unnecessary and irritating hassle in the project so that we 'simply' can conduct an enjoyable project that satisfies both client and contractor (PM2).
- Phase 4: pre-award phase and final awarding – in this phase the client and contractor together started defining what work actually must be done in the project. Only with the final contractor a technical specification is drafted in this phase. This is done to

limit transaction costs, only with the last remaining contractor a technical solution will be worked out. This will be further elaboration in the early contractor involvement paragraph below. These conversations take place before the final awarding. If the client is confident after these conversations that in collaboration with the contractor the project can be adequatly controlled and can successfully be finalised based on the provided documents and decisions made in this phase the project will be awarded.

Top down the process is as follows: a successful project requires a good process (phase 3), a good process requires good collaboration (phase 2) and good collaboration requires matching visions (phase 1) (Projectteam DOEN, 2016).

Interview findings

It is clear that much focus is placed on collaboration during the procurement phase. PM2 pointed out that one could only win by being honest and showing sincere interest. He stated that this attitude removed all perverse incentives for him and his team. He described it as a shift of focus, from the work itself towards the team; there was a high investment in the people (PM2). Workshops and game situations under the guidance of a phycologist helped to get to know yourself and the each other. “You really got to know each other, how the team behaved under stress, and most importantly how you behaved yourself” (PM2). Also, many informal moments where used to get to know each other better. This intensive pre-trajectory created trust among the team and set the basis for good collaboration; “it really paid off in the execution phase” (PM2). PM1 agrees, in the early phases of the project set the basis for good collaboration and trust. If this phase is not done successfully the project can easily fail. This phase helped to create an integrated team that trusts each other, has a no-blame culture and collaborates effectively.

Removal of financial pressure

The removal of financial pressure as has been done in Project DOEN can also be implemented apart from the collaborative procurement process as described above. The cost estimation is made jointly by members of the client and the contractor. This cost estimation also included the contract cost estimate, this is the actual tendering sum from the contractor that is presented towards the client and their line organisation (Projectteam DOEN, 2017, p. 17). An expert from the client and an expert from the contractor made the cost estimation jointly based on the award design, the execution method, the planning, the risk register and the assumptions list (Projectteam DOEN, 2017, p. 16). The client’s line organisation independently tested this estimation. A fixed percentage is added to the estimation to cover general project costs. On top of this subtotal sum a profit margin is calculated. Both these percentages are based on previous project results. These margins where seem fair by both client and contractor and therefore where no point of discussion or negotiation.

Interview findings

PM1 explains that as a result of this methods two things happened. The financial pressure was removed from the project and all involved had a good understanding of where costs came from, which made it easier to explain to the line organisations. PM2 adds that due to the removal of financial pressure also the financial interest is satisfied and therefore played no further role in the project. Financial interests are often the cause of conflict and prevent good collaboration. As a contractor, we could try to make more money by means of extra

work or exploiting ambiguities in the contract. We however have no interests in doing so because we get paid a fair price with a fair profit margin for the works. So why try to earn more if this will damage the relationship with the client, prevents collaboration and destroys trust. Also during the execution phase, the financial pressure is removed. An example of this is the absence of fines for planning overruns. PM1 explains that because we created the planning together, everyone knows why there are certain deadlines and why they must be met. If something happens that jeopardises the deadline we look together how it can be solved so that the deadline can still be achieved. Fines are not in line with this way of working, we drafted the plan and assumptions together meaning that both parties are to blame if a deadline cannot be met, and not one party. The removal of the financial pressure allows the parties to focus on the project and it decreases the change of conflict and distrust.

Early contractor involvement

In phase 4 of the above-described procurement phase, the contractor is invited to develop the project together with the client. This phase is elaborated separately because it is not a procurement phase, in this phase the contractor has been chosen who is pre-awarded the contract and is invited to co-create with the client. The client and the contractor define together what the technical solution would be, how the risks are allocated, the cost estimate, the planning and the contractual conditions (Projectteam DOEN, 2016). This is done in consultation with the customer, whom the team identified as the administrator of the bridge, and other stakeholders. By doing so the technical specification meets the needs of the customer and the stakeholders. Also, problems can be identified and solved in an early stage of the project and the customer can choose the desired price to quality ratio, by doing so maximum customer value can be created (Projectteam DOEN, 2016). The client has the final call in this ratio. The price is determined jointly by experts from both the client and the contractors. The idea behind this final price is “fair money for fair work” and therefore a ‘fair’ profit margin was decided upon that all parties found acceptable.

Interview findings

PM2 was satisfied with this approach. He states the risks and responsibilities are allocated in a fair way. The client and contractor looked together how the risks could be best reduced and allocated. He found that when you identify and manage the risks jointly, they can be managed in a much more efficient and effective way. Also, the costs aspect has been dealt with effectively. The costs estimation has been made jointly. As a result, everyone had a clear overview where the costs were coming from, there were no ambiguities in the estimation that could result in conflict. PM1 agrees, the cost estimation was fully transparent; this enabled as to explain clearly were the costs were coming from to our line organisation. Due to the absence of ambiguities in the cost estimation, there was no conflict regarding these costs during the project. This saved us both time and costs as there were no need to settle arguments. PM2 described this process as finding a mutual objective while having opposite interests. He states that you can perfectly have different interests as long as you explain these to the other party and find a way to serve both interests while satisfying the mutual objective. PM1 adds that it is not in their interest to be as cheap as possible. We as the client want a working bridge and the contractor should be able to make a profit. By focussing on the mutual objective, we want to create a win-win situation.

During the early contractor involvement phase, the customer was also involved in the process. PM2 experienced this positively, by consulting the customer directly in this early phase we removed one link in the process (normally the process is contractor → client → customer). This enabled us to better understand the needs of the customer. Furthermore, by discussing the technical solution with the customer problems and ambiguities were tackled that normally would enter the project as additional work. This process was very successful for all involved parties, the contractor knew what to expect, the customer was able to choose the technical solution that best suits its needs and the client obtains a work without surprises in the execution phase. PM1 adds that due to the involvement of the customer in the process and actively discussing the technical specifications with the contractor support and trust among all members was created. Furthermore, due to this integrated process regarding the technical specifications, the change for extra work and unexpected technical difficulties was largely reduced. This resulted in almost no changes in design during the execution phase and a smooth execution process.

Joint risk allocation

Joint risk allocation has already been briefly discussed in the early contractor paragraph, here it is further elaborated. Joint risk allocation is seen as a stand-alone aspect because it can be used separately from early contractor involvement. Therefore, this paragraph further explores the possibilities of joint risk allocation. In Project DOEN the client and contractor jointly as one team identified, quantified and allocated the risks (Projectteam DOEN, 2017). Furthermore, prevention and control measures for each risk has been drafted jointly. The allocation of the risks is based on the principle that the party who is best able to manage the risk controls and bears the risk. This also provides an incentive for that party to manage the risk to his best of his ability (Projectteam DOEN, 2017). Allocating the risks to one party does not mean that the other party cannot help control the risk. Within Project DOEN parties expressly stated that the parties help each other control the risks as best as possible. Most risks are allocated to either the contractor or the client. By doing so, it is clear what parties bear what responsibilities even though the parties work as mostly as one team (Projectteam DOEN, 2017). Risks that when occurs have a negative effect on both parties and which are difficult to allocate are placed in the shared risk fund. Client and contractor are both 50% responsible for risks placed in this fund. This incentivises both parties to manage these risks as best as possible. Risks in the category unforeseen-unforeseen (black swans) are allocated to the client. Allocating these to the contractor is not seen as fair and will result in a significantly higher tender bid due to the pricing of the risks (PM1).

Interview findings

PM1 explains that the parties jointly made the risk allocation and as a result, they only had to preserve the jointly made agreement during the execution phase. This also entails accepting losses if they occur. “Each party took the risks it was best able to bear, then if these risks occur the party should not complain but simply accept the consequences.” PM2 adds that both parties sometimes simply have to accept drawbacks. It is in the best interest of the team and thus for the project that we quickly move on after a drawback otherwise it can deteriorate the ethos and the chances of falling back into old behaviour can increase. We do however look together what the possibilities are to tackle the problem. Next to a more efficient way of tackling risks this also creates a group feeling and creates trust among the team.

Furthermore, PM1 states that because the parties made the risk allocation jointly, it was quickly approved by the supervisors of both client and contractor. It also made it impossible to be dissatisfied with the risk allocation as everyone was involved in the drafting process and accepted the final risk allocation. The contractor had many changes to provide a fair price for the works including the risks he was allocated and he had no incentive in the process to deliver to low bid or to behave opportunistic. Therefore the risk that the contractor made an uncomplete costs estimation was for the contractor itself. “If events happen the contractor did not anticipate he must not ask for extra funds, he should have made a better estimation upfront” (PM1). PM2 agrees: “you should not feel bad for a contractor that is not doing his work properly.” At the start, you jointly make a risk allocation as best to both parties’ knowledge, but if things are different than expected, you do not blame each other for this (PM2). Next to this, PM2 states that due to the intensive joint risk allocation process it is clear for all involved what the thinking steps are to allocate risks logically. This helps during the execution of the project when unexpected and unforeseen things happen. The same thinking steps are used to logically allocate the consequences as up front not everything can be foreseen. By stating and jointly accepting that this will be used to allocate unforeseen risk during the execution the chances of conflict regarding unforeseen risks are reduced. The risk can be reasonably allocated and managed jointly, allowing the parties to focus on the project.

Joint project team

The project team conduction project DOEN is an integrated project team. This is different from two teams working together. The team is composed of members from each organisation which is different from teams from each organisation who are stuck together. Tasks within the team are divided based on questions such as: who has the knowledge and skills to do it, who knows people needed to do the job, who has the time and who likes to do it (Projectteam DOEN, 2017). From what organisation an individual comes is irrelevant to this task division. This process resulted in one organogram in which every team member is represented, instead of two organograms (one of the client and one of the contractor). The team works as one team from a shared project location. An environment is created in which each individual can express his opinion based on his expertise. This means that it is not necessary that this opinion meet the opinion of the line organisation. In this environment, people are also more likely to behave in a best-for-project way (Projectteam DOEN, 2017). This entails that there are no pre-meetings conducted by client or contractor in which they create their point of view and defend this in the joint meeting, in contrary all problems are discussed openly in the joint meeting in which problems are tackled in a joint and best-for-project way.

Interview findings

PM2 states that the project team was formed organically, it did not matter from which organisation one came from. Logic was used for the division of tasks, for instance the role of surroundings manager was initially done by the client because in the early stages a more administrative approach was needed, as soon as the project entered the execution phase a more practical approach was required resulting in a change of surroundings manager from an individual from the client to an individual from the contractor. PM1 adds that for many roles in the team there is only one. For instance, there is only one contract manager and one surrounding manager. This means that you have to work with people from other

organisations, you cannot avoid each other. This result in an easy to manage project because both parties behave as one and serve the mutual objectives. In the beginning, this was not always easy, it takes time to learn how the other behaves and understand each other's choices. However, understanding the contractor helps to apprehend why certain things happen, this creates a sense of mutual understanding when thing go wrong. It took some time before a good balance between the cultures of the client and contractor where found. The client wanted to discuss every detail in a meeting while the contractor wanted to start working in the field. This was not tackled as a problem but as an opportunity to learn. The client learned from the contractor that sometimes you just need to make a decision and see how it plays out and the contractor learned not to make hasty decisions (PM1). PM2 agrees: "by gaining insight into each other's process you get a lot more understanding for each other". The continuous meeting was sometimes difficult and irritating for the contractor; "we perfectly know what is the best option", yet when a problem is discussed jointly we experienced that we were able to find a better fitting solution for all involved parties than the solution we would have implemented if we did not discuss the problem (PM2). As a result of the integrated team, we can tackle problems efficiently and effectively, and find a solution that is best-for-project.

Continuous process reflection

During the project, the integrated team continually reflects on what they are doing and why they are doing it. Next to this, it is evaluated if a particular process actually resulted in the expected result. By doing so, the processes can be optimised during the execution of the project because we are able to learn from our mistakes and get understanding why things did no go as expected (Projectteam DOEN, 2017).

Interview findings

PM2 states that it is necessary to keep each other focused and invested in the process to prevent falling back in old behaviour. It requires a constant investment in each other to keep the groups from the client and contractor actively talking to each other and openly sharing information. Old behaviour is always lurking, mainly because sometimes it is easier to do something by yourself than to explain it to the team and get tough questions about it, while this can result in a better solution. By agreeing upfront to reflect constantly, the falling back in old behaviour can be prevented and the process can continuously be optimised. Therefore it is important to reflect both on the project and on yourself. PM1 agrees and expresses that the reflection process thus far resulted in a smooth process. By reflecting together, future problems can be prevented and process that where unsatisfying for one party can be eliminated from the project.

Continuity

In order to work as one team, the members of the team must trust each other and must be able to work with the other members of the team. Continuity is essential for this because relations form among the team members and trust exists between individuals. When these individuals change the trust has to be build up from scratch again (Projectteam DOEN, 2017). Therefore, the team members of the client have been mostly the same since the preparations for the tender phase. The team members from the contractor also remained the same team that initially joint the process during the tender phase.

Interview findings

PM2 states that as a result, the knowledge gained during the tender, early contractor involvement and executions phase is still present in the team working currently on the project. Furthermore, the relations and trust among the team members are not lost due to the replacement of the team. When a team member has to leave the project the parties together look for a new team member who fits into the team with the goal to limit the impact of the switch of team members. PM1 adds that continuity in the project is critical, during the process you get a relation with a person if that person leaves the project and is replaced the trust can decrease in the project team.

Joint problem or conflict resolution

The project team has agreed to keep investing in collaboration on both professional and personal level. By doing so, the team aims to create an environment in which problems and issues are resolved openly and transparently by the team as a whole (Projectteam DOEN, 2017). By tackling problems with the entire team, making them negotiable and asking questions as 'what is really going on?' the team aims to tackle the problem at its core. Furthermore, the team has actively agreed to try to let problems not damage the collaboration or the relation, instead, try to use collaboration or the relation among the team to tackle the problem.

Interview findings

PM2 explains that all points of interest and unexpected events are discussed. In these conversations, we express our interests and how these relate to the mutual objectives. We state as a contractor how we normally would solve the issue, the client can give his input and based on these joint discussions we create a solution that fits both the client's and the contractors interest while it also serves the mutual objectives. No judgement is done based on opinions, everything is done based on facts and observations. This requires the willingness from both parties to find solutions that might not perfectly serve your own interests, but which are in best interests for the project as a whole. Instead of immediately issuing extra work tickets we jointly investigate the situation and draft a satisfying solution for both. As a result, the execution phase becomes enjoyable again for all involved. PM1 adds that by looking jointly to problems a lot of unnecessary and extra work is prevented. Normally the parties would look individually to the problem and draft up what for them would be the best outcome, thereafter this standpoint is defended during the meeting. Our goal is to help each other and draft a best-for-project solution.

Furthermore, PM1 explains that inspections are conducted jointly. Not only the problems are tackled together, they are also discovered together. There are no formal inspections, the parties together identify problems and how the work is progressing. This process makes it clear for all involved what the problems are and how the work is being executed. This also makes it possible to jointly explain to the line organisations why certain choices were made. Explaining together why things happen created broader support within the line organisations. As a result, the parties are better able to focus on the mutual objectives of the project and less on the costs and extra work aspects that in traditional (old behaviour) project often require much time.

Optimization incentive

In Project DOEN there is an incentive used that aims to motivate the contractor to keep optimising the process during the project. This incentive is the securing of the profit margin in the early stages of the project based on the tendering sum. This means that the absolute profit sum will not change during the project unless there are scope changes requested by the client (Projectteam DOEN, 2017). This allows the contractor to increase the profit margin if he can optimise the scope and thereby reduce his costs. By doing so, the client aims to stimulate the contractor to focus on the mutual objective of successful project delivery.

Interview findings

PM2 stated that when the scope is optimised it benefits the client as the costs decline. We are rewarded for this by fixing the absolute profit sum upfront and thus our profit margin increases. However, not only the gains are shared, when we have costs overruns the profit sum is also fixed and thus our profit margin decreases. Finally, he states that an incentive like this should in the ideal world not be needed. “You should not be rewarded to work in a way that is best for the project, you must want to work in such a way because it is the best thing to do.” Yet, an incentive like this can help to keep the contractor on track and prevent the possible falling back into old behaviour.

3.2.2 Possible drawbacks of Project DOEN methods

From the previous paragraph it became clear that there are several possibilities and opportunities in Project DOEN that might improve collaboration in the Dutch construction sector. In this paragraph, the possible drawback or risks that come with these methods for collaboration are identified. This identification is based on the tender reflection document provided by the team of Project DOEN and the exploratory interviews that are also used in paragraph 3.2. There can always be additional drawbacks than the ones discussed here, this is because every project is different. The drawbacks discussed here are by no means a complete list of all the possible drawbacks and one should always consider the specific circumstances of the project at hand.

Most methods in project DOEN require both parties’ entire teams to be willing to collaborate and embrace working jointly. PM2 states that the way of working done in Project DOEN requires a change of mind. The project required the team members to focus on collaboration and to be critical of one’s own behaviour. It is necessary to keep yourself focused in order to not fall back into old behaviour (PM2). Furthermore, the individuals from both the client and the contractor must be able to work with each other. In Project DOEN emphasis was placed on this aspect in the procurement phase. If this is not done, it can be the case that the two teams from client and contractor are too far apart in their way of thinking which can hinder collaboration. PM1 explains that there has to be a professional match between the two teams to be able to collaborate in an intensive way.

The process of defining how to collaborate in an intensive way was more challenging than expected beforehand (PM2). This has two main reasons. First, such a process requires both parties to expose themselves; how they do certain things and how decisions are made. For this, it is necessary that each individual dare to expose him- or herself in a vulnerable and honest way. Only then you get a good insight into the process of the other party. By accepting that another person works differently enables you to draft a process with which both parties

can work effectively. When a satisfying method for collaboration is found, the process does not end. Because both parties work in an open and low-regulated environment you have to keep paying attention that people do not abuse this freedom. Therefore, asking the question why things happen and being present at the project site is necessary. This also keeps both parties on track and it prevents falling back in old behaviour (PM2).

The methods found in Project DOEN cannot be implemented in another project without consideration for that specific project. The methods require tailoring to the project in order to work properly. The project manager must carefully consider that is important is his project and adopt methods that fit this need. For this to be successful capable project manager is required that can oversee what the needs of the project at hand are. If he is capable to identify these needs he can chose or adapt methods that can help him successfully execute the project. This research aims to provide the project manager with a clear overview of the available methods and how they can affect the process within project. This can help the project manager to choose methods that best serve his project.

The methods from project DOEN require the parties to adopt new working methods. By doing so, the team can run into two problems. The first is that adopting a new way of working support is needed from the line organisations of both parties. When this support is not received the team can run into problems as processes can be rejected by the line organisation or the line organisation stimulates 'old behaviour' and prevents thereby collaboration. Second is that organisations often struggle to change their way of working. Boonstra (2000) found that 70% of all organisational changes fail. The main reason found for this failure is that employees often fall back into the behaviour they are familiar with. When unexpected things happen, it is saver to behave familiarly as it is unknown what the new method will bring (Boonstra, 2000). Therefore, when a new method is used people have to dare to use it and focus each other and themselves to keep using the method.

The final and most dangerous drawback from Project DOEN is that there are very little rules or securities in the project and its methods. PM1 explains, when a party wants to do harm or behave in bad faith, he can easily do a lot of harm in this project. Most of the methods are based on trust between the parties, if there is no trust the methods will not work. The given that each party can easily harm the other party is a liability for all parties and forms a significant risk. Therefore it is required that there is a strong basis of trust created among the parties, if the parties fail to create this basis in the early stages of the project it is not recommended to use Project DOEN methods.

3.2.3 Conclusion

Several methods that can influence collaboration have been identified. Each of these methods can influence collaboration because it is linked with one or more factors of collaboration described in paragraph 2.4. In table 3, an overview is presented of the identified methods that can influence one or more of the factors of collaboration. In this table, the identified Project DOEN methods that potentially can influence collaboration are displayed on the vertical axis. On the horizontal axis, the different factors that enable collaboration are placed. The 'x' represents a connection between a method and a factor of collaboration. This connection shows what factors the method can have influence on and thereby potentially

influence collaboration. A further insight into the basis of the connection can be found in appendix F.

This table can provide an insight into what factors of collaboration the methods can potentially influence. This is useful when a certain aspect of collaboration needs more attention in a project. From this table, it becomes clear what method might provide the needed stimulant on that aspect of collaboration.

Table 3: Project DOEN methods that can improve collaboration

Factors stimulating collaboration / Project DOEN methods	Mutual objectives	Gain and pain sharing	Trust	No-blame culture	Joint working	Communication	Joint problem solving	Fair risk allocation	Effective performance measurement	Continuous learning
Collaborative procurement	x		x	x	x	x				x
Removal of financial pressure	x		x	x	x					
Early contractor involvement	x		x	x	x	x	x	x		x
Joint risk allocation	x	x	x	x	x	x		x		
Joint project team	x				x	x	x			x
Continuous process reflection				x		x			x	x
Continuity			x		x					
Joint problem or conflict resolution	x			x	x	x	x		x	
Optimization incentive	x	x								

This table provides a preliminary overview of the possibilities and opportunities of Project DOEN. In the case studies and the expert panel validation it will be investigated if the links between the methods and factors of collaboration in this table are exist in practice in integrated projects in the Netherlands. Based on these findings a final table is presented in the conclusion of this report.

With these methods do come potential drawbacks. One of the main drawbacks is that the methods require a team that is willing to implement the methods and can collaborate with each other intensively. If the team from either client or contractor is not fully willing to collaborate or withholds information the methods will likely not bring the desired result. Next to this, the methods cannot be easily copy pasted into a project, adjustment is needed in order to make the methods work for each project. Therefore, a competent project manager is needed that is able to choose methods that make sense in his project and who can tailor these methods to make them meet the project's needs.

Furthermore, it requires both parties to be open and honest about the process. This requires courage from the individuals in the team, as they have also show failure. Support from the line-organisation is also needed to implement the methods successfully. If no support is given to the team from the line organisation, it can be hard to work in a situation with little rules and certainty. Next to this, the change that is needed for a successful implementation can be difficult as can be seen from the fact that around 70% of organisational changes fail (Boonstra, 2000). Therefore, the change process must be conducted with due care.

Finally, the major drawback from Project DOEN is its lack of rules and securities. Because of this parties can easily harm each other by behaving in bad faith. The other party will have no legal foundation on which it can defend itself. Therefore, a basis of trust must be formed in the early stages of the project. If this is not formed, it is not recommend to use Project DOEN methods.

3.3 Conclusion

The objective of this chapter was to provide an answer to the fourth sub research question. This research question reads:

What Project DOEN and NEC4 ECC methods and clauses can potentially improve collaboration and what are the possible drawbacks that come with these methods and clauses?

The first part of the conclusion follows from a combination of the sub-conclusion 3.1.3 and 3.2.3 regarding the methods and clauses that can improve collaboration. The two tables that are presented in these sub-conclusions are merged to form one overarching table containing methods of both the NEC4 ECC and Project DOEN. Similar methods and clauses, and methods and clauses with the same object or goal are merged. The final table is presented in table 4. In this table, the identified NEC4 ECC and Project DOEN methods and clauses that potentially can improve collaboration are displayed on the vertical axis. On the horizontal axis, the different factors that enable collaboration are placed. The 'x' represents a connection between a NEC4 ECC clause and a factor of collaboration and the 'o' represents a connection between a Project DOEN method and a factor of collaboration. This connection shows what factors of collaboration the method or clause can have influence on and thereby potentially improve the overall collaboration in the project.

In this table, the origin of each method is shown by the use of abbreviations (N) and (D) behind each method. The abbreviation (N) is placed behind methods that come from the NEC4 ECC and (D) behind methods that come from Project DOEN. This clarifies what the similarities between the merged methods are and if the linkage corresponds with the NEC4 ECC or Project DOEN method. All merged methods and clauses are briefly elaborated:

- Early contractor involvement – early contractor involvement has been identified in both the NEC4 ECC and Project DOEN. The NEC4 ECC clause and Project DOEN method have been merged because although the methods have a slightly different process, they do have the same objective. The NEC4 ECC method is more focused on rules in the early contractor process and the Project DOEN method is more focused on open communication especially in phase 2-4 of their process. Here the main focus lies on working together in open communication. However, as can be seen from table 4, the

methods have the same potential to stimulate collaboration. Because of the same objective and identical potential to stimulate collaboration, the methods are merged;

- Incentives – in both the NEC4 ECC and Project DOEN there are incentives that aim to stimulate the contractor to optimise the process and thereby reduce (overall) costs or time or increase quality. Because the process and the objective of the identified incentives is highly similar and often only form a small portion of the overall project process they are merged in the final table. A distinction between the methods would likely result in a more comprehensive final advice;
- Risk allocation – two methods are merged that both deal with the allocation of risks and therefore are same in basis. The compensation event method of the NEC4 ECC aims to make a clear distinction in the risks for the contractor and the risks for the client. This provides a clear list of events for which the contractor can expect extra payment or time. The Project DOEN risk allocation is based on joint allocation of the risks. The methods have the same objective as they both aim to provide a clear risk allocation in an early phase of the project that both parties see as fair. Due to this similarity, the methods are merged;
- Problem/conflict solving – both NEC4 ECC and Project DOEN methods are identified that aim to solve problems and conflicts in a joint way. Just like the risk allocation explained above the NEC4 ECC methods do this in a more contractual way, where the method of Project DOEN is focussed on active communication. Yet, the potential to stimulate collaboration, the process and the objective show many similarities and therefore these methods are merged and tested jointly in the case study.

Table 4: NEC4 ECC and Project DOEN methods and clauses that can potentially stimulate collaboration

Factors stimulating collaboration / NEC4 ECC & Project DOEN methods and clauses	Mutual objectives	Gain and pain sharing	Trust	No-blame culture	Joint working	Communication	Joint problem solving	Fair risk allocation	Effective performance measurement	Continuous learning
Early contractor involvement (N)(D)	**x o**		**x o**	**x o**	**x o**	**x o**	**x o**	**x o**		**x o**
Optimization incentive (D) & CS* (N) & WLC* (N) & CP* (N) & BEC* (N)	**x o**	**x o**	**x**							
Joint risk allocation (D) & Compensation events (N)	**o**	**o**	**o**	**o**	**o**	**x o**		**x o**		
Joint problem or conflict resolution (D) & EW* (N) & RD (W3)* (N)	**x o**		**x**	**o**	**o**	**x o**	**x o**		**x o**	
Good faith obligation (N)			**x**	**x**		**x**				
Communications (N)						**x**			**x**	
Programme and planning (N)						**x**	**x**		**x**	
Collaborative procurement (D)	**o**		**o**	**o**	**o**	**o**				**o**
Removal of financial pressure (D)	**o**		**o**	**o**	**o**					
Joint project team (D)	**o**				**o**	**o**	**o**			**o**
Continuous process reflection (D)				**o**		**o**			**o**	**o**
Continuity (D)			**o**		**o**					

*CS: Contractors share, WLC: Whole life costs, CP: Contractor proposals, BEC: Bonus for early completion, EW: Early Warning, RD: Resolving disputes

This table shows how the identified methods can potentially influence collaboration. It gives an overview of what factors of collaboration each method can potentially influence. This is a summary of what is discovered in this chapter. How these methods achieve their potential influence on collaboration can be found in the sub-paragraphs of this chapter. This table also shows how the methods and clauses can potentially influence collaboration, for instance by influencing mutual goals or joint working.

The second part of the answer to the sub-research question refers to the possible drawbacks that can come with the implementation of these methods.

The main risks when implementing methods of the NEC4 ECC are linked to the capabilities of the project managers. When implementing NEC4 ECC methods emphasis must be placed on the training of project managers on how to use these methods. Otherwise, it is likely that the

methods will not bring the desired result and even hinder the process in the project. Also, the NEC4 ECC clauses require more capacity from the project managers. A pro-active professional attitude is required from both the client and contractor to ensure the clauses are implemented and maintained successfully. When this is not available the methods can fail resulting in overall project failure.

Implementation of the NEC4 ECC clauses has to be done with due care, the contract is written for the United Kingdom and therefore the clauses need careful inspection to ensure that they comply with Dutch law. The relatively simple language in the clauses can lead to ambiguities in a Dutch legal context. Next to this, several barriers must be overcome for successful implementation of NEC ECC methods in the Netherlands. The main barriers are the unawareness among project teams of the possibilities and benefits of the NEC4 ECC, lack of training resulting in insufficient capabilities among project managers, unwillingness to change in the Dutch construction sector and the lack of experience with the NEC4 ECC in a Dutch context. From a cultural point of view, no major risks are found. From Hofstede it follows that the cultural differences between the United Kingdom and the Netherlands do not form an insurmountable barrier to implement NEC4 ECC clauses in the Netherlands.

Concerning the Project DOEN methods, the main risks can be linked to the need of having a willing and cooperative team. Attention must be paid to the forming process of the team; a team that is willing to place emphasis on collaboration is necessary to implement and use the Project DOEN methods successfully. A professional match between the individuals in the proposed team is necessary to obtain the full positive impact that these methods can have on collaboration. Individuals must dare to expose themselves in a vulnerable and honest way. Only then can be Project DOEN methods be fully used, otherwise there is a high chance of failure of the method.

Next to this, the methods themselves need to be tailored to the project. It is important that the methods are not copied one to one on a new project. The spirit (intention) of the method can be copied directly, but not the method itself. Also, because the methods are new and contain few ‘hard’ rules the full support from the line organisations of both parties is needed. The parties must be willing to take a leap of faith with the other party. When the line organisations do not support this, using the methods the way they are intended is difficult.

Another drawback of the Project DOEN methods is that the methods do not contain hard rules or securities but are based on around trust. Project DOEN itself provides several methods that can create the needed trust. Especially methods that can be used in the early project phases such as collaborative procurement, early contractor involvement and joint project team can ensure that trust is created between client and contractor. If the parties fail to create a basis of trust in the early stages of the project it is not recommended to use Project DOEN methods.

The conclusion presented here is an intermediate result. The connections made here will be further tested in the case studies on its correctness and thereafter they are validated by industry experts. Based on the findings in the cases studies and the validation, table 4 will be adjusted. The adjusted table and the identified risks form the basis for the conclusion of the research.

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4. Case study – collaboration in Dutch integrated construction contracts

In this chapter, the table presented in the conclusion of chapter 3 will be evaluated in this case study research. In this research three cases are studied on their process and collaboration. The goal of this analysis is to evaluate the connections made in chapter 3 with regard to the Dutch construction sector.

4.1 Case study methodology

There are several options for the design of a case study. Yin (2009) has defined four main types of case study designs. These are based on the nature of analysis of the case study and the number of case studies. The case study designs are shown in figure 11. The nature of this research is embedded, there are multiple units of analysis: the Project DOEN methods and NEC4 ECC clauses that positively influence collaboration. There are multiple case studies conducted in this research which are compared using a cross-case analysis and thereby improve the accuracy of the findings (Yin, 2009). Because multiple units of analysis are researched and multiple case studies are conducted the embedded multiple-case design is used, this design is encircled in figure 11.

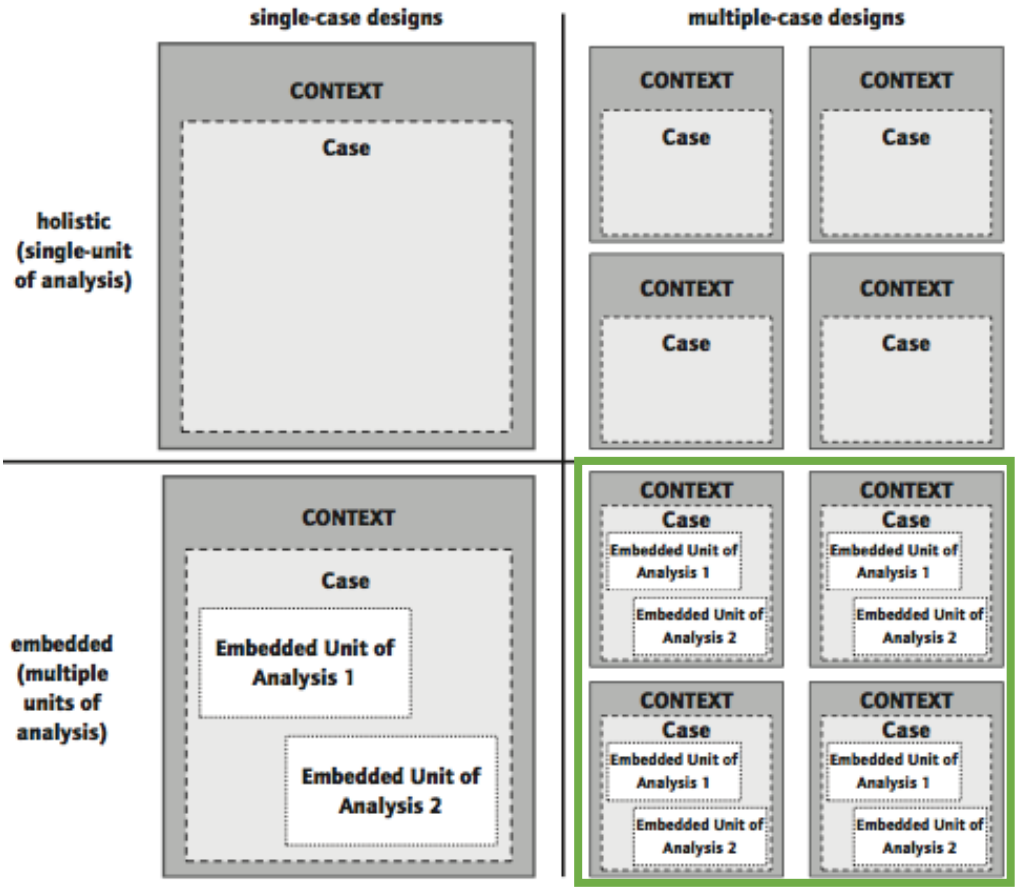

Figure 11: Basic types of Design for case studies (Yin, 2009)

For the qualitative data collection during the case studies, the method of semi-structured interviews will be used. This method is chosen because the objective of the case studies is to explore what methods for collaboration can potentially work in practice. Semi-structured interviews can help identify if a method or clause can work in practice because the interviews can be used to understand how certain things/people work or behave (Easterby-Smith et al.,

2002). To successfully conduct these semi-structured interviews, a protocol will be followed. In short, this entails:

- Interviewee selection – to get a good insight in the case people with different roles need to be interviewed. The goal is to interview different members of the core-team from both the client and contractor organisation;
- Interview protocol – the interview consists of six parts and can be found in appendix G. In the introduction a brief insight into the research is provided to the interviewee. During the interview itself, the interviewee is invited to do most of the talking and provide examples to illustrate their experience. Also, the "why" question will frequently be asked to obtain an insight into the situation. In the wrap up, an insight will be given to the interviewee regarding what will happen to the data. Also, it is asked if the interviewee knows colleagues that can provide relevant information regarding the research, this can help by identifying new interview candidates;
- Validation protocol – the obtained results during the interview will be shared with the interviewee. He/she can read these and validate if it is indeed what was meant by the statements made. When the statements are approved the results can be used as research input.

To conduct a cross-case analysis, there must be a similar units of analysis for each case (Yin, 2009). As stated earlier in this paragraph this case study is embedded of nature there are multiple units of analysis: the Project DOEN methods and NEC4 ECC clauses that positively influence collaboration. The units of analysis must be similarly addressed in each case. By comparing the units of analysis, a sub-conclusion based on the cases can be drafted.

In each case the daily project management team is interviewed. This is similar for each case. This is done because these people work on the project in a daily basis and together create the process and manage it over time. Because these people are at the core of the process, are able to manage it during project execution and have an oversight over the entire project they are best able to describe the collaboration and its process in the case. Explaining how it could be improved and what went well in the project.

4.2 Case study selection

Cases are identified from the available cases at Witteveen+Bos, forming the first criterion. Also, this study is scoped to the Dutch construction industry and integrated contracts, this formed the second and third criterion.

Furthermore, to obtain an insight into methods and clauses that positively influence collaboration, there has to be good collaboration in the case due to the use of collaborative methods. The purpose of the case studies is to test the identified NEC4 ECC and Project DOEN methods in a Dutch context. As there are no NEC4 ECC and other Project DOEN cases, UAV-GC cases are used in which these methods are used (up to a certain extent). To obtain suitable cases, the final criterion is that in the cases the parties must have the intention to collaborate and thus place emphasis on collaboration.

In summary, the following criteria were drafted:

- The case is an integrated project;
- There had to be the intention to collaborate in the case;
- The case project must be conducted in the Netherlands;
- Witteveen+Bos must have a role in the case.

These criteria are used to scope the search for suitable cases. The search process is displayed in figure 12.

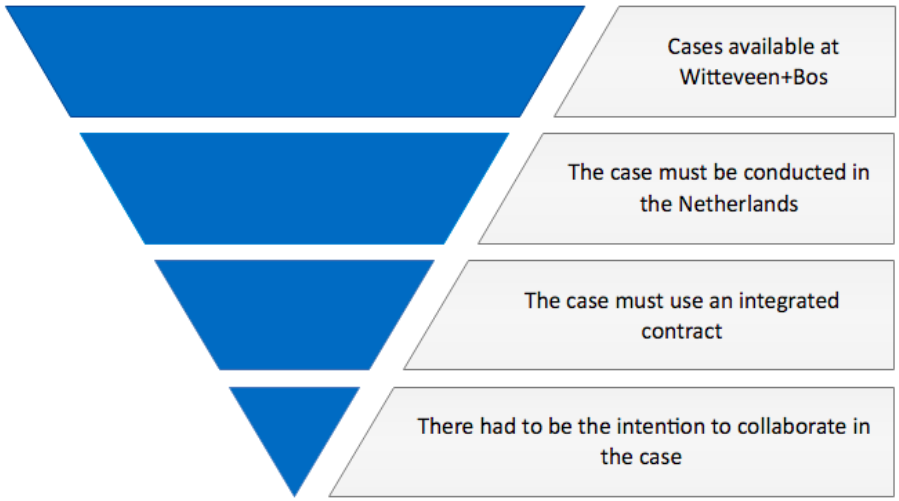

Figure 12: Case study selection process

The process displayed in figure 12 resulted in a pool of several cases that could potentially be used in this research. Witteveen+Bos employees who worked on the particular case where contacted to gain more information about the case and discuss the possibility to use the case for this research. Not all cases appeared to be relevant as no methods were used that where relevant to this research. Also, some cases could not be used due to the sensitivity of the case or to high stakes involved with the case. This process finally resulted in three suitable cases that will be further investigated in this research. The cases and respondents have been anonymised on request of the respondents. The following cases are used in the research:

- Reinforcement of a bridge
- Soil improvement project
- Construction of a viaduct

In two of the cases the same contractor conducted the works. The cases are however different with regard to collaboration. In one case, the collaboration was successful. In the other case there was willingness to collaborate, but the teams failed to successfully collaborate. Therefore, it cannot be said that the positive findings are based on the fact that the same contractor conducted two cases. Each of the cases is briefly explained in table 5 and are further elaborated in their corresponding paragraph. The case studies will be conducted based on a case study protocol. This protocol can be found in appendix G.

Table 5: Case overview

Case 1: Reinforcement of a bridge

Case 1 concerns the reinforcement of a bridge. This bridge had to be reinforced as soon as possible because it did not meet the needed requirements. As a result, lanes had to be closed off resulting in hinder for the area.

For this project the client needed a contractor who was able to successfully and efficiently execute the necessary reinforcements in a timely manner. Due to positive experiences in a previous project, they chose a suited contractor.

The works included of the renovation of the pylon, the main beam, the anchors and the braces.

Figure 13: The reinforced bridge (Google Streetview, 2018)

Case 2: Soil improvement

Case 2 is part of a larger project, the development of a new residential area in the city of Gouda. The area will contain a large pond and has its own nature and recreation area of 45 hectares. In several phases, 4000 houses will be built.

This case concerns the soil improvement of the second project phase. The client is exist of multiple parties including the municipality. The client mostly outsourced their responsibilities to third parties, who supplied the project managers.

In total 15 hectares of soil improvement are executed. Next to this, the soil is raised and made ready for construction.

Figure 14: Execution soil improvement (VOF Westergouwe , 2017)

Case 3: Construction of a viaduct

Case 3 concerns the building of a new viaduct. As a result of increasing traffic in the region due to development of industries in the area, there is the need to change the existing single-level intersection with an overpass, being viaduct.

Figure 15: Impression of the viaduct (Port of Rotterdam, 2016)

The works include replacing the single-level intersection with an overpass, extension of the current primary access road from a 2-lane road into a 4-lane road for a length of 5 km and removing the existing intersection.

4.3 Case study semi-structed interview processing methodology

As stated in paragraph 4.1 the methodology used for the case studies is a semi-structured interview based on an interview protocol which can be found in appendix G. Here it is elaborated how the findings of these interviews are processed and how the results will be presented.

The findings from the interviews will be processed into tables in which they are presented in the report for reference. Findings for each clause or method from Project DOEN or NEC4 ECC are clustered in a table resulting in 12 tables for each case. These tables consist of three columns. In the first column, it will be stated which respondent did the statement, in the second the statement itself is presented and in the third what factor of collaboration it has influence on is shown. This factor will also be colourised in green or red depending on if the statement has a positive or a negative relation with the factor. Green represents a positive relation and red a negative one. For efficiency and clarity reasons the factors are numbered. These numbers are placed in the column. The numbering is as follows:

1: mutual objectives
2: gain and pain sharing
3: trust
4: no-blame culture
5: joint working
6: communication
7: joint problem solving
8: fair risk allocation
9: effective performance measurement
10: continuous learning

These tables are placed in appendixes. In the main text, the findings of the semi-structured interviews are clustered and presented in the same framework as used in the conclusion of chapter 3. In this framework, percentages are placed at the corresponding linkages of a method or a clause and the factors that stimulate collaboration. The percentage represents the amount of respondents that verified the linkage. For instance, the percentage 50% means that half of the respondents stated that this linkage existed in the case. Also, red percentages are used, this represents the amount of respondents that stated that there is a negative linkage and thus that the method or clause can have a negative influence on that aspect of collaboration.

The 10 factors used in this research that can stimulate collaboration were not shown to the interviewees. This is done to ensure that the interviewees only describe relations between factors of collaboration and the methods or clauses that they experienced in the project and to prevent pre-defined answers form the interviewees as this might give a too optimistic overview of possible linkages. When the interviewees have to come up and describe linkages by themselves without showing a premeditated answer only truly existing linkages for that case will follow from the results.

This procedure has two downsides. The first is that because some linkages are not top-of-mind for some respondents it might be the case that they forget to mention the linkage by themselves. Because the author does not provide an overview of possible linkages, some linkages might be forgotten. It is however unlikely that all interviewees in the case will forget the linkage and thus the linkage will likely be found. However, due to this the tables only provide an insight into the possibly existing positive and negative connections and not a full overview of all possible linkages, there can be more connections than presented in the table. The tables show an insight into connections that are likely to exist in the Dutch construction sector, the higher the percentage, the more likely that the linkage exists in practice.

The second downside is that because these 10 factors of collaboration are not stated literally to the interviewee, it can be the case that in the statements the factor is not mentioned literally. As a result, to be able to make to allocate factors of collaboration to a statement sometimes a certain level of interpretation of the author is needed. To prevent interpretation as much as possible the author explicitly asked the interviewee what he meant with a statement if it was unclear what the underlying thought of the statement was. Because the author was aware of the 10 factors of collaboration he could ask if one of the factors was what the interviewee meant. Due to this the need of interpretation of the statements was limited as much as possible and consequently mis-interpretation is prevented as much as possible. All interpretation steps needed to fit the statements into the framework can be found in the appendices.

To prevent that there are conclusions made on mis-interpretations two main measures are used. The first is that conclusions are never based on only one statement. Always several statements are used before a conclusion is derived from it. It is unlikely that if a conclusion is based on total 8 statements from 3 cases that all these statements are misinterpreted. The second measure is that the conclusions are compared with literature and validated before a final conclusion is drafted. By means of these two measures the author hopes to limit the influence of mis-interpretation of the statements on the conclusion as much as possible.

4.4 Case 1 – Reinforcement of a bridge

The case concerns the reinforcement of a bridge. This bridge is a cable-stayed bridge with a total span of approximately 280 meters and a main span of 109 meters. It is located between Rotterdam and Brielle. The bridge spans the northern part of the Hartelkanaal. On top of the bridge, a 2x2 lanes road runs. The bridge is displayed in figure 16.

Figure 16: The reinforced bridge (Rijkswaterstaat, 2012)

The works that are to be conducted are focussed on the strengthening of the existing bridge. At the start of the project, the bridge did not meet the applicable guidelines regarding maximum load distribution, therefore a maximum load limit has been imposed on the bridge. Due to this maximum load limit, one driving lane for each direction had to be closed.

The bridge had to be renovated to meet the norms set by the government. To do so several types of works had to be done, in short, the following works are conducted:

- Reinforcement of the main beam – the main beam of the bridge, being the tube beam, needed reinforcement. In this tube steel strips are welded to ensure its strength;
- Reinforcement of the pylon – the pylon of the bridge is internally reinforced by applying steel profiles in the corners;

- Instalment of additional tension anchoring – to further ensure strength attentional anchors are installed at the north side of the bridge;
- Reinforcement of the braces – the starting point of the braces are reinforced both at the main beam and the pylon.

To get an insight in the case study semi-structured interviews are conducted with the following people with between brackets the abbreviation RS[x] (responded) is used to address them in de remainder of this case study:

- Respondent 1 (RS1) – area manager Witteveen+Bos;
- Respondent 2 (RS2) – contract manager client;
- Respondent 3 (RS3) – account manager contractor and commercially responsible;
- Respondent 4 (RS4) – project manager contractor.

These persons are interviewed because they had a key role in the process of the project and were part of the project management team in accordance with the used methodology elaborated in chapter 4.1. These people referred to each other when asked who else would be interesting to interview for this research. When the author stated that these people would be interviewed the interviewee's stated that these people were the right to interview. These persons formed the core project team and actively participated in the process. Therefore, these persons could provide the author with a good insight in the project and the process within the project.

4.4.1 Identified connections case study 1

In this paragraph, the case-study findings are presented. The raw data can be found in appendix H. To use the data, it analysed and interpreted (appendix K). In the analysis, factors of collaboration are connected to the statements made by the respondents. By doing so an overview of methods that can potentially positively influence specific collaborative factor can be made. This overview shows how a method or clause can have a positive influence on collaboration. This overview is presented in table 6.

Table 6: Findings case study 1 (N=4)

Factors stimulating collaboration / NEC4 ECC & Project DOEN Methods and clauses	Mutual objectives	Gain and pain sharing	Trust	No-blame culture	Joint working	Communication	Joint problem solving	Fair risk allocation	Effective performance measurement	Continuous learning
Early contractor involvement (N)(D)	100%		100%	100%	100%	100%	100%	50%		75%
Optimization incentive (D) & CS (N) & WLC (N) & CP (N) & BEC (N)	50%	25%								
Joint risk allocation (D) & Compensation events (N)	75%	50%	50%	50%	50%	75%	50%	75%		
Joint problem or conflict resolution (D) & EW & RD (W3) (N)	50%	50%	75%	75%	75%	100%	100%			
Good faith obligation (N)	75%			50%	25%	75%				
Communications (N)	25%		75%	50%	25%	100%	50%		75%	25%
Programme and planning (N)	100%		25%	50%		100%	75%	25%	100%	
Collaborative procurement (D)	100%		100%	100%	100%	100%	50%			25%
Removal of financial pressure (D)	75%		50%	75%	75%			50%		
Joint project team (D)	100%		50%	50%	100%	100%	100%			
Continuous process reflection (D)				75%		100%			25%	50%
Continuity (D)			100%		75%	50%				25%

CS: Contractors share, WLC: Whole life costs, CP: Contractor proposals, BEC: Bonus for early completion, EW: Early Warning, RD: Resolving disputes

4.4.2 Impact ranking case study 1

Next to the semi-structured interview, the interviewees were asked to rank the methods and clauses from methods or clauses that had a high impact on collaboration in the project and were therefore most important in their project to methods or clauses with a minimal impact, and were therefore less important. These insights can be found in appendix N. An overview of these results in presented in table 7. Here the clauses or methods are displayed with the corresponding rankings per respondent in the same row. The clauses or methods are displayed from the highest average rank to the lowest average rank.

Table 7: Ranking of clauses or methods case study 1

	Rank numbers per respondent				
Clauses or methods	**RS1**	**RS2**	**RS3**	**RS4**	**Average**
Collaborative procurement	1	3	5	1	2.5
Good faith obligation	2	4	1	3	2.5
Removal of financial pressure	4	1	2	4	2.75
Early contractor involvement	3	2	7	8	5
Joint risk allocation	5	9	10	2	6.5
Joint problem or conflict resolution	7	6	8	5	6.5
Continuity	8	5	4	10	6.75
Communications	6	10	3	9	7
Continuous process reflection	9	7	9	6	7.75
Programme and planning	10	8	11	7	9
Joint project team	11	12	6	12	10.25
Optimization incentive	12	11	12	11	11.5

This overview provides several insights. Insight that pop out are discussed here.

- **Consensus impactful methods –** What these results show is that there is a consensus among the interviewees that collaborative procurement, good faith obligation and removal of financial pressure were important in the case and that these methods and clauses have contributed to the positive relation and good collaboration within the case. This places extra emphasis on these methods and clauses as it is more likely that these can have a positive influence in the Dutch construction sector.
- **Consensus low impact methods –** These results also shows that there is a consensus among the interviewees that the optimization incentive did not stimulate the relation or collaboration in the case. This corresponds with the negative linkage that is found between the optimization incentive and mutual objectives in this case. Furthermore, three of the four interviewees found that having a joint project team or a clear programme and planning have had little influence on the relation and collaboration in the case.
- **Dissension on impact level –** Another interesting point that follows from the results is that two interviewees stated that joint risk allocation had a positive influence on the relation and collaboration in the case and the two other interviewees stated that it had little influence on these aspects. What this shows is that the experience that follows from these methods differs for each individual. Therefore, these results are only meant to give an insight in what potentially can work to stimulate the relation or collaboration and is by no means a conclusion that is guaranteed to work in every project or situation.

4.5 Case 2 – Soil improvement project

The case soil improvement is part of a larger project in the city of Gouda. The project concerns the development of a new residential area. The total area of the new residential area is 45 hectares on which around 4000 homes will be built. Next to this, it includes a large pond, nature and recreation area, own shopping centre and many other facilities. This case concerns the soil improvements necessary for the second phase of the overall project. Figure 17 shows the execution of the soil improvement.


Figure 17: Execution soil improvement (Geonius, 2017)

Because there is a lot of peat in the ground at the project location it is required to improve the soil conditions before the construction of buildings and roads can take place. In total 15 hectares of soil need to be developed in this phase. This soil improvement includes the applying of a substantial sand package that will remain for a long period in order to densify the ground. The soil must be made available in separate phases to install pipelines for the sewage system and several cables.

The client in this project consists of three parties. These parties outsourced their client role to third parties. The contractor is responsible for the soil improvements and has the option to do more work in other phases if the work is done to the satisfaction of the client.

To get an insight in the case study semi-structured interviews are conducted with the following people with between brackets the abbreviation RS[x] (responded) is used to address them in de remainder of this case study:

- Respondent 5 (RS5) – technical- and surroundings manager for the client;
- Respondent 6 (RS6) – contract manager for the client;
- Respondent 7 (RS7) – contract manager contractor;
- Respondent 8 (RS8) – technical manager contractor.

These persons are interviewed because they formed the project management team and together oversaw and steered the project and its process in accordance with the used methodology elaborated in chapter 4.1. These people referred to each other when asked who else would be interesting to interview for this research. When the author stated that these people would be interviewed the interviewee's stated that these people were the right to interview. These persons formed the core project team and actively participated in the process. Therefore, these persons could provide the author with a good insight in the project and the process within the project.

4.5.1 Identified connections case study 2

In this paragraph, the case-study findings are presented. The raw data can be found in appendix I. To use the data, it analysed and interpreted (appendix L). In the analysis, factors of collaboration are connected to the statements made by the respondents. By doing so an

overview of methods that can potentially positively influence specific collaborative factor can be made. This overview shows how a method or clause can have a positive influence on collaboration. This overview is presented in table 8.

Table 8: Findings case study 2 (N=4)

Factors stimulating collaboration / NEC4 ECC & Project DOEN Methods and clauses	Mutual objectives	Gain and pain sharing	Trust	No-blame culture	Joint working	Communication	Joint problem solving	Fair risk allocation	Effective performance measurement	Continuous learning
Early contractor involvement (N)(D)	100%	25%	75%	75%	100%	75%	100%	25%		25%
Optimization incentive (D) & CS (N) & WLC (N) & CP (N) & BEC (N)	75%	50%	100%	25%	25%	25%	25%	25%	25%	
Joint risk allocation (D) & Compensation events (N)	25%		25%	50%	75%	100%	75%	100%		
Joint problem or conflict resolution (D) & EW & RD (W3) (N)	25%		50%	100%	100%	100%	100%			
Good faith obligation (N)	25%		25%	75%	75%	100%				25%
Communications (N)			25%	100%	50%	100%	100%		75%	
Programme and planning (N)	50%		50%	50%	50%	100%	25%		100%	
Collaborative procurement (D)	25%		50%		100%	50%	75%	25%		
Removal of financial pressure (D)	25%			75%	25%	25%	25%	25%		25%
Joint project team (D)					75%	100%	100%			
Continuous process reflection (D)			25%	100%	50%	100%	75%			50%
Continuity (D)			100%		25%	100%				

CS: Contractors share, WLC: Whole life costs, CP: Contractor proposals, BEC: Bonus for early completion, EW: Early Warning, RD: Resolving disputes

4.5.2 Impact ranking case study 2

Next to the semi-structured interview, the interviewees were asked to rank the methods and clauses from methods or clauses that had a high impact on the collaboration in the project and were therefore most important in their project to methods or clauses with a minimal impact, and were therefore less important. These insights can be found in appendix O. An overview of these results in presented in table 9. Here the clauses or methods are displayed with the corresponding rankings per respondent in the same row. The clauses or methods are displayed from the highest average rank to the lowest average rank.

Table 9: Ranking of clauses or methods case study 2

	Rank numbers per respondent				
Clauses or methods	**RS5**	**RS6**	**RS7**	**RS8**	**Average**
Joint problem or conflict resolution	4	4	1	1	2.5
Joint risk allocation	1	3	2	9	3.75
Continuous process reflection	5	6	4	2	4.25
Communications	8	2	5	3	4.5
Continuity	2	7	9	4	5.5
Programme and planning	6	5	6	7	6
Good faith obligation	3	1	11	12	6.75
Optimization incentive	7	8	7	6	7
Removal of financial pressure	10	11	3	5	7.25
Joint project team	11	12	8	8	9.75
Collaborative procurement	9	10	12	10	10.25
Early contractor involvement	12	9	10	11	10.5

This overview provides several insights. Insight that pop out are discussed here.

- **Consensus impactful methods –** the result show that the respondents are in consensus about the impact of the top three methods. This indicates that these methods can have a great impact on the project and therefore can influence collaboration in a positive way effectively. There is one exception on this consensus of the top three methods. This exception is in the method joint risk allocation. Here one contractor placed the method on place 9 in contrast to place 1, 3 and 2 of the other respondents. This big difference indicates that the contractor either did not experience the impact of the method or misinterpreted the content of the method. Because this difference is this large and the other contractor did state the impact of the method is this difference not further investigated. It is likely that there was some sort of misinterpretation or different experience of the method.
- **Consensus low impact methods –** the data also shows consensus about methods that had the least impact on collaboration in the project. The bottom three methods show a consensus among the respondents that these methods had little impact. Interesting is that the respondents state that these three methods do have connections with many factors of collaboration as can be seen in table 8. This seems like a contradiction. However, this can be explained by the fact that none of these three methods were used in the project. Therefore the impact of the methods would be hard to estimate for the respondents or the respondents did believed that these methods were not appropriate for this case and as a result obtained a low score. This indicates that even when a method does have many potential to positively influence collaboration it does not mean that this method suits every project.
- **Dissension on impact level –** the results show that there are two clear differences regarding the impact of the methods between the client and contractor respondents. These big differences show in the methods good faith obligation and removal of financial pressure. The good faith obligation method is given a high impact score by the client and a low score by the contractors, for the removal of financial pressure method this is vice versa. It is interesting that the clients and contractors think very differently about the impact of these methods. For the good faith obligation it can be explained that the clients want to focus on setting a good basis for collaboration to

ensure that they can trust the contractor to successfully conduct the works. The contractor might think this is to 'soft' and simply wants to get to work as soon as possible. For the removal of financial pressure it can be the case the for the contractors this is very beneficial to do as they no longer have to take on large risks. For the client this can mean that the project can turn out to be more expensive or that the competition on price between contractors disappears and is therefore hesitant to use this method. These two examples show a difference in interests and the importance to gain an understanding of what the other party finds important.

4.6 Case 3 – Construction of a viaduct

Case 3 concerns the construction of a viaduct in Rotterdam. Due to increased traffic intensity in the area, there is the need to transfer the single level intersection into an overpass that can cope with the increasing traffic density. The goal is to create a future-proof route to the container terminals in the port of Rotterdam. To do so, the following works are conducted:

- The single level intersection will be replaced with an overpass by means of a viaduct;
- The primary access road will be extended from a 1-lane road to a 2-lane road and an emergency lane in both directions over a length of approximately 5 kilometers;
- The current intersection will be removed.

The scope of the project consist of the designing and realisation of two viaducts over the existing road, rail tracks and the to-be build Exchange Route. The works will be executed in phases. To add to the complexity, the existing road may not be closed off and construction above the rail tracks may only be done during periods the tracks are put out of service because the access road and rail tracks are used around the clock to keep the container terminals operational. Furthermore, the works must meet the architectonical vision of the area, meaning that the works must be of high quality and fit within the landscape. Therefore, quality and design have high priority in the project. An impression of the viaduct is displayed in figure 18.

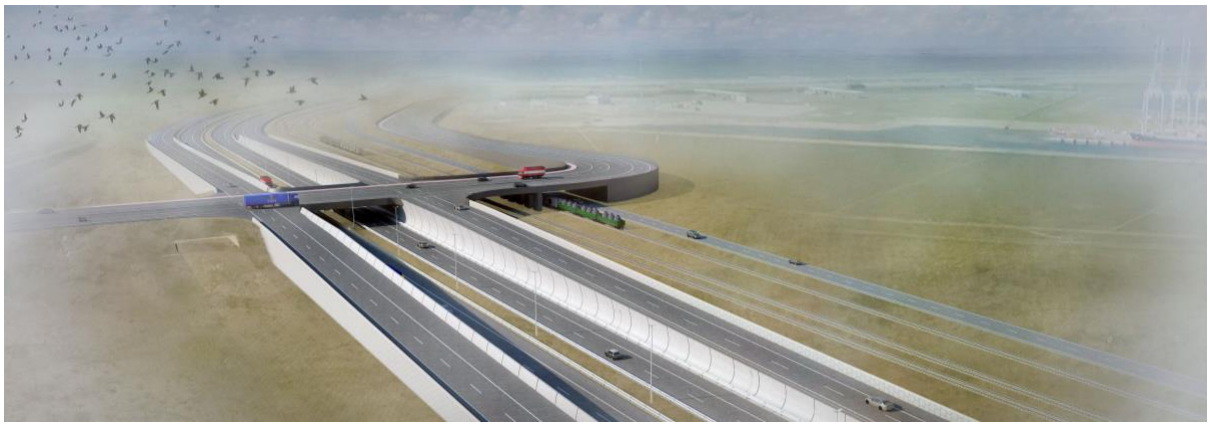

Figure 18: Design of the viaduct (Port of Rotterdam, 2016)

To get an insight in the case study semi-structured interviews are conducted with the following people with between brackets the abbreviation RS[x] (responded) is used to address them in de remainder of this case study:

- Respondent 9 (RS9) – contract manager for the client;
- Respondent 10 (RS10) – contract manager for the contractor.

Only these two persons are interviewed because they together formed the daily project team and were responsible for the process in the project. These people referred to each other when asked who else would be interesting to interview for this research. When the author stated that these people would be interviewed the interviewee stated that these two people were the right to interview.

4.6.1 Identified connections case study 3

In this paragraph, the case-study findings are presented. The raw data can be found in appendix J. To use the data, it analysed and interpreted (appendix M). In the analysis, factors of collaboration are connected to the statements made by the respondents. By doing so an overview of methods that can potentially positively influence specific collaborative factor can be made. This overview shows how a method or clause can have a positive influence on collaboration. This overview is presented in table 10.

Table 10: Findings case study 3 (N=2)

Factors stimulating collaboration / NEC4 ECC & Project DOEN Methods and clauses	Mutual objectives	Gain and pain sharing	Trust	No-blame culture	Joint working	Communication	Joint problem solving	Fair risk allocation	Effective performance measurement	Continuous learning
Early contractor involvement (N)(D)			50%		100%		100%	50%		
Optimization incentive (D) & CS (N) & WLC (N) & CP (N) & BEC (N)	50%		50%		50%	50%				
Joint risk allocation (D) & Compensation events (N)					100%	100%	50%	100%		
Joint problem or conflict resolution (D) & EW & RD (W3) (N)	100%	50%	50%	100%	100%	100%	100%			
Good faith obligation (N)	50%			100%	100%	100%	50%			
Communications (N)	50%		100%	100%	100%	100%	100%		100%	
Programme and planning (N)					100%	100%	100%		100%	
Collaborative procurement (D)	100%		100%	100%	100%	50%	50%	50%		
Removal of financial pressure (D)				50%	100%		100%	50%		
Joint project team (D)			50%	50%	50%	100%				
Continuous process reflection (D)				100%		100%	50%		100%	100%
Continuity (D)			100%	100%		50%	50%			

CS: Contractors share, WLC: Whole life costs, CP: Contractor proposals, BEC: Bonus for early completion, EW: Early Warning, RD: Resolving disputes

4.6.2 Impact ranking case study 3

Next to the semi-structured interview, the interviewees were asked to rank the methods and clauses from methods or clauses that had a high impact on collaboration in the project and were therefore most important in their project to methods or clauses with a minimal impact, and were therefore less important. These insights can be found in appendix P. An overview of these results in presented in table 11. Here the clauses or methods are displayed with the corresponding rankings per respondent in the same row. The clauses or methods are displayed from the highest average rank to the lowest average rank.

Table 11: Ranking of clauses or methods case study 3

	Rank numbers per respondent		
Clauses or methods	**RS9**	**RS10**	**Average**
Joint problem or conflict resolution	4	1	2.5
Good faith obligation	3	3	3
Continuity	9	2	5.5
Continuous process reflection	5	6	5.5
Removal of financial pressure	2	9	5.5
Joint risk allocation	1	11	6
Collaborative procurement	8	5	6.5
Communications	7	8	7.5
Joint project team	12	4	8
Programme and planning	6	10	8
Optimization incentive	11	7	9
Early contractor involvement	10	12	11

This overview provides several insights. Insight that pop out are discussed here.

- **Consensus impactful methods –** What this shows is that there is a consensus among the interviewees that joint problem solving and the good faith obligation are methods that can be beneficial for a good collaboration. They shows from the fact that both client and contractor placed this method high in their ranking. This places extra emphasis on these two methods of collaboration because these methods are likely to have a large impact on collaboration.
- **Consensus low impact methods –** From the result is also follows that the interviewees agree that in the context of their project early contractor involvement has a low impact on collaboration. This shows from the fact that both the client and the contractor placed these on low in their ranking. Placed in the context of this project it can be explained why the respondents stated this low impact. The respondents explained that this project is in a low-risk area and that it is a relative standard project. Therefore no complex issues had to be solved in the early phases of the project. This context is likely the reason why they stated that the impact of this method would be small in this case.
- **Dissension on impact level –** What is interesting from these results is that, besides the three methods mentioned above, there is little consensus between the interviewees about what is important for good collaboration. This shows from the differences in rankings of the methods. Examples of this are the methods joint project team or joint project allocation. In these two methods the differences in ranking are very large. This

shows that client and contractor have a different perception of what they think is important for good collaboration. This is particularly interesting because in this case both client and contractor placed emphasis on collaboration but still the two parties were not able to collaborate successfully. Therefore it might be the case that there is a relation between having the same idea about collaboration and having a successful collaboration.

5. Cross-case analysis

In this chapter, the findings from the three cases will be merged, analysed and interpreted. This will be done for both the identified connections and the found rankings of methods. First the found connections will be discussed, thereafter the found rankings of the method and finally an overall conclusion is presented.

To analyse and interpret the joint results of the three cases table 6, 8 and 10 are merged into one table. The process of merging is elaborated in appendix Q. The merged table is shown in table 12. The percentage in this table displays the average percentage of the three cases, a breakdown of the percentages can be found in appendix Q. The table shows what connections exist with a strength of at least 50%.

Table 12: Cross-case insight into the potential of NEC4 ECC and Project DOEN methods to stimulate collaboration

Factors stimulating collaboration / NEC4 ECC & Project DOEN Methods and clauses	Mutual objectives	Gain and pain sharing	Trust	No-blame culture	Joint working	Communication	Joint problem solving	Fair risk allocation	Effective performance measurement	Continuous learning
Early contractor involvement (N)(D)	67%		75%	58%	100%	58%	100%			
Optimization incentive (D) & CS (N) & WLC (N) & CP (N) & BEC (N)			50%							
Joint risk allocation (D) & Compensation events (N)					75%	92%	58%	92%		
Joint problem or conflict resolution (D) & EW & RD (W3) (N)	58%		58%	92%	92%	100%	100%			
Good faith obligation (N)	50%			75%	67%	92%				
Communications (N)			67%	83%	58%	100%	83%		83%	
Programme and planning (N)	50%				50%	100%	67%		100%	
Collaborative procurement (D)	75%		83%	67%	100%	67%	58%			
Removal of financial pressure (D)				67%	67%					
Joint project team (D)					75%	100%	67%			
Continuous process reflection (D)				92%		100%				67%
Continuity (D)			100%			67%				

CS: Contractors share, WLC: Whole life costs, CP: Contractor proposals, BEC: Bonus for early completion, EW: Early Warning, RD: Resolving disputes

Table 12 provides an insight into how each method can potentially influence collaboration. The connections found for each method are further elaborated in the next sub-chapter.

5.1 Interpretation cross-case results

To give meaning to table 13 the connections will be interpreted and analysed. First the found connections for each method are elaborated in paragraph 5.1.1. By identifying the similarities and differences in the statements conclusions are drawn regarding the expected potential of each method. After the elaboration on the connections for each method, four vertical axes are elaborated in paragraph 5.1.2. These axes are gain and pain sharing, fair risk allocation, effective performance measurement and continuous learning. In table 13, the interpreted and analysed data clusters are highlighted and numbered. The numbers correspond with the number of the paragraph in which the data cluster is analysed.

Table 13: Interpreted an elaborated data clusters per method or axis (numbered)

Factors stimulating collaboration / NEC4 ECC & Project DOEN clauses/methods	Mutual objectives	Gain and pain sharing (13)	Trust	No-blame culture	Joint working	Communication	Joint problem solving	Fair risk allocation (14)	Effective performance measurement (15)	Continuous learning (16)
Early contractor involvement (N)(D) (1)	67%		75%	58%	100%	58%	100%			
Optimization incentive (D) & CS (N) & WLC (N) & CP (N) & BEC (N) (2)			50%							
Joint risk allocation (D) & Compensation events (N) (3)					75%	92%	58%	92%		
Joint problem or conflict resolution (D) & EW & RD (W3) (N) (4)	58%		58%	92%	92%	100%	100%			
Good faith obligation (N) (5)	50%			75%	67%	92%				
Communications (N) (6)			67%	83%	58%	100%	83%		83%	
Programme and planning (N) (7)	50%				50%	100%	67%		100%	
Collaborative procurement (D) (8)	75%		83%	67%	100%	67%	58%			
Removal of financial pressure (D) (9)				67%	67%					
Joint project team (D) (10)					75%	100%	67%			
Continuous process reflection (D) (11)				92%		100%				67%
Continuity (D) (12)			100%			67%				

CS: Contractors share, WLC: Whole life costs, CP: Contractor proposals, BEC: Bonus for early completion, EW: Early Warning, RD: Resolving disputes

5.1.1 Interpretation and analysis of the cross-case results per method or clause

In this paragraph each method or clause will be elaborated and interpreted. This entails includes numbers 1 to 12 from table 13. For each method or clause the statements are analysed and similarities and differences are elaborated. Based on the interpretation of these statements conclusions are drawn.

1. Early contractor involvement

In all three cases, the respondents stated that this method has multiple connections with factors of collaboration, meaning that this method could potentially influence collaboration in several ways. Interesting is that most of the benefits are stated in the two cases that used this method, case 1 and 2. In case 3, fewer benefits are stated by the respondents.

Some benefits are stated in all three cases. These are that the method has a positive influence on joint working and joint problem solving. The respondents stated highly similar that the method caused the parties to work together from the start of the project enabling them to think about a suitable solution jointly. By doing so they were able to optimise, create win-win situations and create a best for project solutions (statement 1, 2, 3, 7, 11, 12, 18, 19, 135, 137, 139, 141, 144, 239, 243). The similarity in which these benefits are stated is striking. Due to this high similarity across all three cases, it is likely that these benefits exists and that this method thus has this positive influence on joint working and joint problem solving.

In case 1 and case 2, in which this method was used, the respondents stated that this method has additional benefits to the ones stated above. They state that the method enabled them to set mutual goals (statement 2, 6, 8, 10, 12, 13, 14, 16, 19, 21, 22, 135, 137, 141, 144), form a real team (statement 2, 10, 12, 15 138, 142), develop trust among the teams (statement 1, 2, 12, 20, 138, 142, 143), gain understanding of the other party (statement 8, 12, 20, 139, 142, 143 144) and have effective communication (statement 2, 8, 12, 19, 22, 135, 138, 140). These benefits might only come to light when the method is used and are unknown for people who did not use the method.

Finally, from both literature and the Project DOEN interviews it followed that the same connections presented in table 13 are likely to exist (appendix E and F). Hence, a primary conclusion can be drafted that early contractor is likely to have a positive influence on several aspects of collaboration.

2. Optimization incentive

No positive connections with factors of collaboration are found for this method. Only one negative connection is found with trust. The contractors in case 2 and case 3 state that mainly fines show distrust towards the contractor (statement 151, 154, 245). In all cases, it is stated that an optimization incentive is not needed when the parties fully work together on the project (statement 23, 26, 147, 150, 245). Also, it is stated that by incentivising optimization on the planning often less attention is placed on the quality, therefore the use of incentives can be dangerous (24, 27, 150, 154).

These three categories of negative comments suggest that the method does not positively influence collaboration. Some positive connections were found, these were however stated

anecdotical. Therefore, no conclusion can be drawn from them. In short, this method will likely not positively influence collaboration and should therefore not be used to do so.

3. Joint risk allocation & compensation events

Four connections are found with this method, with the strongest for communication (92%) and fair risk allocation (92%). The last will be elaborated separately in paragraph 14 , as explained in the introduction of this chapter. Next to this, the method has connections with joint working (75%) and joint problem solving (58%).

It is stated with great similarity that this method enabled the parties to discuss the risks jointly (statement 29, 31, 33, 155, 156, 157, 161, 247, 249). Next to this, it stimulated joint working by enabling the joint making of the control measures for the risks. Due to this appropriate control measures could be created (statement 29, 30, 31, 32, 35, 157, 159, 161, 248, 249). This shows that the method both opened the discussion about risk allocation and it helped to create effective control measures by working together and tackling the problems together.

It can be concluded that joint risk allocation & compensation events causes both a fair risk allocation (elaborated as number 14) and effective control measures for these risks. This is beneficial for the relationship between the client and contractor as both feel treated fairly and conflicts about the risks can be avoided.

4. Joint problem or conflict resolution

This method is interesting because of its high potential to positively influence collaboration. It has four strong relations with factors of collaboration, no-blame culture (92%), joint working (92%), communication (100%) and joint problems solving (100%). Also connections are found with mutual objectives (58%) and trust (58%). The connection with joint problem solving is a logical connection because it is a synonym of the method. This means that when using this method, automatically one factor of collaboration is stimulated. The connections with joint working and communication also follow logically from this method. After all, joint problem resolution implies that the parties work together and it opens the discussion about these problems. This means that when this method is used properly almost automatically three factors of collaboration are stimulated.

Furthermore, the data shows that no-blame culture, trust and mutual objectives are likely to be stimulated. From all three cases, it followed that this method enabled them to better understand the problem of the other (statement 41, 42, 44, 45, 48, 49, 163, 168, 171, 250, 254). As a result, there was a no blame-culture between the parties. Instead, the parties tried to help each other overcome the problem. Due to the joint solving of problems trust was formed among the teams (statement 45, 165, 167, 173, 250). From the literature and Project DOEN interviews followed these same positive connections with collaboration as found in these cases (appendix E and F). The consensus about the benefits of this method both between the cases and the literature, and the strong connections with multiple methods indicate that joint problem or conflict resolution is a method that can have a positive impact on collaboration.

5. Good faith obligation

This method is interesting because in the literature study the question arose if this method has extra value compared to the similar to the Dutch 'redelijkheid en billijkheid' method. The key difference is that by use of this method the parties explicitly state how they want to collaborate and discuss this. The Dutch method is on the other hand part of the Dutch Civil Code and therefore it always applies automatically. In the literature study, the question arose if this method added value next to this Dutch method. Chao (2017) and Cheung L. (2015) argued that it might as it places extra emphasis on collaboration.

From the case study it followed that this method can positively influence collaboration, mostly by facilitating a no-blame culture and effective communication. In all three cases both the clients and the contractors mentioned highly similar that this method opened the discussion about collaboration (statement 51, 52, 53, 174, 175, 176, 178, 179, 180, 256, 257, 259) due to which a mutual understanding about collaboration was formed (statement 51, 52, 53, 174, 175, 176, 180, 256, 257, 258, 259). As a result of this better understanding, a process that suited both client and contractor could be created (statement 53, 175, 180, 256, 258), and a basis for good communication and collaboration was formed (statement 52, 176, 178, 180, 256, 257, 259). Across all three cases there is a consensus about what benefits this method brings and that this method does have extra benefits next to the Dutch 'redelijkheid en billijkheid' method. The great similarity in responses strengthens the likelihood of that these benefits occur in other projects as well.

Concluding, it can be said that this method does have extra benefits when used next to the Dutch 'redelijkheid en billijkheid' method. It is found that the method can influence collaboration in several ways, but mainly focusses on creating understanding among the teams and thereby form a basis for collaboration. Therefore, it is recommended to use the method; the needed input for the method is minimal and only at the start of the project and the output can have a positive influence on the entire project.

6. Communications

Given the overlap of the nature of the communications method and the communication factor of collaboration a 100% score could be expected on this connection. Therefore, this connection is not further elaboration. Other strong connections are with no-blame culture, joint problems solving and effective performance measurement, all 83%. The latest is elaborated separately in paragraph 15 , as explained in the introduction of this chapter.

From the case studies it followed that this method enabled the parties to better understand each other (statement 59, 61, 63, 182, 188, 189, 193, 260, 261, 263, 266), due to which they knew what to expect from each other (statement 56, 59, 188, 261, 266). Due to this clarity trust was formed between the teams (statement 57, 59, 61, 189, 264, 267). Continuous, open and honest communication also enabled them to solve problems effectively in a best-for-project way by creating solutions that suited both parties (statement 64, 69, 183, 188, 193, 196, 260, 263, 267, 268). These positive effects are stated with great similarity among the cases. This strengthens the likelihood that these benefits occur in other projects as well. Next to this, it is stated that the method prevents opportunistic behaviour (statement 54) and that it is the key to good collaboration (statement 260). This further indicates that the method has great potential to influence collaboration positively.

It can be concluded that having a good communication structure can positively influence collaboration is several ways, other than communication itself. The method not only enables better problem solving, but also creates understanding and trust among the teams.

7. Programme and planning

The programme and planning method has two 100% connections, which indicates that the method is likely to stimulate collaboration positively. These connections are with communication and effective performance measurement. The latest is discussed separately is paragraph 15, as explained in the introduction of this chapter. Next to these 100% connections, the method has connections with joint working, joint problems solving and mutual objectives.

The respondents across the three cases stated similarly that the method is a clear and effective communication tool (statement 70, 73, 76, 201, 202, 205, 206, 207, 271, 273). It enabled to parties to clearly communicate about the status of the project. Because of this they could identify and solve problems quickly and effectively in a joint way (statement 70, 74, 76, 200, 202, 206, 271, 272, 274). Because of this clear insight and joint problem identification, solutions could be created that were is best interests of the mutual objectives (statement 70, 72, 200, 202, 206, 274). What this shows is that the programme and planning method is not only a communication tool, but it can also help to identify problems and solve these together. Due to this potential, the method can be very beneficial to collaboration.

8. Collaborative procurement

This method is barely used in The Netherlands because it is recently developed. Because of this, it is interesting to see what the potential benefits for collaboration of this method are. In Project DOEN this method brought benefits in multiple aspects of collaboration. In the cross-case comparison, similar connections are found. The strongest connections are found with mutual objectives, trust and joint working.

This method is used in one case, case 1. Interesting is that in this case more connections are found and the connections are stronger, mostly 100%. What became clear from the statements in case 1, is that it resulted in a process that could be optimised in best interest of both parties resulting in win-win situations (statement 78, 79, 83, 87, 91, 93, 94, 95, 96). Due to the intensive and joint early stages of the project trust was formed among the teams (statement 80, 84, 90, 94), mutual understanding was gained (statement 86, 89, 93) and a basis for good collaboration was set (statement 82, 84, 85, 90, 92). In the other two cases some of the respondents state a similar potential. Even though the method is not used in these cases it is stated that the method could cause the creation of mutual goals (statement 210, 277) and trust (statement 210, 212, 213, 214, 276, 279). It also could facilitate joint problem solving (statement 213, 215, 216, 279, 280) and provide a basis for good collaboration (statement 210, 214, 215, 216, 275, 276, 277, 280).

The statements of all three cases show that the respondents, regardless of whether they used the method or not, do believe the method can create a basis for good collaboration and trust. It also indicates that due to this method the parties can solve problems together in the earliest stages of the project and create an optimal process. By doing so, win-win situations can be

created. From this a conclusion can be drawn that collaborative procurement has benefits for collaboration. However, due to the limited use of the method is uncertain what the exact extend of these benefits will be.

9. Removal of financial pressure

This method had a great impact on Project DOEN and was seen as necessary for successful collaboration. In Project DOEN it was found that the method prevents distrust and conflict, and causes a pleasant working atmosphere due to which the parties can work together, as can be seen in appendix F. Interestingly, few strong connections are found for this method in the case studies. The strongest connections found are with a no-blame culture (67%) which correlates with the 'pleasant working atmosphere' described in Project DOEN and joint working (67%) which is similar to the Project DOEN findings.

In the case in which this method is used, case 1, significantly more benefits of the method are mentioned. The benefits stated in this case are similar to the ones mentioned in the Project DOEN (appendix F). The respondents in this case state that due to the method conflicts could be reduced (statement 98, 99, 100), trust was formed (statement 98, 100, 103), a best-for-project solution was made (statement 98, 100) and that it enabled the parties to collaborate successfully (statement 102, 103, 104, 105). In the other two cases the respondents did not use the method and mostly benefits regarding better problem solving and avoiding unpleasant discussions about costs are mentioned.

The case studies together with the Project DOEN data show that the method can positively influence collaboration by creating a no-blame culture and facilitating joint working. The method might also have substantial benefits regarding trust, reduction of conflicts and successful collaboration, but because this method is new and barely used in The Netherlands its benefits are largely unknown in the sector.

10. Joint project team

This method is interesting because it requires a different approach to collaboration, instead of two teams there is one integrated team. Form the case studies it followed that the respondents were still hesitant to use this method and pervert two separate teams. In one case, case 1, this method was used at the beginning of the case. The respondents stated that this helped them to create mutual goals (statement 112, 118), team spirit (statement 110, 111, 113, 117) and set a basis for collaboration (statement 118). After the start-up phase, they chose to continue in two teams because the contractor was able to execute the project by itself and the client did not have the needed capacity available. They still had direct contact which allowed them to solve problems quickly and effectively.

In the other two cases, the clients stated that they preferred two separate teams with direct communication instead of one integrated team (statement 222, 223, 283). The contractors on the other hand state that a truly integrated team can result in better communication, problems solving and collaboration (statement 224, 225, 284, 285). This different perception shows, for at least these two cases, that the contractors are willing to have one integrated team and see the benefits of having one integrated team while the clients are hesitant and prefer two teams.

Concluding, the joint project team can bring benefits for collaboration. The respondents that did use the method acknowledge these benefits and the contractors from the other two cases see similar potential in the method. The clients that did not use the method are however hesitant. It might be the case that client organisations do not have the capacity for a joint project team or that this different approach to collaboration is still difficult to implement. Training and studies that show the potential of the method can help overcome this difficulty and thereby enable clients to exploit the potential of the method.

11. Continuous process reflection

This method can potentially bring benefits to collaboration without the need of a high (time and energy) investment by the parties. Reflection moments can be planned far ahead and there are many reflection methods available. From the case studies it followed that having continuous reflection can positively influence collaboration on three factors: no-blame culture, communication and continuous learning. The latest is elaborated separately in paragraph 16 because this is the only method that has a connection with continuous learning and is therefore particularly interesting.

Respondents from all three cases stated that due to this method they better understood each other and the problems of the other party (statement 123, 126, 127, 226, 230, 287, 289), could remove and prevent irritations (statement 124, 229, 231, 287), communicate effectively (statement 126, 231, 232, 286, 288) and tackle problems together (statement 127, 226, 230, 231, 232, 289). Overall it was beneficial for the collaboration in the projects (statement 123, 229, 232, 287, 288). This shows that all respondents experienced the benefits of this method similarly which strengthens the likelihood that these benefits will occur in other projects.

It can be concluded that this method will likely positively influence collaboration in several ways. The strong connections combined with the ease of implementation make this method an attractive option to implement in order to improve collaboration.

12. Continuity

From the comparison of the three cases, it followed that continuity has a strong connection (100%) with trust and communication (67%). Especially the connection with trust is interesting because it is the strongest identified connection with trust and trust is seen as an important aspect of collaboration. Furthermore, continuity is not a difficult method to implement, however sticking to the method can be troublesome.

The similarity of responses regarding the connection with trust is remarkable. All respondents state that this method is very important (statement 129, 130, 132, 133, 235, 238, 290) because it ensures that trust (129, 130, 132, 133, 235, 237, 238, 290, 292) and good communication (statement 132, 133, 234, 235, 237, 238, 293) between the team members stays within the project. This shows that even though this method does not necessarily create trust or good communication, it is of importance to keep trust and good communication within the project. The high similarity in statements indicates that the method is likely to have these benefits in other projects as well and that both clients and contractors are aware of this positive effect of continuity.

Even though the positive effects of continuity are broadly acknowledged, it is a difficult method to stick to. This is because projects often take a long period to complete and team members cannot be forced to stay on the project. The reality is that people sometimes leave the project. This does not mean that placing extra emphasis on continuity cannot have a positive effect. By placing extra emphasis on continuity a disturbance in continuity can be prevented as much as possible. Furthermore, by jointly searching for suitable new team members, team members can be found that fit well within the team. Due to this, it is likely that trust and good communication will (re)form quicker and that a disturbance in continuity has no high impact on the collaboration in the project.

5.1.2 Interpretation and analysis of the cross-case results from the vertical axes

In this paragraph four noteworthy axes of the "factor of collaboration" axis are elaborated separately. These are elaborated separately because none, one or two connections are found with the investigated methods per axis, suggesting that the methods and clauses hardly have influence on these factors.

13. Gain and pain sharing

No methods that positively stimulate this factor of collaboration are found in the case studies. From literature and Project DOEN interviews it followed that the optimization incentive and joint risk allocation method have a connection with this factor, as can be seen in appendix E and F. The fact that no strong connection was found in the cases similar to the literature based connections can be explained in three different ways:

- Gain and pain sharing has not been stimulated in all three cases and the respondents did not have experiences with stimulating it, resulting in no statements on this factor;
- The respondents did know how to stimulate the factor, but it comes with other downsides or risks that the parties are not willing to take;
- The examined methods did not stimulate this factor in the cases.

From the data, it cannot be said what the correct explanation is. Therefore, this research does not provide a conclusive advice on how to stimulate the factor.

14. Fair risk allocation

Interestingly only for one method a connection with fair risk allocation is found. Almost all respondents however stated this connection in the three cases (92%), the one respondent that did not state the connection was not involved in the risk allocation and therefore made no statement. It can thus be said that all respondents involved in the risk allocation stated that joint risk allocation stimulates a fair risk allocation.

The clients and contractors from all three cases state highly similar that due to the joint risk allocation method they were able to allocate risks in an open (statement 29, 31, 33, 156, 157, 247), clear (statement 28, 33, 156, 158, 247), best for project (statement 32, 33, 35, 156, 158) and fair (statement 31 ,32, 35, 158, 160, 161, 248, 249) way. Due to this process the parties could create better and more effective control measures for the risks (statement 29, 32, 33, 35, 156, 157, 159, 161, 249). This shows that the method can provide both a fair risk allocation and proper control measures for when the risks do occur.

Furthermore, from both the literature and the Project DOEN interviews it followed that a joint risk allocation stimulates a fair risk allocation, as can be seen in appendix E and F. Based on

this, combined with the findings in the case study, it can be concluded that when the parties allocate the risks jointly, it will likely result in a fair risk allocation with proper control measures. This benefits the collaboration as both parties feel treated fairly and risks can be dealt with openly and effectively.

15. Effective performance measurement

For the stimulants of this factor of collaboration, only two methods are identified in the case studies. These connections with these methods, communications and programme and planning, are strong, 83% and 100% respectively. This indicates that there is a high likelihood that these methods can positively influence effective performance measurement.

The respondents state similarly that the communications method enables effective performance measurement by having open and formal communication. This ensures that the entire team is up-to-date on the process of the different disciples. This resulted in a good insight of the status of the project (statement 56, 58, 69. 181, 186, 194, 197, 262). The same connection is found in literature (Wu G., 2013; Harmon, 2003). The similarity in results between literature and the case study indicates that having open and formal communication helps to measure the performance of the project effectively.

Regarding the programme and planning method, there is a deviation in the made statements. In case 1 and case 3 both the clients and contractors stated that by having a shared planning which they jointly updated everyone was up-to-date on the process (statement 70, 72, 74, 76, 272, 274). In case 2, they mainly mention a 'clear' planning, that has to be made by the contractor, enabled them to stay up-to-date on the process (statement 198, 204, 207). All respondents state the same benefits, but how these benefits are obtained varies. What this shows is that having at least a clear planning helps to stay up-to-date. Having a planning that is jointly updated can further enhance these benefits by enabling the parties to respond to events quickly. In literature, it was also found that having a joint planning that is continuously updated enables effective performance measurement (Hide, 2009; Barnes, 2002). This, together with the case study results, indicates that when the planning is used actively and jointly, effective performance measurement can be achieved.

16. Continuous learning

Only one connection between continuous learning and a researched method followed from the case study. This method is continuous process reflection. The respondents that stated this connection state similarly that by means of continuous reflection they better understood each other (statement 127, 226, 230, 287) due to which they learned were to place more emphasis in the project (statement 127, 286, 287) and how to smoothen out the process (statement 126, 226, 230, 287, 288).

This consensus shows that even though the connection is medium in strength (67%), the connection might exists. This is mainly because respondents from all three cases stated similar effects. It can be the case that the other respondents did not explicitly state the learning aspect of the method because it was not asked for by the interviewer. The clients that did not state the connection did mention that it solved irritations (statement 231, 232) and that it is beneficial for collaboration (statement 123). This shows that these respondents might also have experienced the learning aspects but did not mention it.

From Project DOEN it also followed that this method enabled them to better understand where improvement could be made and to learn from their own behaviour (Projectteam DOEN, 2017; PM2). Due to this similarity from both the three cases and Project DOEN it can be concluded that it is likely that this method can stimulate continuous learning.

5.2 Impact on collaboration per method

Next, the impact scores of the three cases are compared and analysed. The impact tables per case (table 7, 9 and 11) are merged to provide a cross-case insight into the impact of the methods. In this table, the impact scores of the clients and contractors for case 1 and 2 are combined into one average score. This means that for case 1 and 2 there is one score for the clients and one score for the contractors as can be seen in table 14. To illustrate, RS1/2 means that the scores in this column are the average scores of RS1 and RS2. By doing so each case has one client score and one contractor score. This is done to give the scores of each case a similar weight (1/6) in the overall cross-case average of the impact scores.

The methods in the table are ranked based on average cross-case impact score of the method from the lowest to the highest. The lower the number the higher the impact the method has on collaboration according to the respondents. Thus, the average highest impact method is on the first rank and the average lowest impact method on the last. This table is displayed in table 14.

Table 14: Merged method impact case 1-3

	Rank numbers per respondent						
	Case 1		Case 2		Case 3		
Clauses or methods	**RS1/2**	**RS3/4**	**RS5/6**	**RS7/8**	**RS9**	**RS10**	**Average**
Joint problem resolution	6,5	6,5	4	1	4	1	3,8
Good faith obligation	3	2	2	11,5	3	3	4,1
Removal of financial pressure	2,5	3	10,5	4	2	9	5,2
Joint risk allocation	7	6	2	5,5	1	11	5,4
Continuous process reflection	8	7,5	5,5	3	5	6	5,8
Continuity	6,5	7	4,5	6,5	9	2	5,9
Communications	8	6	5	4	7	8	6,3
Collaborative procurement	2	3	9,5	11	8	5	6,4
Programme and planning	9	9	5,5	6,5	6	10	7,7
Early contractor involvement	2,5	7,5	10,5	10,5	10	12	8,8
Optimization incentive	11,5	11,5	7,5	6,5	11	7	9,2
Joint project team	11,5	9	11,5	8	12	4	9,3

Table 14 provides an overview of the likely impact on collaboration per method. In the table it can be seen that joint problem solving, good faith obligation and removal of financial pressure have the highest impact on collaboration according to the cross-case result. Due to their high potential impact the scores per method are further interpreted below:

- **Joint problem resolution** – from the consensus among the respondents that this method can have a high impact on collaboration and the many connections this

method has with aspects of collaboration it can be concluded that this method is likely to have a high positive impact on collaboration.

- **Good faith obligation** – interestingly almost all respondents stated that this method can have a high impact on collaboration except for two contractors. This indicates that discussing collaboration upfront explicitly can have high impact on collaboration during the project. This is conform the findings from the statements of the respondents. From this, a conclusion can be drawn that this method is likely to have a high impact on collaboration and is therefore recommended to use.
- **Removal of financial pressure** – this method shows high impact scores over all three cases. This is interesting because this method was used in only one case (case 1). In this case, the method received a high impact score from both client and contractor. At the other two cases, there is a larger difference between the client and contractor respondents. In short, the potential of the method is recognised by the respondents that used the method and there is also some recognition by respondents that did not use the method. This shows that this method might have high impact because both respondents that used the method and respondents that did not use the method stated that it (would have) had high impact on collaboration in their case.

The optimization incentive and joint project team are at bottom of the table, meaning that the respondents think that these methods do not have a high impact on collaboration.. This is in line with the statements made by the respondents, as elaborated in chapter 5.1.1. This low impact score combined with the statements made about these method indicates that these methods are have little to no influence on collaboration.

Another interesting point that follows from these results in that there is a significant difference in the scores per method. This indicates that the respondents have a different view on what method can (potentially) have a high impact on collaboration and that the impact a method can have on collaboration varies per case. Each situation and each team is different. Therefore, must methods be chosen that suit the specific situation and team. Other insights that follow from the table are:

- **Collaborative procurement** – similar to the removal of financial pressure method, this method was used only in case 1. This method also received a high impact score in this case from both the clients and contracts, were in the other cases it did not. This indicates, similar to the findings based on the statements, that it can be that only the impact this method can have on collaboration only comes to light when the method is used. This method is new in the Dutch sector and many clients and contractors never used it. This can explain the great difference in scores. It can be that this method does have high impact on collaboration, but that this is not yet recognised in the sector.

- **Early contractor involvement** – this method only received a high impact score from the clients in case 1. This contradicts the findings from the statements where all respondents state that this method can positively influence collaboration in many ways. It might be that the respondents do believe that the method can influence collaboration in several ways but that the impact of doing so is limited in their project. It can thus be the case that the method can influence collaboration in several ways, but that it will not have an impact in every project.

- **Joint project team** –from the impact scores it followed that this method systematically receives a lower score by the clients. This conforms to the findings from the statements where most clients were still hesitant to use this method. This shows that the clients do not see much potential in this method, both how it influences collaboration and the impact of this influence. Therefore it can be stated that this method likely does not suit the Dutch sector from a client perspective or that client organisations currently have a limited understanding of this method.

5.3 Impact on collaboration per method by client and contractor views

To complete the analysis, it is taken one level deeper by separating the merged table (table 14) into two tables, one for the clients and one for the contractors. Similar to the merged table in these tables the methods are ranked from highest (potential) impact to the lowest (potential) impact. These tables are presented in table 15 and 16. These tables are placed next to each other and connections are drawn between them. This is done to gain insight into the difference in perspective on the impact of the method between clients and contractors. This can be helpful to align the visions of both parties as it shows what each party finds important. As is stated many times by the respondents it is important to gain an understanding of what the other party finds important in order to have successful collaboration. This insight aims to help create this understanding.

Table 15: Merged client impact scores case 1-3

Client respondents				
Case 1	Case 2	Case 3		
RS1/2	**RS5/6**	**RS9**	**Average**	**Clauses or methods**
3	2	3	2,7	Good faith obligation
7	2	1	3,3	Joint risk allocation
6,5	4	4	4,8	Joint problem resolution
2,5	10,5	2	5,0	Removal of financial pressure
8	5,5	5	6,2	Continuous process reflection
2	9,5	8	6,5	Collaborative procurement
8	5	7	6,7	Communications
6,5	4,5	9	6,7	Continuity
9	5,5	6	6,8	Programme and planning
2,5	10,5	10	7,7	Early contractor involvement
11,5	7,5	11	10,0	Optimization incentive
11,5	11,5	12	11,7	Joint project team

Table 16: Merged contractor impact scores case 1-3

	Contractor respondents			
	Case 1	Case 2	Case 3	
Clauses or methods	**RS3/4**	**RS7/8**	**RS10**	**Average**
Joint problem resolution	6,5	1	1	2,8
Continuity	7	6,5	2	5,2
Removal of financial pressure	3	4	9	5,3
Good faith obligation	2	11,5	3	5,5
Continuous process reflection	7,5	3	6	5,5
Communications	6	4	8	6,0
Collaborative procurement	3	11	5	6,3
Joint project team	9	8	4	7,0
Joint risk allocation	6	5,5	11	7,5
Optimization incentive	11,5	6,5	7	8,3
Programme and planning	9	6,5	10	8,5
Early contractor involvement	7,5	10,5	12	10,0

This analysis provides several insights. The green, blue and red lines show that there is a consensus among the clients and contractors about what methods have a high, medium and low impact respectively. A high score being the top 4, medium rank 5-8 and low the bottom 4. This shows that client and contractors do think similarly about the impact of most methods. Due to this similar perception, it is easier to implement the method because both client and contractor understand its potential impact on collaboration. Also, the methods connected with the green line are more likely to have a high impact in practice. This is because both the clients and the contractors state this. This increases the likelihood that these methods have a high impact on collaboration.

Difficulty can arise when either client or contractor wants to implement a method that is connected with a yellow line, being joint risk allocation, continuity and joint project team. This is because the clients and contractors have a different perception about the possible impact of these methods. It can cause irritations when one party wants to implement a method that this party sees as very important, but the other party neglects this request or

places less emphasis on it. This can be used to create a process that suits both parties due to an increased understanding among the parties. These differences indicated by the yellow lines are further explored below to obtain an understating if there is a logical explanation for this difference.

- **Joint risk allocation** – it is interesting that the clients believe that joint risk allocation can have a higher impact on collaboration than the contractors. There are several possible explanations for this:
  - For the clients, joint risk allocation gives them extra certainty about the risks. They know how the risks are allocated and more importantly what control measures are used. This gives them insight into the contractor's process due to which they believe a better collaboration can be developed;
  - The contractors see themselves as perfectly capable of making a risk allocation. They see little benefit in doing this jointly, as long as the risk allocation is fair they are satisfied. As a result, they score this method lower on its impact on collaboration;
  - Both among the clients and the contractors themselves, there is great difference in impact scores. This indicates that it is highly case depended if the method can have a high impact on collaboration. In more complex cases it might have a higher impact because the parties can tackle the problems together and develop a relationship by doing so, while in a less complex project it seems unnecessary to do so.

  These reasons are not mutually exclusive and thus more than one reason can be the explanation for this phenomenon. From the data, it cannot be said what the correct reason is. What can be said is that, overall, this method is likely to have a positive impact on collaboration. It is, however, case depended how high the impact of the method will be;

- **Continuity** – what can be seen in the data is that the difference in average impact between the clients and contractors is mainly caused by case 3. In this that there is a significant difference in score between client and contractor, 9 and 2 respectively. In the other two cases, the impact scores are more similar. It can thus be that this difference was case specific. Zooming in on this case, the client did state that continuity is "very important". It could, however, be the case that he believes that for this case it would not have a high impact because there were other more pressing problems regarding collaboration. The contractor disagrees, and stated that it would have had a high impact on collaboration. This can be explained because there were continuity problems on the client's side due to which the contractor encountered problems (slow decision making, poor communication). It is likely that the client and contractor thought differently about the root cause of their collaborative problems. Therefore, it can be said that this difference is case specific of nature. Based on the impact scores of the other cases and the statements made by the respondents it can be concluded that it is likely that continuity has a positive impact on collaboration. The impact difference discussed here is another clear example that methods always need to be implanted with due care; no case is the same and methods will always require tailoring to the case.

- **Joint project team** – like explained earlier the clients were hesitant about the use of a joint project team. This becomes even evident from the separated impact tables. Because almost all clients gave this method the lowest possible impact score, together with the statements made on this method, it can be concluded that the clients do not see potential in this method and thus that this method is not likely to have a positive impact on collaboration in the current Dutch marked.

5.4 Conclusion

The objective of this chapter is to answer sub-question 5:

Are there methods or clauses in the NEC4 ECC and Project DOEN that can positively influence collaboration in case studies using integrated contracts in Dutch construction sector and if so how do they do this?

The first part of this question regarding if there are methods in the NEC4 ECC and Project DOEN that can positively influence collaboration can be answered with a yes, several methods from both the NEC4 ECC and Project DOEN are identified that are highly likely to have a positive influence on collaboration. It is also found what factors of collaboration these methods are likely to influence and thus how these methods will likely influence collaboration. Next to this, the impact of these methods on collaboration is determined, both the total average impact and the average impact separated by client and contractor. These impact levels can strengthen or weaken the possible influence the method will likely have on collaboration. Based on the insights in table 13, 14, 15 and 16 the following is concluded:

- **Early contractor involvement** can have a positive influence on collaboration. This is because this method can result in the creation win-win situations, best for project solutions, mutual goals, developing trust, formation of a real team, development of an understanding among the teams and creation of effective communication. The expected impact of this method on collaboration is however low according to both clients and contractors. In case 1 the impact scores of the clients and contractors is higher than in the other cases. This suggests that the method can have a high impact but not in every project, meaning that the amount of impact is case depended. Because this cannot be tested no concluding remark can be made on the impact of the method, this can be investigated in future research;
- It is unlikely that the **optimisation incentive** method has a positive influence on collaboration. No positive connections with factors of collaboration are found and both the clients and contractors stated that the impact of the method on collaboration is low;
- **Joint risk allocation & compensation events** can have a positive influence on collaboration. It helps to create a fair risk allocation and it stimulates the parties to work together on the control measures. Due to this, effective control measures can be created. The impact of this method is seen as high by the clients, but low by the contractors. It is likely that this method will have a positive influence on collaboration, but that it is case depended. Alignment between client and contractor is needed to obtain the benefits this method can bring;
- **Joint problem or conflict resolution** can have a large positive impact on collaboration. It is found that due to the nature of this method it almost automatically stimulates three factors of collaboration, joint problem solving, joint working and

communication. The method can also help to form trust, a no-blame culture and mutual goals. Furthermore, the impact of this method on collaboration is identified as high; the contractors see this as the most impactful method. This shows that this method has great potential to have a positive impact on collaboration;

- **Good faith obligation** is likely to have additional benefits over the Dutch 'redelijkheid en billijkheid' method. The method opens the discussion about collaboration, resulting in mutual understanding, a better process and a basis for collaboration. Next to this, the method is regarded as most impactful on collaboration by the clients and also the contractors stated that this method has high impact. Meaning that not only does the method influence collaboration in several ways, this will likely also have a high impact on collaboration throughout the project;
- The **communications** method can positively influence collaboration is several ways, other than communication itself. The method not only enabled better problem solving, but also creates understanding and trust among the teams. The impact of the method is stated to be medium by both the clients and contractors, but it can still have a significant impact because good communication benefits other methods as well;
- The **programme and planning** method can be used as a clear communications tool. Due to this, all involved in the project have a clear insight into the project's process. This can help to identify problems and stimulate the joint solving of these problems. The impact of the method on collaboration is however low according to both the clients and contractors. This means that the method can bring these benefits, but that on itself the method will likely not have a high impact on collaboration;
- **Collaborative procurement** can positively influence collaboration by creating a basis for good collaboration and trust. Problems can be solved in the earliest stages of the project and a process can be formed that suits both client and contractor, resulting in the creation of win-win situations. The overall impact score of the method is medium, but in the case where the method is used it received high impact scores by both the client and the contractor. This indicates that only the full potential of the method to positively influence collaboration comes to light when the method is used. Overall, it is likely that the method will have a positive impact on collaboration;
- The **removal of financial pressure** method stimulates a no-blame culture and joint working. In one case the method is used. this case, benefits are found regarding the formation of trust, best-for-project solutions and the reduction of conflicts. This enabled them to collaborate successfully. In the other two cases, these benefits are not mentioned. Interestingly, the impact of this method is stated to be high by both clients and contractors. This shows that in all three cases the method could have had an impact, the respondents were however uncertain what this impact would be. This can be explained by the fact that this is a new method.
- It is unlikely that the **joint project team** method will stimulate collaboration. This is mainly because the clients prefer two separate teams and see little benefits in one joint team. Also, this method received the lowest impact score of all researched methods by the clients. From this, it is concluded that the joint project team method will not likely stimulate collaboration in the Dutch construction sector;
- **Continuous process reflection** is likely to stimulate collaboration positively. It does this by reducing irritations, creating understanding, and stimulating clear communication and continuous learning. By means of continuous learning learned were to place more emphasis in the project and how to smoothen out the process. Its

impact on collaboration is regarded to be high by both client and contractor. The combination of potential benefits and high impact imply that this method can have a positive impact on collaboration;

- The **continuity** method can be used to keep trust and good communication in the project. Both clients and contractors find this important. Emphasis should be placed on this method to prevent trust from leaving the project. The impact of doing so is likely substantial, but also case dependent. Both per case and per client or contractor there is a large difference in impact score. Therefore, no concluding statement can be made regarding the impact on collaboration.
- None of the researched methods stimulated the factor of collaboration **gain and pain sharing**. The data does not provide a clear answer on why no connection with this factor of collaboration is found. Therefore, it is concluded that none of the researched methods stimulate this factor. Why they do not do so remains uncertain.
- **Joint risk allocation** and **compensation events** method is the only method that can help create a fair risk allocation. By doing so, it has a positive influence on collaboration. There is disagreement between clients and contractors on the impact of this method on collaboration. The clients state it has a high impact and the contractors that it has a medium impact. Due to this the true impact cannot be determined, but it is clear that it does have a positive impact on collaboration;
- **Communication** and **programme and planning** are the only two methods that can stimulate effective performance measurement. For both methods, it is found that they effectively ensure that everyone is up-to-date at all times and thereby have a positive effect on collaboration.

Because of the qualitative nature of this research, these conclusions provide a potential insight into the possibilities of the methods and clauses. To strengthen these conclusions industry experts validate them in the next chapter.

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6. Expert validation

The conclusions drawn in chapter 5 are validated in this chapter by industry experts. The validation gives an insight into the validity of these conclusions. When for instance the experts on average agree with a conclusion, it increases the likelihood that the conclusion is true in practice. This process strengthens or weakens the conclusions as it indicates if the identified potential holds in projects that use integrated contracts in the Dutch construction sector according to industry experts.

6.1 Validation methodology

By transferring the conclusion of chapter 5 into statements the conclusions are validated. Per conclusion one to three statements are created. Each conclusion is about one method. The amount of created statements per conclusion is determined based on the amount of found connections between the method and the factors of collaboration. Each factor of analysis is translated into a statement. If a conclusion had multiple factors of analysis, multiple statements are drafted. Some connections are not taken into account in the validation process because the validation must not be to extensive, the industry experts only have limited amount of time available. Connections are excluded for the following reasons:

- The connection is more obvious of nature. Examples of this are the connections between joint problem or conflict resolution with joint problem solving and communications with communication. Due to the nature of these methods they automatically influence these factors of collaboration and therefore validation of these connection would be superfluous;
- The connection strongly correlates with another connection. An example of this is the connection between early contractor involvement and joint working. This connection is not validated because it correlates with the connection between early contractor involvement and joint problem solving. The latest is validated, and when accepted it is also likely that the connection with joint working exists;
- The connection does not embody the intention of the method and is a side-effect. What is meant by this is that for example for the removal of financial pressure only the connection with no-blame culture is tested and not the connection with joint working. This is because the method aims to create a no-blame culture and for doing so joint working is necessary. Therefore, this connection is a side-effect of the method.

By use of the methodology in total 25 connections are selected to be validated by the industry experts. Because these connections are separate units of analysis they are separately processed into statement, resulting in 25 statements.

In table 17 the statements used to validate the conclusions in chapter 5 are presented. In the first column of the table the method or clause to which the statement correlates is presented. In the second column the statement itself is stated in English. These statements are translations of the Dutch statements the respondents were presented. The original Dutch statements can be found in appendix R. In the third column the factor of collaboration the statement aims to validate for that method is placed.

Per statement one factor of collaboration is validated to prevent unclarity about which connection between the method or clause and a factor of collaboration is validated. Statement 19 regarding joint project team is an exception to this, here a sub-conclusion is validated that does not correspond with a factor of collaboration. This sub-conclusion is

validated because if it is true, it means that the method is likely not suitable for the Dutch sector. This undermines the other statements regarding this method.

Table 17: Statements used to validate connections in the expert validation

#	Method	Statement presented in the validation	Factor of collaboration the statement aims to validate
1.	Early contractor involvement	Early contractor involvement benefits collaboration because it stimulated the joint solving of problems.	Joint problem solving
2.	Early contractor involvement	Early contractor involvement benefits collaboration because it increases understanding due to the formation of trust among client and contractor.	Trust
3.	Optimization incentive	Optimization incentives does not have a positive impact on collaboration because it creates distrust between client and contractor.	Trust
4.	Joint risk allocation	Jointly allocating risks and forming control measures together benefits collaboration because is results in a fair risk allocation.	Fair risk allocation
5.	Joint risk allocation	Jointly allocating risks benefits collaboration because by doing so the parties are better able to create fitting control measures together.	Joint working
6.	Joint problem or conflict resolution	The joint solving of problems and conflicts has a positive impact on collaboration because it increase understanding about the problems of the other party.	No-blame culture
7.	Joint problem or conflict resolution	The joint solving of problems and conflicts has a positive impact on collaboration because it opens the discussion about these problems due to which to parties can solve the problems effectively.	Communications
8.	Joint problem or conflict resolution	By solving problems and conflict together trust forms between the teams. This has a positive influence on collaboration.	Trust
9.	Good faith obligation	This method benefits collaboration because the parties better understand each other due to which they can create a process that suits both.	No-blame culture
10.	Good faith obligation	Good faith obligation benefits collaboration because it opens the discussion about collaboration at the start of the project due to which the parties can discuss how they want to collaborate.	Communication
11.	Communications	Communications benefits collaboration because by effectively and timely communication all involved stay up-to-date on the progress of the project.	Effective performance measurement
12.	Communications	Communications benefits collaboration because it causes understanding for the problems of the other party because the parties are more aware of each other's progress and problems.	No-blame culture
13.	Programme and planning	This method positively influences collaboration because it provides a clear overview of the progress and (future) obstacles of the project.	Effective performance measurement

14.	Programme and planning	This method positively influences collaboration because it facilitates collaboration between the client and the contractor. Because the clause provides an insight into the status of the project it can be used as a communication tool due to which the parties can keep each other up-to-date.	Communication
15.	Collaborative procurement	This form of procurement benefits collaboration because trust can be formed during the procurement process by means of the intensive pre-trajectory.	Trust
16.	Collaborative procurement	By use of this form of procurement a contractor can be selected with whom the client can properly collaborate.	Joint working
17.	Collaborative procurement	This form of procurement benefits collaboration because it enables the creation of mutual goals which leads to the working on these mutual goals.	Mutual goals
18.	Removal of financial pressure	This method can have a great impact on collaboration because it reduces opportunistic behaviour.	No-blame culture
19.	Joint project team	This method does not bring benefits for collaboration in the Dutch construction sector. Clients do not benefit from this method or do not have the capacity/knowledge to use the method. working with two separate teams is works better.	Sub-conclusion based on statements made in the cases
20.	Joint project team	This method has a positive impact on collaboration because it creates a team spirit due to which the project becomes a shared project.	Joint working
21.	Joint project team	This method has a positive impact on collaboration because problems can be solved quicker and more effectively.	Joint problem solving
22.	Continuous process reflection	Having continuous process reflection benefits collaboration because it creates understanding about the problems of the other party.	No-blame culture
23.	Continuous process reflection	This method benefits collaboration because both parties can learn for the process thus far and based on these lessons learned adjust the process to improve it.	Continuous learning
24.	Continuity	Continuity in the project teams is important to keep trust relations within the project teams. This has a positive effect on collaboration.	Trust
25.	Continuity	Continuity in the project teams is important to keep direct communication lines within the project teams. This has a positive effect on collaboration.	Communication

These statements are presented to experts within Witteveen+Bos by means of an online survey. A respondent is regarded as an expert when he has at least 10 years of work experience with integrated contracts in the Netherlands. In the online survey, the statements are presented per method. Per section, first, the method is explained to give the respondent an idea what the method compromises. Next, one to three statements for the method are presented. Each statement contains one factor of analysis to ensure that there is no uncertainty about why the respondents agreed or disagreed with the statement. By use of a slider, the respondents can state to what extent they agree with the statement. This slider has a scale from 1 to 5 were 1 resembles fully disagree, and 5 resembles fully agree. The slider is displayed in figure 19.

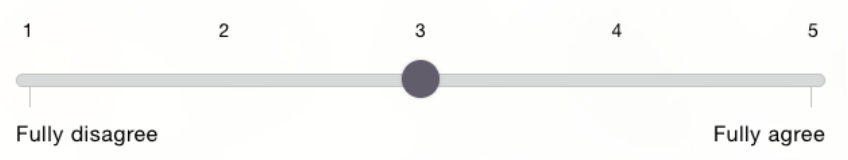

Figure 19: level of agreement slider used in the validation survey

Next to the slider, a text box is presented for each statement in which the respondents can give an elaboration on their level of agreement. Both the score based on the input with the slider and the elaboration on the score are used to give a final verdict if the statement is confirmed, rejected or that there is uncertainty regarding the validity of the statement.

6.2 Limitations of the validation

This validation comes with two main limitations:

- This validation is done using an online survey. Because of this, the author could not explain the method himself or directly react to the level of agreement of the experts. This limitation is overcome as much as possible by providing a clear explanation of each method to the experts and by giving the experts the possibility to explain and elaborate their level of agreement for each statement;
- All experts work at the same company, Witteveen+Bos. Due to this, it can be that all experts have the same angle of approach to this problem. To overcome this limitation as much as possible, experts based in different geographical locations and from different company divisions took part in the survey.

6.3 Validation results

Not all found connections in chapter 5 are validated by the use of statements. As explained above, only the core elements of the conclusion of each method is validated. For instance, for early contractor involvement, the connection with joint problem solving is validated with the use of a statement, and not the connections with joint working and communication. This is because joint problem solving is the strongest connection and joint problem solving implies that the parties also work together and communicate. To reduce the complexity of the validation and prevent confusion for the experts by stating highly similar questions, these similar connections are not validated separately.

The following scale is used for the interpretation of the level of agreement declared by the industry experts:

- 1.5 – 2.5, the experts disagree with the statement. The conclusion that correlates with the statement is disregarded unless there are strong indicators in the case study or literature to go against the judgement of the industry experts;
- 2.5 – 3.5, the experts are neutral on the statement, the conclusion that correlates with the statement can be based on the explanation given by the experts if this indicates strongly towards validated or rejected. Otherwise it is unclear if the connection is validated or not;
- 3.5 – 4.5, the experts agree with the statement. This strengthens the conclusion that correlates with the statement because the conclusion can be based on three sources, literature, case studies and industry experts.

This scale is used because it is a balanced distribution of the values from 1.5 to 4.5 over three equally sized brackets. The values 1-1.5 and 4.5-5 are disregarded in the creation of this scale. This is because the data is normally distributed. This means that the chance that the average of these values is in one of these 90% tails is low; the further the value is away from the central value (3) the more unlikely it is that the value exists. Therefore, these 90% tails are not taken into account in the creation of the scale brackets.

After the interpretation of the level of agreement, key takeout's from the explanation given by the experts to their score are presented. An explanation is a key takeout when it is mentioned by several experts in a highly similar way or when it provides clear conditions or restrictions to the method. These takeout's give a context to the score. The scores, the context and a conclusion statement per validated connection can be found in appendix S. Ten experts validated the statements, the average years of work experience of these experts is 14 years. Based on the data interpretation in appendix S a conclusion per validated connection is presented in table 18. Here per connection it is stated if the connection is confirmed, rejected or that it is unclear if the connection is validated.

Table 18: Validation results per investigated connection

Connection between method and factor of collaboration	**Conclusion**
Early contractor involvement – joint problem solving	**Confirmed**
Early contractor involvement – trust	**Confirmed**
Optimization incentive – distrust	**Rejected**
Joint risk allocation – fair risk allocation	**Confirmed**
Joint risk allocation – joint working	**Confirmed**
Joint problem or conflict resolution – no-blame culture	**Confirmed**
Joint problem or conflict resolution – communications	**Confirmed**
Joint problem or conflict resolution – trust	**Confirmed**
Good faith obligation – no-blame culture	**Unclear**
Good faith obligation – communication	**Confirmed**
Communications – effective performance measurement	**Unclear**
Communications – no-blame culture	**Rejected**
Programme and planning – effective performance measurement	**Confirmed**
Programme and planning – communication	**Unclear**
Collaborative procurement – trust	**Unclear**

Collaborative procurement – joint working	**Confirmed**
Collaborative procurement – mutual goals	**Confirmed**
Removal of financial pressure – no-blame culture	**Unclear**
Joint project team – unfit for Dutch construction sector	**Rejected**
Joint project team – joint working	**Confirmed**
Joint project team – joint problem solving	**Confirmed**
Continuous process reflection – no-blame culture	**Confirmed**
Continuous process reflection – continuous learning	**Confirmed**
Continuity – trust	**Confirmed**
Continuity – communication	**Unclear**

In total, of the 25 investigated connections in the validation process, 16 connections are confirmed, 3 connections are rejected, and for 6 connections it is unclear if they are validated due to doubt among the experts or a large difference in answers by the experts.

These results are combined with the conclusions from chapter 3 and 5. Based on these three sources, the literature study, the case study and the validation of the findings, the final conclusion of the research is drafted. The data from these three sources will be combined in the conclusion chapter to gain a total overview of the findings. Also, the risks and points of attention are taken into account to draft a complete answer to the research question. Based on the results recommendations are drafted for the Dutch construction sector.

7. Conclusions and recommendations

This chapter contains the conclusions of this research. Based on these conclusions, recommendations are drafted for the Dutch construction sector and future research. Finally, the research's validity, relevance and limitations are discussed.

7.1 Conclusions

The five sub-research questions are researched and discussed throughout the report. In this paragraph, the answers to these five sub-research questions are re-stated. By connecting the answers of the sub-research questions, an answer is drafted to the research question.

7.1.1 Conclusions to the sub-research questions

1. What does collaboration between client and contractor in integrated contracts entail?

Collaborative working is defined as working together of different organisations to effectively and efficiently accomplish a project (Xue et al., 2010). In the definition of Xue et al. (2010) "joint working" or "working together" means that the involved parties shall work with each other with a shared goal in mind, resulting in solutions that create benefits for all. Due to good collaboration, goals can be achieved that an organisation by itself would not be able to achieve (Lank, 2005). Furthermore, the sharing of knowledge can result in a reduction of errors, time delays and re-work (Rowlinson & Cheung, 2004).

Within integrated contracts, it is expected that the contractor takes a more active role when collaborating than the client who is more passive compared to the traditional contracts (Bruggeman et al., 2007, p. 143). This means that the contractor is responsible for the execution and quality of the works and the client has a controlling role (Chao-Duivis & Koning, 2015, p. 17). The most used integrated contract form in the Netherlands is the Design and Construct (D&C) contract (Rijkswaterstaat, 2008) for which the UAC-IC contract is often used in the Netherlands (Koning, 2013, p. 100). The purpose of the integrated contract is to reduce the number of interfaces and thereby poorly integrated sub-optimisations (Dorée, 2001). Several benefits can be obtained from collaboration in integrated contracts, such as a reduction of disputes and litigations and claims (Akintoye & Main, 2007). There is a general understanding that collaboration can cause better project results, it does, however, come with risks. The main risks are dependence on the other party (Anderson J., 2017) and deviation in goals (Patching, 1994). Furthermore, a failed collaboration attempt can hinder project success, collaboration should thus be done with due care (Merchant, 2011).

2. What is the current state of collaboration in integrated contracts in the Dutch construction sector and what problems occur in the sector?

The culture in the Dutch construction sector is mostly uncollaborative of nature, the needed change towards collaborative behaviour is still absent (Wisse & Arends, 2017; Koenen, 2015; Noorderhaven et al., 2006; Dronkers, 2016). The sector is faced with opportunistic or 'old' behaviour (O'Connor, 2009; Eriksson & Westerberg, 2011; Harmon, 2003). This entails behaviour by a contractor that is motivated to pursue its self-interest at the expense of the owner (Das & Rahman, 2010; Lu et al., 2016). The contractor is, however, not always to blame for this.

The problems that follow from this opportunistic or 'old' behaviour are more and more recognised in the Dutch construction sector. To counter this behaviour and to boost collaboration, the Marketvision 2016 has been drafted by major client and contractor organisations in the sector. The Marketvision does not contain concrete actions, but it clearly embodies the need for change towards a culture focused on more and intensive collaboration with effective communication and increased collaborative behaviour by both client and contractor organisations (Rijkwaterstaat et al., 2016). The Marketvision started a transition from the period of poor collaboration referred to as 'old behaviour' towards a new period of collaboration between clients and contractors. The desired culture change is however not completed. Currently, there is lack of trust, inequality, dishonesty, egocentricity and uncooperative behaviour among other problems in the Dutch construction sector (CROW, 2017).

3. Which factors can positively influence collaboration between client and contractor in integrated construction projects according to literature?

From literature, numerous factors that can cause an efficient and effective relationship based on collaboration are identified. Factors that are regarded as the most important for the enabling of good collaboration are summed up. The factors that can positively influence collaboration will be used in the exploration of the methods and clauses in the NEC4 ECC and Project DOEN. Methods or clauses that have the potential to influence one or more of these factors are likely to positively influence the overall collaboration in the project.

- **Mutual objectives** – it is vital for collaboration to develop mutual objectives and set aside self-interest (Xianhai, 2011);
- **Gain and pain sharing** – this process incentivises the parties to achieve the mutual project goals and effective collaboration (Bayliss et al., 2004);
- **Trust** – to obtain a good working relationship, and thereby good collaboration, trust among the parties is needed (Pinto et al., 2009);
- **No-blame culture** – when adopting a no-blame culture, an environment can be created in which the parties can effectively work together (Bennett & Peace, 2006);
- **Joint working** – joint working can increase collaboration by joint decision making based on mutual objectives (Chan et al., 2004) and by stimulating the joint effort to continuously improve (Larson, 1997);
- **Communication** – lack of effective communication is one of the main causes of collaborative failure in projects (Ng et al., 2002). Communication can result in an open exchange of information and a decrease of misunderstandings (Cheng et al., 2000);
- **Joint problem solving** – joint problem solving stimulates collaboration (Meng, 2012) and it can prevent large disputes (Ogunlana, 1999; Bennett & Jayes, 1995);
- **Fair risk allocation** – fair risk allocation can reduce the negative impact of the risks on the project performance (Rahman & Kumaraswamy, 2004b) and reduce disputes between the teams (Wang & Chou, 2003);
- **Effective performance measurement** – effective measurement of the project performance enables the teams to identify possibilities for improvement (Thomas & Thomas, 2005). Discussing findings jointly enlarges the changes of finding opportunities for process improvement (Cain, 2004);
- **Continuous learning** – By continuously learning, the parties can jointly identify which aspects are essential and need focus, and which aspects are irrelevant and should be

eliminated (Thomas & Thomas, 2005). This improves the chances of reaching the mutual objective of project success (Jones & O'Brien, 2003)

For these factors to positively influence collaboration, it is needed that the client and contractor are willing to invest in a collaborative relationship. Without the intent to collaborate, establishing collaboration is impossible (Caldwell et al., 2009; Kumaraswamy & Anvuur, 2008). To achieve successful collaboration and reach project success, a suitable and willing contractor and a pro-active attitude from the client is necessary (Eriksson & Westerberg, 2011).

4. What Project DOEN and NEC4 ECC methods and clauses can potentially improve collaboration and what are the possible drawbacks that come with these methods and clauses?

Multiple connections are found between NEC4 ECC clauses or Project DOEN methods with factors of collaboration. These connections show how each method or clause can have a positive influence on collaboration. These connections are presented in table 19. This table displays what factors of collaboration the method or clause can influence and thereby potentially improve the overall collaboration in the project.

In this table, the identified NEC4 ECC and Project DOEN methods and clauses that potentially can improve collaboration are displayed on the vertical axis. On the horizontal axis, the different factors that enable collaboration are placed. The ‘x’ represents a connection between a NEC4 ECC clause and a factor of collaboration and the ‘o’ represents a connection between a Project DOEN method and a factor of collaboration. Similar methods and clauses among the NEC4 ECC and Project DOEN are combined to reduce overlap in the research. The origin of each method is shown by the use of abbreviations (N) and (D) behind each method. The abbreviation (N) is placed behind clauses that come from the NEC4 ECC and (D) behind methods that come from Project DOEN.

Table 19: NEC4 ECC and Project DOEN methods and clauses that can potentially stimulate collaboration

Factors stimulating collaboration / NEC4 ECC & Project DOEN methods and clauses	Mutual objectives	Gain and pain sharing	Trust	No-blame culture	Joint working	Communication	Joint problem solving	Fair risk allocation	Effective performance measurement	Continuous learning
Early contractor involvement (N)(D)	x o		x o	x o	x o	x o	x o	x o		x o
Optimization incentive (D) & CS* (N) & WLC* (N) & CP* (N) & BEC* (N)	x o	x o	x							
Joint risk allocation (D) & Compensation events (N)	o	o	o	o	o	x o		x o		
Joint problem or conflict resolution (D) & EW* (N) & RD (W3)* (N)	x o		x	o	o	x o	x o		x o	
Good faith obligation (N)			x	x		x				
Communications (N)						x			x	
Programme and planning (N)						x	x		x	
Collaborative procurement (D)	o		o	o	o	o				o
Removal of financial pressure (D)	o		o	o	o					
Joint project team (D)	o				o	o	o			o
Continuous process reflection (D)				o		o			o	o
Continuity (D)			o		o					

*CS: Contractors share, WLC: Whole life costs, CP: Contractor proposals, BEC: Bonus for early completion, EW: Early Warning, RD: Resolving disputes

For both the NEC4 ECC clauses and the Project DOEN methods several risks, drawbacks and barriers are found. The main risks for the NEC4 ECC clauses are correlated to the capabilities of the project managers. When implementing NEC4 ECC clauses emphasis must be placed on the training of project managers. Insufficient training can result in failure of implementation which can hinder the project process. The clauses require more capacity from the project managers along with a pro-active professional attitude from both the client and contractor.

Implementation of NEC4 ECC clauses has to be done with due care. The NEC4 ECC contract is written for the United Kingdom and the relatively simple language in the clauses can lead to ambiguities in a Dutch legal context. Therefore, the clauses need careful inspection to ensure that they comply with Dutch law. Next to this, several barriers must be overcome for successful implementation in the Netherlands. The main barriers are:

- Unawareness among project teams of the possibilities and benefits of the NEC4 ECC;
- Lack of training resulting in insufficient capabilities among project managers;
- Unwillingness to change in the Dutch construction sector;
- The lack of experience with the NEC4 ECC in a Dutch context.

From a cultural point of view, no major risks are found. From Hofstede, it follows that the cultural differences between the United Kingdom and the Netherlands do not form an insurmountable barrier to implement NEC4 ECC clauses in the Netherlands.

For the Project DOEN methods to work successfully, a willing and cooperative team is necessary, this also forms one of the most significant risks. If a team is not willing to emphasize collaboration, the methods will likely not produce the desired result. Therefore, a professional match between the individuals in the proposed project team is necessary. Individuals must dare to expose themselves in a vulnerable and honest way. Only then can Project DOEN methods be fully used.

Also, the Project DOEN methods themselves need to be tailored to the project. Adjustment is needed to ensure that the methods bring the desired result. The spirit (intention) of the method can be copied directly, but not the method itself. Because the methods are new and contain few 'hard' rules, the full support from the line organisations of both parties is needed. The line organisations must be willing to take a leap of faith with the other party. If no support is given, using the methods the way they are intended is difficult.

Due to the limited hard rules and securities in the Project DOEN methods, most methods are based on trust. Several Project DOEN methods can create trust by themselves. Especially methods that can be used in the early project phases, such as collaborative procurement, early contractor involvement and joint project team, can ensure that trust is created between client and contractor. If the parties fail to create a basis of trust in the early stages of the project, it is not recommended to use Project DOEN methods.

5. Are there methods or clauses in the NEC4 ECC and Project DOEN that can positively influence collaboration in case studies using integrated contracts in Dutch construction sector and if so how do they do this?

Based on three cases, the potential influence of the NEC4 ECC clauses and Project DOEN methods on collaboration is identified. The factors of collaboration identified in sub-question 3 are used to analyse how a method or clause can influence collaboration. Also, it is investigated what the expected impact of the methods and clauses on collaboration is and if there is a different perception between clients and contractors on this impact level.

The results from the case study are evaluated by 10 industry experts from Witteveen+Bos in a validation process. In total, the positive influence of four methods is fully confirmed, of five methods not all possibilities to influence collaboration are confirmed and for three methods it is unclear if they can positively influence collaboration. The overview of the findings is shown in table 20.

Table 20: Overview showing the case study results combined with expert validation results

Factors stimulating collaboration / NEC4 ECC & Project DOEN methods and clauses	Mutual objectives	Gain and pain sharing	Trust	No-blame culture	Joint working	Communication	Joint problem solving	Fair risk allocation	Effective performance measurement	Continuous learning	Expected impact on collaboration	
											Clients	Contractors
Early contractor involvement	67%		75%	58%	100%	58%	100%				low	low
Optimization incentive & CS* & WLC* & CP* & BEC*			50%								low	low
Joint risk allocation & Compensation events					75%	92%	58%	92%			high	low
Joint problem or conflict resolution & EW* & RD (W3)*	58%		58%	92%	92%	100%	100%				high	high
Good faith obligation	50%			75%	67%	92%					high	high
Communications			67%	83%	58%	100%	83%		83%		medium	medium
Programme and planning	50%				50%	100%	67%		100%		low	low
Collaborative procurement	75%		83%	67%	100%	67%	58%				medium	medium
Removal of financial pressure				67%	67%						high	high
Joint project team					75%	100%	67%				low	medium
Continuous process reflection				92%		100%				67%	medium	medium
Continuity			100%			67%					medium	high

Legend
Green colour – confirmed connection in expert validation
Orange colour – unclear if the connection is confirmed in expert validation
Red colour – rejected connection in expert validation
Purple colour – confirmed connection in expert validation, but negative connection in case study
Black colour – connection is not taken into account in expert validation

The percentages in this table are the per case weighted average percentages of respondents that stated the connection. The higher the percentage, the more respondents stated the connection. The colours represent the outcome of the expert validation process. The meaning of each colour is explained in the legend. In the last two columns, the expected average impact of the method or clause on collaboration is presented for both the clients and the contractors. Based on these results the following is concluded:

- **Early contractor involvement** can positively influence collaboration by stimulating joint problem solving and it thereby can boost joint working and communication. Also, trust and a no-blame culture can be formed when this method is used. Due to the early alignment between client and contractor and the formation of trust, the chance that collaborative risks of unaligned project goals and limited mutual understanding occur is reduced. However, the average impact of the method on collaboration is low according to both the clients and the contractor. The clients and contractors, that used the method, gave a higher impact score. This indicates that it can be that the benefits of this method are not yet recognised by all parties in the Dutch construction sector. Because the method can influence collaboration in multiple ways and reduce collaborative risks, it is recommended to use the method more often. By doing so the benefits become more known in the sector and collaboration can be improved;
- There are contradictions in the data about the **optimization incentive**. The case study and the expert validation show different results. Due to this, no conclusion can be drawn regarding the influence of this method on collaboration;
- **Joint risk allocation** results in a fair risk allocation. By doing so, it has a positive effect on collaboration. Due to the fair risks allocation, the method reduces the collaborative risks of the fear of fighting and unclarity who to blame because upfront it is made clear who bears the risks and the parties feel that the risks allocation has been done fairly. Also, the method positively influences communication, joint problem solving and a no-blame culture. This indicates that the method has great potential to stimulate collaboration which is supported by the fact that the clients state that this method has a high impact on collaboration. The contractors do not think that the method has a high impact. This can be because the contractors see themselves as perfectly capable of making a risk allocation. It is however recommended to use the method because multiple benefits for collaboration are identified and the method can reduce risks associated with collaboration;
- **Joint problem or conflict resolution** can positively influence collaboration in multiple ways. Strong connections are found with communication, no-blame culture and trust. Due to the nature of the method it also naturally stimulates joint problem solving and joint working. Jointly solving problems can reduce the collaborative risk of lack of decision making because the process is steered to making decisions. Also, the impact of this method on collaboration is high according to both the clients and contractors. Due to multiple positive effects of the method on collaboration and its high impact, it is highly recommended that the method is used in construction projects in the Netherlands. There is a high chance this method will have a positive effect on collaboration;
- The **Good faith obligation** method opens the discussion about collaboration. By doing so, the involved parties can align their processes and create a fitting collaborative approach. This can also result in a no-blame culture, industry experts are however uncertain if this will happen. Nonetheless, the impact of this method on collaboration is high according to both the clients and the contractors. The high impact and identified benefits are a strong indicator that this method has additional benefits over the Dutch 'redelijkheid en billijkheid' method. Therefore, it is recommended to use the method. Users must however take into account that when using this method the collaborative risks of talking instead of doing and more hugs than decisions can occur.

Users must be aware of these risks and pay attention that decisions and progress is made when the method is used;

- Due to contradictions in the case and validation data, no conclusion can be drafted for the **communications** method. From the case study, it followed that a thorough communication structure can have benefits regarding no-blame culture, trust and joint problem solving. The experts in the validation however state that a thorough communication structure works counterproductive and can result in distrust; good communication should be expected from every professional without the need for specific agreements. Due to this different perception, it cannot be said that the influence of the communications method is on collaboration;
- The **programme and planning** method can be used to measure the performance of the project effectively. By doing so, the method can have a positive influence on collaboration. The impact of this influence is however deemed to be low according to both the clients and contractors. This indicates that the method can be beneficial to collaboration, but that it has a limited impact. It is recommended to use the method due to its benefits, but only little impact on collaboration should be expected;
- **Collaborative procurement** can positively influence collaboration because it stimulates joint working at the earliest phases of the project due to which mutual goals can be formed. By doing so, it can also from trust among the teams, industry experts are however in doubt if this will happen. It is likely that the formation of trust is highly case depended. The overall impact score of the method is medium, but in the case where the method is used it received high impact scores by both the client and the contractor. This is an indicator that the full potential of the method is not yet recognised in the sector. It is recommended to use the method, it has great benefits for collaboration and it can create understanding among the client and contractor teams. When the method is used, its benefits will likely become more known in the sector. There are, however, two risks that must be taken into account when using the method. These are being unaware of the answer and adopting unclear or uncomfortable roles. These risks entail that the users of the method must be willing to accept some level of ambiguity because in the collaborative procurement process not everything is clear up front. The participants must also be willing to take on new and different roles that they are used to in standard procurement procedures;
- The case study shows that the **Removal of financial pressure** method can positively influence collaboration due to the creation of a no-blame culture and joint working. Also, the impact on collaboration is stated to be high by both the clients and contractors. The industry experts, however, place doubts if this method will work in practice. Due to this contradiction, no final conclusion can be drafted for this method. It is likely that the method will have impact but how this will influence collaboration in the Netherlands remains uncertain;
- A **joint project team** is beneficial for collaboration because it stimulates joint working and joint problem solving due to which it can also stimulate communication. The clients pointed out that the method has the risks of oversharing of information and more work due to which they currently prefer two separate teams over a joint project team. Industry experts go against this and state that multiple collaborative benefits can be obtained; to overcome the risks the method needs to be tailored to the project. This indicates that this method can positively influence collaboration, but that it must be tailored for each individual project;

- **Continuous process reflection** can positively influence collaboration because it creates a no-blame culture and it enables the parties to openly discuss past mistakes or miscalculations enabling the parties can learn from these mistakes. As a result, the parties are able to improve their process. This shows that the method can have multiple collaborative benefits. When using this method, it must be taken into account that individuals do not behave emotionally when discussing past mistakes. This must be avoided because collaboration is not about feeling good, it is about making the best business results. When this is taken into account, it is recommended to use the method because it can be beneficial for client-contractor collaboration;
- **Continuity** helps to keep trust relations within project teams. By doing so, it has a positive effect on collaboration. Most respondents stated that continuity is "very important" and the contractors also believe it has a high impact on collaboration. However, it is also a method that is difficult to retain during the project; you cannot force people to stay on a certain project. Despite this, emphasizing continuity can be beneficial for collaboration. The teams can jointly search for new team members that fit well within the existing team, allowing trust relations to form quicker. Therefore, it is recommended to emphasize continuity;

The results show that multiple of the identified NEC4 ECC clauses and Project DOEN methods can potentially influence collaboration positively. Nine of the twelve researched methods and clauses can have a positive influence by stimulating one or more factors of collaboration. Some of these methods and clauses come with collaborative risks while others have the potential to reduce collaborative risks. It is important that the risks are always taken into account, the tailoring of methods and clauses can help to reduce the collaborative risks.

7.1.2 Conclusion of the research

Based on the findings in literature regarding the NEC4 ECC and Project DOEN, the case study and the expert validation an answer is drafted to the research question:

Are there clauses in general conditions or methods of collaboration that can positively influence collaboration in integrated contracts in the Netherlands?

This question can be answered with a yes, clauses in general conditions that can influence collaboration positively in integrated contracts in the Netherlands have been identified in NEC4 ECC and methods of collaboration that can influence collaboration positively in integrated contracts in the Netherlands are identified in Project DOEN. The influence is potential of nature. This is because when looking at relations and collaboration it cannot be said that a method or clause will for certain show a particular influence. The following clauses and methods can potentially influence collaboration positively:

- **Early contractor involvement**
- **Joint risk allocation & compensation events**
- **Joint problem or conflict resolution**
- **Good faith obligation**
- **Programme and planning**
- **Collaborative procurement**
- **Joint project team**
- **Continuous process reflection**
- **Continuity**

For the **optimization incentive**, **communications** and **removal of financial pressure** methods and clauses contradictions among the analysed data are found. Therefore, it cannot be said what the possible impact of these methods and clauses on collaboration is.

Multiple of these methods and clauses are focussed on the early phases of projects. These methods and clauses are **early contractor involvement**, **joint risk allocation**, **good faith obligation**, **collaborative procurement** and **joint project team**. These methods and clauses can be used to align the visions, processes and expectations of both teams at or before the start of the project. This enables the teams to work and solve problems together, and it can result in trust among the teams, the formation of a no-blame culture and a fair distribution of risks. Which benefits are obtained depends on the method or clause that is used. An overview of the benefits of each of these methods and clauses is presented in table 21.

These 'early-phase' methods and clauses enable the parties to set a basis for collaboration at the start of the project, increasing the chance of a collaborative kick-off the project. By doing so, these methods and clauses can reduce the two most common causes of collaborative failure being an improper alignment of goals and lack of mutual understanding about expectations. Also, early contractor involvement and collaborative procurement can be used to create a basis of trust in the early stages of the project. It is highly recommended to use one or both of these methods because other methods, like joint project team and joint problem resolution, are likely to be more effective if there is a basis of trust among the teams.

In short, these 'early-phase' methods and clauses stimulate collaboration from the earliest phases of the project and thereby encourage communication, the alignment of goals and the creation of mutual understanding and trust. Therefore, it is recommended to use these methods in projects using integrated contracts in the Netherlands. Each method suits a different situation. Table 21 with corresponding legend can be used to identify which method or clause suits the situation of a specific project based on a match between the factors of collaboration that each method or clause stimulates and the needs of that specific project.

Table 21: Methods and clauses that can positively influence collaboration in the early project phases

Factors stimulating collaboration / NEC4 ECC & Project DOEN methods and clauses	Mutual objectives	Gain and pain sharing	Trust	No-blame culture	Joint working	Communication	Joint problem solving	Fair risk allocation	Effective performance measurement	Continuous learning
Early contractor involvement	~		√	~	~	~	√			
Joint risk allocation & Compensation events					√	~		√		
Good faith obligation				~		√				
Collaborative procurement	√		~	~	√	~				
Joint project team					√	~	√			

Legend
√ Connection based on literature, case study and validation
~ Connection based on literature and case study

When the projected is kicked-off and enters the execution phase, the methods **joint problem or conflict resolution**, **programme and planning**, **joint project team**, **continuous process reflection** and **continuity** can be used to maintain and expand the collaboration in the project. These methods and clauses stimulate the formation of (a higher level of) trust, a no-blame culture, joint working, joint problem solving and effective performance measurement. Which benefits are obtained depends on the method or clause that is used. An overview of the benefits of each method or clause is shown in table 22.

The methods joint problem or conflict resolution and joint project team enable the parties to work jointly on the problems the parties run into, stimulating them to solve the problems together in an open environment. By doing so, trust can be formed and better more or innovative solutions can be created. The programme and planning method ensures effective performance measurement due to which the parties can spot future problems quickly. This enables them to prevent risks from occurring and effectively solve problems together.

Continuous process reflection enables the parties to stay aligned on their goals and expectations. The parties can learn from their past mistakes and thereby improve the process. By continuously adjusting the process, the parties ensure it meets everyone's expectations. Emphasizing continuity can ensure that trust relations stay within the project. Although it cannot be prevented that people leave the project, emphasizing continuity can help to reduce the number of people leaving the project. Also, by jointly finding new team members that fit within the existing project teams, trust relations can (re)form quicker. Implementing one or multiple of these methods and clauses stimulates the creation and preservation of a collaborative process that satisfies both parties.

In short, these 'execution-phase' methods and clauses can establish or further stimulate collaboration, depending on if the parties formed a basis of collaboration in the early project phases. Therefore, it is highly recommended to implement one or multiple of these methods or clauses in projects in the Netherlands that use integrated contracts. Table 22 with the corresponding legend can be used to identify which method or clause suits the situation of a specific project based on a match between the factors of collaboration that each method or clause stimulates and the needs of that specific project.

Table 22: Methods and clauses that can positively influence collaboration in the execution project phase

Factors stimulating collaboration / NEC4 ECC & Project DOEN methods and clauses	Mutual objectives	Gain and pain sharing	Trust	No-blame culture	Joint working	Communication	Joint problem solving	Fair risk allocation	Effective performance measurement	Continuous learning
Joint problem or conflict resolution	~		√	√	~	√	~			
Programme and planning						~	~		√	
Joint project team					√	~	√			
Continuous process reflection				√		~				√
Continuity			√							

Legend
√ Connection based on literature, case study and validation
~ Connection based on literature and case study

Finally, for three methods or clauses contradictions in the literature, case and validation data are found. Therefore, no conclusion can be drafted regarding their impact on collaboration. For each method or clause, the contractions are discussed.

Regarding the **optimization incentive** method, the respondents in the case study state that the method will likely cause distrust in the project. Especially fines are an unwanted tool. The industry experts disagree. They state that the method can be beneficial for trust as long as there is a balance between fines and bonuses. Due to this different perception, no conclusion can be made with the data available.

In the case study, it is found that the **communications** clause can be beneficial for collaboration in multiple ways. The industry experts place doubts if the method brings these benefits and state that the method might cause distrust and a blame culture due to its extended rules and regulations. The industry experts state that good communication should be expected from every professional and that there is no need to agree upon communication rules in an extra clause. They state that this would only work counterproductive.

For the **removal of financial pressure** method several possibilities to positively influence collaboration are found. The industry experts, however, express their doubt if this method works in practice. They state that it is impossible to know all risks upfront and therefore it is impossible to price the entire project. Next to this, they express doubt if the method is allowed under Dutch procurement law. This indicates that this method needs further investigation. In this research, no conclusion can be made regarding this method. The method

might have benefits for collaboration, but the concerns expressed by the industry experts need further investigation before a conclusion can be drafted.

7.2 Recommendations for the Dutch construction sector

Based on the conclusion several recommendations for the Dutch construction are drafted. These recommendations are divided into three project phases: the early project phase, the execution phase and the project end phase. An overview of the recommendations is shown in figure 20. Per phase the recommendations are further elaborated upon below the figure.

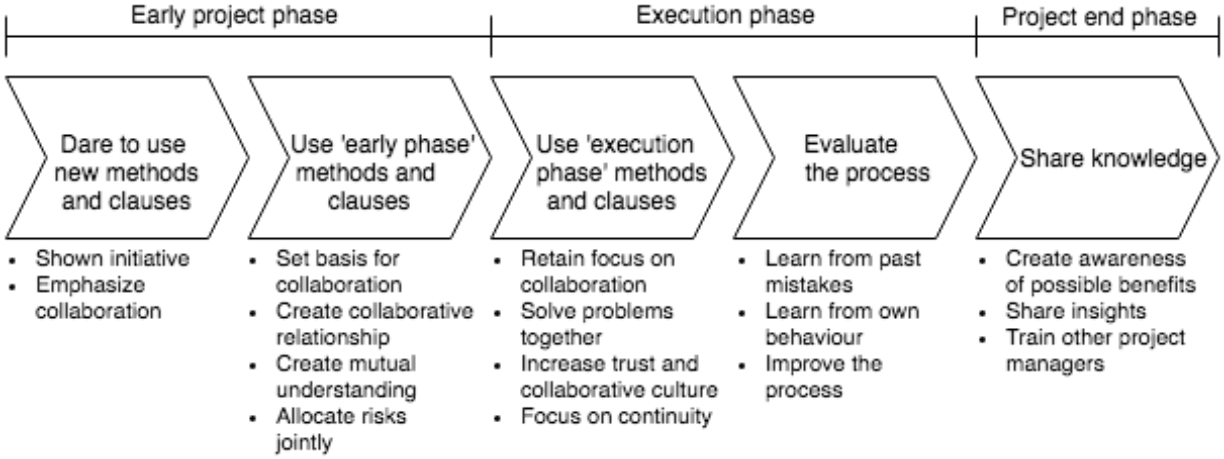

Figure 20: Overview of recommendations per project phase

Early project phase

First and foremost, dare to use new and different methods and clauses. During the interviews, respondents were often enthusiastic about a method or clause, but also saw difficulty in its implementation, comments are made such as 'that will be difficult to implement in this sector' or 'that will need the full support of the other party, and we do not expect to get that'. Counter this thinking pattern by initiating the use of new methods and convince the other party of the possible benefits that these methods and clauses contain.

By placing more emphasis on collaboration, it is likely that the benefits of collaborating become more known among the teams. Still, often little attention is placed on collaboration and the process in the project. Emphasizing collaboration and the process is the first step into realising good collaboration and its positive influence on project success. The methods collaborative procurement and good faith obligation can help place this emphasis on collaboration.

Use methods and clauses that focus on the early project phases, such as collaborative procurement, early contractor involvement, good faith obligation and joint project team, to align the visions and expectations of both teams. By doing so, a basis of collaboration can be created between the teams. When these methods or clauses are used it is highly likely that the parties start the project collaboratively. The formation of these collaborative relations early on in the project can be beneficial during all project phases. Problems and risks can be dealt with together and by jointly creating solutions it is more likely that better and/or more innovative solutions are created. Also, it is easier to create a collaborative relationship in the start of the project. If a negative event occurs, and there is no collaborative relationship in place to deal with the problem together, it is likely already too late to create an effective

collaborative relationship. Therefore, it is highly recommended to focus on collaboration early on in the project with the use of the identified early-phase methods and clauses.

By creating a mutual understanding between the client and the contractor one of the main collaborative problems between the client and the contractor, being a limited understanding of the problems and the process of the other party, can be prevented. Understanding why matters are important for the other party and taking notice of the process of the other supports the creation of good collaboration. The methods and clauses early contractor involvement, collaborative procurement, good faith obligation, continuous process reflection and joint problem or conflict resolution can help create this understanding and close the gap between the client and the contractor.

Allocate risks jointly. When risks are allocated jointly it is likely that it will result in a fair risk allocation. Carelessly transferring all risks to the contractor is one of the main reasons collaboration often fails. If a party feels treated unfair and unequal, it is nearly impossible to collaborate. Allocating the risks together can help the parties to collaborate and start the project in a fair and equal way. It is highly recommended to allocate risks together as it enables collaborative relations to form.

Execution phase

Retain focus on collaboration during the project execution phase. During the execution phase, it is easy to fall back into 'old patterns'. It is essential to keep focussing on collaboration to prevent this and obtain all benefits collaboration can bring. The methods joint problem or conflict resolution and joint project team can help to create or strengthen the collaborative culture in the execution phase. The methods stimulate the joint solving of problems and joint working. The programme and planning clause can be used to spot problems early on, enabling the parties to tackle these problems effectively. These methods and clauses can result in better and more effective problem solving, the reduction of conflicts, and the creation or enlargement of trust and a no-blame culture. Therefore, it is highly recommended to use the methods and clauses joint problem or conflict resolution, joint project team and programme and planning in the project execution phase.

Focus on continuity. By focussing on continuity trust relations stay within the project. Although it cannot be prevented that people leave the project, emphasizing continuity can help to reduce the number of people leaving the project. Also, by jointly finding new team members that fit within the existing project teams, trust relations can form quicker. This recommendation comes with the side note that when teams do not get along well, it can be beneficial to switch team members and thus not to focus on continuity.

Evaluate the process in the project. By looking back at how the process in the project is going the parties can learn from past mistakes. These learnings allow the parties to improve the process and thereby effectively improve the collaboration in the project. The continuous process reflection method can help to accomplish the evaluation and continuous learning.

Project end phase

Create awareness of the methods and clauses among organisations in the Dutch construction sector and their project managers. The main identified barriers for implementation of the

methods and clauses are related to lack of awareness of the possibilities and benefits of the identified methods and clauses and insufficient expertise among project managers regarding these methods and clauses. Organising trainings in which NEC4 ECC or Project DOEN experts come to talk can help to create the needed awareness of the methods and clauses. By spreading and exchanging knowledge about these methods and clauses the chances of successful implementation of the methods and clauses in the Netherlands increase.

7.3 Recommendations for future research

There are several recommendations for future research. These are mainly based on the fact that NEC4 ECC clauses and Project DOEN methods are barely used in the Netherlands during the execution of this research. When the methods and clauses are used more often, more and better data to test the influence of the methods on collaboration in the Dutch construction sector is available. The recommendations are:

- It has not been investigated if all methods can be used under Dutch procurement law. Further investigated is needed to see if the adjustment of certain methods is needed;
- Most NEC4 ECC clauses are never directly used in practise in the Netherlands; it is recommended to test the effectiveness and appropriateness of these methods in Dutch projects using integrated contracts;
- At the time of the research Project DOEN was still in execution. Therefore, the true possibilities and effects of the methods could not yet be determined. Reflection on these methods after project completion is recommended to obtain a complete insight into these methods;
- The number of case studies in this research is limited. The validity of the research can be increased if the research is conducted with a larger number of cases. The higher the number of studies into the subject the higher the significance of the found result;
- This research is scoped on the NEC4 ECC and Project DOEN. Methods from other sources might have positive effects on collaboration, this has not been researched;
- An extra translation step of the conclusion by use of (for instance) a decision tree can make it easier to implement the identified methods and clauses in practice. This decision tree can include certain project scenarios that commonly occur. Based on these scenarios a project manager can go through the decision tree and by doing so see what method or clause can be beneficial for the situation in that specific project. What this decision tree should include can be investigated in future research.

7.3 Discussion

In this paragraph, the reliability and validity, scientific contribution, and limitations of the research are discussed.

7.3.1 Reliability and validity of the research

The reliability and validity of this research are tested based on the four criteria defined by Bryman (2012, p. 390) for qualitative research, being:

- **External reliability** – external reliability relates to the extent to which the research can be repeated. This is a difficult criterium for qualitative researches because the research is done in a certain social setting. In a different social setting other results can be obtained. This can be prevented by adopting a similar social role than the author of this research had. The author took the role as an independent outsider of the sector, which can be copied by other researchers or master-thesis candidates.

Therefore, the external reliability of this research can be seen as high. With the provided interview protocols a researcher can redo the research with the use of different cases. Condition to this is that the researcher can take-on the role of independent outsider and is thus not linked to organisations in the sector;

- **Internal reliability** – internal reliability concerns the extent to which the research team is in consensus about the results. This research is, however, conducted by one individual. Therefore, this aspect is not relevant to this research. Nonetheless, the conclusions found in this report are in line with the conception of industry experts. This indicated that the study likely has sufficient internal reliability;
- **Internal validity** – internal validity compromises the match between theoretical concepts and ideas developed in the research, and the observations made by the researcher. In this research, the theoretical concepts are developed into an assessment framework. Based on this framework the in-depth interviews with respondents during the case interview are analysed. Interpretation of the statements made by the respondents had to be done to some extent. To ensure that this is done objectively, each interpretation is explained and elaborated upon. By doing so, the researcher showed its objectivity in interpretation. Due to this congruence between the theory and the observations, the study has sufficient internal validity.
- **External validity** – external validity refers to the degree to which the conclusion can be generalised. External validity is a problem for qualitative studies. LeCompte and Goetz (1982) explain that because qualitative studies are based on a small number of case studies, it is difficult to generalise the conclusions based on these case studies. This also holds for this research, since the conclusions are based on three cases. Therefore the external validity of the research cannot be determined.

  It is, however, generally known that collaboration cannot be generalised, it is always case dependent. Because of this general knowledge, the research aimed to provide a conclusion on a higher abstraction level. The conclusions presented here can be used as a starting point for organisations in the Dutch construction sector. It will always be necessary to tailor methods and clauses to the specific situation the project is conducted in, regardless of the qualitative nature of this research because collaboration itself cannot be generalised.

7.3.2 Scientific contribution

This research gives a contribution to the existing knowledge in five fields:

1. The research shows a clear image that the collaborative problems in the Dutch sector are not solved at the moment. Data from several sources are combined to showcase that collaboration is to this day one of the large problems in the Dutch construction sector. In the case study, it also followed that collaboration is still difficult to achieve in the Dutch sector. Often, client and contractor do not fully understand each other and make little attempts to gain an understanding of the world of the other. On the other hand, the case study also shows how to improve this situation. These successful cases can be inspirational for other projects;
2. Separate NEC4 ECC clauses are investigated. Investigating the separate NEC4 ECC clauses on collaboration has not been done before. The possible effects on collaboration per clause have been identified based on literature. This fills the

knowledge gap that exists regarding the contract form and spreads knowledge on the possibilities of the separate NEC4 ECC clauses in the Netherlands;

3. Project DOEN methods are investigated. In Project DOEN new methods have been developed. Little research has been done to these methods separately. This research provides an overview of all methods in Project DOEN that have on influence on collaboration. It also provides an overview of how these methods can influence collaboration. This exploration can be used to spread understanding about what Project DOEN entails and what methods can be beneficial in another project;
4. Effects of NEC4 ECC clauses and Project DOEN methods in Dutch integrated contracts are examined by means of a case study and validation process. This has not been done before for separate NEC4 ECC clauses and Project DOEN methods. The insight obtained from this research showcases the possibilities of these separate methods and clauses to positively influence collaboration in projects that use integrated contracts in the Netherlands. This can be used to spread knowledge and practical information about these possibilities. Organisations in the Dutch sector can use this information to select methods that suit their situation or project. By doing so, collaboration can be positively influenced in the Dutch sector. This can help reach the ambitions formulated in the Marketvision 2016;
5. The research provides an insight into the amount of impact the investigated NEC4 ECC and Project DOEN methods and clauses can have on collaboration in projects that use integrated contracts in the Netherlands. This can be used to spread awareness about what the most impactful methods on collaboration are in the Dutch construction sector.

7.3.3 Limitations of the research

Each study has its limitations; this study is no exception. The limitations that had the greatest impact on the conclusions of this research are discussed here.

- Due to the limited amount of case studies, this research is only of exploratory nature. The conclusions should be used as a starting point for organisations in the Dutch construction sector. Based on the conclusions, organisations can start exploring the methods that suit their situation further and develop them in a way that suits their situation;
- Project DOEN and NEC4 ECC are not used directly in the cases, only similar methods are used. It also occurred that a method was not used in the case. Due to this, the expected effect of the method is obtained from the case study and not the true effect;
- A limited number of respondents is questioned per case. This has two reasons. The first is that the parties conducting the project were not willing to let the author speak to the entire project team due to sensitivity in the project or communication guidelines of the company. Second, the research is conducted in a limited timeframe. Conducting more interviews is highly time-consuming and the interviewed respondents indicated that the author interviewed the right persons for each case. The respondents dealt with the project and its process on a daily basis and were the right people to speak to regarding the collaboration according to the other respondents per case. For these reasons, the decision was made to interview the core-project team members only;
- Some Project DOEN methods and NEC4 ECC clauses are combined into a category of similar methods. Due to this some method are not investigated separately. This is

done for two reasons. The first is that these combined methods are highly similar. Because in the cases not precisely these methods are used, only similar methods, it would result in highly similar answers regarding the combined methods. Second, the interview protocol that is used already took significant time to conduct. The respondents actively stated that the time asked by the author (1.5 hours) was the maximum time they could free-up. If these methods were asked separately, it would result in a longer interview protocol which could have resulted in difficulty of finding respondents;

- The validation is done using an online survey. Because of this, the author could not explain the method himself or directly react to the level of agreement of the experts. This could have resulted in misinterpretation of the method and unclarity of the given level of agreement. This is done for two reasons. The first is that the experts have full agenda's, planning a validation with each of them would be difficult. Second, the validation had to be done in a limited timeframe. By use of an online validation, the experts were able to quickly validate the conclusions in moments that suited them. Due to this, the validation could be conducted in the set time-frame;
- All industry experts that validated the conclusions work for the same company, Witteveen+Bos. Due to this, it can be that all experts have the same angle of approach to this problem. This could have resulted in a one-sided validation. This is done because it is more time-efficient to ask experts from the company at which the study is conducted. These experts are more likely to free-up time to help the author. Furthermore, the experts at Witteveen+Bos work for both clients and contractors due to which they have a complete overview of the Dutch construction sector.

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Appendix A: Opportunistic 'old' behaviour in the Netherlands

In this appendix a research is discussed that provided an image of opportunistic or old behaviour in the Netherlands. This gives a clear insight into the scope of the problem in the Netherlands.

In 2006 a research into the relations in the construction sector at that time was conducted. It identified several issues in the construction sector at that time and what the relationships between these issues are. It is important to obtain an understanding of the situation of the market at that period because around 2006 there was poor collaboration in the sector revered to as 'old behaviour'. Understating this old behaviour and its relations with activities can help identify why people currently still fall back into these patterns of old behaviour. The researchers identified 8 main issues occurring in the Dutch construction sector in 2006, these are (Noorderhaven et al.,2006):

- The strategies of contractors – strategies of contracts are seen as not always focused on innovation and quality. It followed that they mainly focus competition based on price and capacity;
- Poor collaboration – there is a poor 'fit' in the sector meaning that parties have poor task divisions and alignment;
- Agreements about the division of works and prices – contracts have high uncertainty whether they bring enough work for optimal capacity of the contactors resources. As a result, a certain form of market regulation is attractive;
- Distrust between clients and contractors – there is an overall lack of transparency between clients and contractors. It is unclear what the motives stimulate the behaviour of clients;
- Traditional commissioning by clients – the strategy of the sector is based on price competition and filling of capacity, without attention to quality and innovation.
- Construction culture – from the research it showed there is poor coordination in the sector regarding collaboration and the context of agreements. Client and contractor have diverged in their way of working and are unaware of the processes of the other party. Furthermore, the culture in the Dutch construction sector is often linked with unfair division of work and poor price based selection;
- Changing role of government in the role of client – the government is using more and more innovative commissioning methods which bring new risks to the market. Together with the distrust in the market this can be counterproductive;
- The building fraud – the building fraud is still seen as one of the major reasons of distrust in the Dutch construction sector. Professionals still carry the load of this period and act based on their experiences.

These issues in the Dutch construction sector are related with one another. These relations are displayed in figure 21. In this figure the size of the arrow presents the significance of the relation found, the larger the arrow, the stronger the relation.

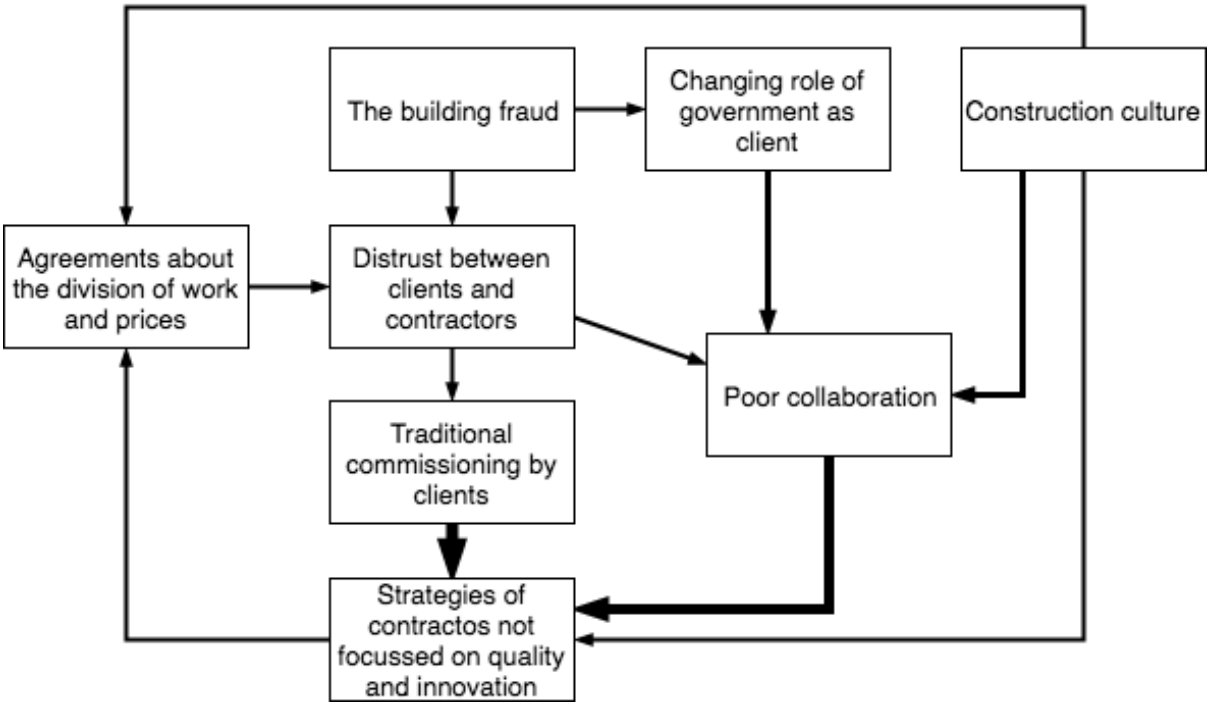

Figure 21: Relation of most important issues in the Dutch construction sector in 2006 (Noorderhaven et al., 2006; translated)

From figure 21 it becomes clear that poor collaboration is directly related to the problems in the construction sector. The poor collaboration is mainly caused by the building culture and the changing role of the government as a client. The building culture is an significant cause of poor collaboration, not only is there a direct connection found, but also an indirect link is found: the culture influences the agreements about work and prices which eventually cause poor collaboration (Noorderhaven et al., 2006). Therefore, according to the study of Noorderhaven et al. (2006), a change in the building culture and the role of the client is deemed necessary to solve collaboration problems in the sector.

Appendix B: Opportunistic 'old' behaviour explained

In this appendix old (traditional) behaviour is explained in more depth. This background knowledge provides a broader insight into old behaviour. Associated with old behaviour is opportunism. Opportunism is seen as one aspect of human nature, Williamson (1985) characterizes it is "self-interests seeking with guile" (Williamson, 1985, p. 47). Opportunism reflects an impulse to misbehave (You et al., 2018). Opportunistic behaviour, which is used as synonym of old behaviour is the Netherlands (Rijkswaterstaat et al., 2016), is the manifestation is this behavior (Das & Rahman, 2010). With regard to construction project oppertunic behaviour is devined as "behaviours by a contractor that are motivated to pursue its self-interest with deceit to achieve gains at the expense of the owner" (Das & Rahman, 2010; Lu et al., 2016). This behaviour entails the traditional client-contractor relationship, an unbalanced risk allocation, adversarial relationships and ambiguous contracts in the construction sector. These aspects are identified as the primary causes for problems in the civil industry (Jannadiaa et al., 2000; Demirel et al., 2016). Each of these aspects will be elaborated in this paragraph.

In the traditional client-contractor relationship, the contractor is primarily focussed on the budget and making a profit while the client wants to have as few risks as possible and therefore transfers most risks to the contractor (Cheung et al., 2003). This attitude and unbalanced risk allocation reduces the chances of project success as it hinders the relationship between the involved parties. Matthews and Howell (2005) state that there are four major systemic problems with the traditional project approach in the construction sector, being:

- Good ideas are held back;
- Traditional contract limits cooperation and innovation;
- An inability to coordinate;
- Pressure for partial optimization at the expense of the project as a whole.

It is found that when contractors enter a project process and see the drawings and design, they often save their best ideas (O'Connor, 2009). By doing so, the contractors hope to gain a competitive edge during the tendering phase. These good ideas are often lost because the design team is at a later stage not able to add them to the design. Also, the contractor often purposely interprets the contract clauses in a different way that better suit its own benefit (O'Connor, 2009). As a result, productivity levels of the construction sector are low compared to other industries, in some countries the levels even have dropped over time.

The traditional design-bid-build procedure influenced the culture in the construction industry heavily and often resulted in adversarial relationships (O'Connor, 2009). By selecting only on price, contractors were forced to tender as low as possible. This increased the risks of cost and time overruns due to a high number of requested change orders (Assaf & Al-Hejji, 2006; Wardani et al., 2006). Through change orders the contractor often tried to compensate for the low tender bid. This traditional procurement procedure of low-bids often resulted in problems in the early stages of the project (Eriksson & Westerberg, 2011). This hinders the chances of project success because the early stages of the project are seen as vital for project success since most agreements are made in this period and relationships are formed (Cheung et al., 2003; Eriksson and Laan, 2007).

Next to the procurement process, the traditional contracts of construction projects are seen as inherently incomplete (Demirel et al., 2016). Consoli (2006) states that incomplete contracts are one of the main factors resulting in conflict. This is because the parties have different perspectives on the project objectives (e.g. quality, time, costs, safety) due to the poor contract communication (Harmon, 2003; Wu, 2013). Furthermore, ambiguity in contracts is an important cause of disputes in construction projects (Chan & Suen, 2005). The traditional contracts also require a clear and definitive allocation of all risks, responsibilities and liabilities among the involved parties (O'Connor, 2009). The increasing complexity of construction projects makes this impossible. Not all risks and uncertainties can be foreseen over a 10-15 year period at the start of a project, not to mention the entire lifespan of the project (Miller & Lessard, 2001). Even risks that are foreseen can have a different impact than expected requiring adjustments in the contract. It was generally seen that the client transferred these highly uncertain risks to the contractor. It often was the case that the contractor was not able to bear these risks. This is seen as one of the main causes of construction conflict (Chan & Suen, 2005).

The traditional client-contractor relationship, an unbalanced risk allocation, adversarial relationships and ambiguous contracts are all identified as causes of conflict (Chan & Suen, 2005). These conflicts in construction projects can lead to confrontational relationships between the involved parties which makes it difficult to achieve the objectives of the project (Jelodar et al., 2015). Relational conflicts can have a negative influence on the project in three ways (Wu et al., 2017). The first is that it can result in team members withholding their opinions and views on the project which limits the flow of information among the project team. Second, conflict can result in anger, tension and negative emotion among the project members which makes it impossible to collaborate. Third, the mutual understanding among the team members is likely to decry, which can result in a higher chance of confrontation and conflict escalation.

The increase of conflict and difficulties to achieve project objectives has caused projects to often run over budget, over time, over and over again (Flyvbjerg B., 2014) or worse, that projects do not deliver their objectives or goals (Matta & Ashkenas, 2003; Shenhar & Dvir, 2007). Due to the increase in conflict, there is an increasingly adversarial atmosphere in the construction sector between the client and the contractor (Harmon, 2003). This adversarial relationship undermines collaboration, which is increases the chances of successful project delivery and is in contradiction with the collaborative nature of construction projects (Harmon, 2001; Brinkman et al., 2015).

Appendix C: Ambitions presented in the Market vision 2016

The table presented in this appendix contains an overview of the main ambitions formulated in the Marketvision by major parties in the Dutch industries. The involved parties jointly sketched an image of the current state of the sector (as is 2016) and state what they see as a wanted situation in the future.

Table 23: Ambitions Marketvision (Rijkwaterstaat et al., 2016)

	Ambitions to achieve	
	From:	**To:**
1.	**Hierarchical client contractor relationship**	Collaborating in the market based on equivalence and complementarity, each with its own role and responsibility in which the task at hand is the primary concern
2.	**Realizing projects**	Realizing and connecting challenges
3.	**Putting own interest fist**	Thinking, working, acting and learning together across the industry
4.	**Act reactive**	Conducting dialogue and act in anticipation
5.	**Fighting relationships**	Excel by starting projects based on realistic preconditions
6.	**Opportunistic behaviour**	Communication in advance about risks, need of information and dilemma's
7.	**Act on basis of power and focus on the contract**	Act based on strength and focus on positive attitude and behaviour
8.	**Competitive advantage through possession of knowledge**	Competitive advantage through speed of accessing and applying appropriate knowledge
9.	**Little room for diversity**	An eye for differences in quality and space for customization

Appendix D: Exploratory interview setup Project DOEN

To obtain a good insight into Project DOEN exploratory interviews are used. The project manager of both the client Rijkswaterstaat and the contractor Combinatie NU are interviewed. The project managers are interviewed separately. In these interviews, the focus is on the success factors defined in paragraph 2.3 and the early identification of possibilities and opportunities done by the author. Areas of interest that followed from this early identification are collaborative procurement, early contractor involvement, joint project team, continuous process improvement, continuity, scope optimization incentive, pain/gain sharing.

During the interview, the author tried to create an organic discussion. This was done so that the interviewee started sharing their view and experiences openly. To gain insight into the used processes and methods the 'why', 'how', 'can you elaborate' and 'can you give an example of that' question were frequently asked. Even though the goal was to have an organic discussion the author prepared several questions to ensure that the success factors and identified areas of interest where discussed. These questions are in Dutch since both the interviewer and the interviewee are native Dutch speakers. Translations and an audio recordings of the interviews are available on request. Questions drafted beforehand:

- Hoe is de samenwerkingsgerichte aanbesteding gegaan?
    - Vervolgvraag: Wat dit uniek voor Project DOEN of is dit mogelijkerwijs ook voor andere projecten te gebruiken?
- Hoe is het kosten aspect behandeld zodat het eerlijk verloopt ondanks het gebrek aan concurrentie op prijs?
- Wat was het doel en de inhoud van het visiedocument en wat vond de aannemer hiervan?
- Hoe vonden beide partijen dat de aanbesteding is verlopen?
- Hoe hebben jullie ervoor gezorgd dat misverstanden zo veel mogelijk worden voorkomen?
- Een raming kan goed gemaakt worden vooraf, maar hoe is omgegaan met onverwachte kosten?
- Hoe wordt met wijzigingen omgegaan?
- Hoe is met de planning omgegaan?
- Hoe hebben je de risico's gealloceerd en waarom hebben jullie dat zo gedaan?
    - Vervolgvraag: Leverde dit problemen op voor de respectievelijke achterliggende organisaties?
- Wat is het proces voor onverwachte grote risico's?
- Vergt Project DOEN erg hoge tijdsinvestering door de intensive samenwerking?
- Veel afspraken die gemaakt zijn, zijn op hoog abstractieniveau. Er is vertrouwen nodig om dit te kunnen afspreken op deze manier met elkaar, hoe hebben jullie dit vertrouwen gekweekt en wat doen jullie eraan om dit vertrouwen te behouden?
- Hoe gaan jullie om met inspecties en mogelijke meningsverschillen die hieruit ontstaan?
    - Vervolgvraag: denk je dat dit ook kan bij complexere projecten?
- Hoe is de rolverdeling binnen het (gecombineerde) team en wat betekend dit voor de samenwerking?
- Als problemen zich voordoen hoe wordt daar vervolgens mee omgegaan?
- Welke risico's of punten van aandacht ben je zelf tegenaan gelopen door de intensieve samenwerking?
- Jullie hebben zelf (in samenwerking met enkele marktpartijen) dit proces van veel samenwerken en intensieve overleggen bedacht. Dit is echter nieuw voor de aannemer. Leverde dit (in het begin) problemen op?
    - Vervolgvraag: was er verschil in bedrijfscultuur en zo ja hoe is hier mee omgegaan?
- Je ziet op dit moment vaker dat de aannemer en opdrachtgever met een positieve houding aan het project beginnen en dat ze graag willen samenwerken, maar dat er toch gedurende het project conflict ontstaat. Hebben jullie bepaalde methodes/processen gebruikt om dit tegen te gaan?
- Resulteert het gebrek aan concurrentie op prijs denk je niet voor steeds hoger wordende kosten? En hoe kan Rijkswaterstaat ervoor zorgen dat het niet structureel te veel gaat betalen voor uitgevoerde werken?
- Zou je zeggen dat de gebruikte methodes en processen in Project DOEN te gebruiken zijn in andere projecten?

Appendix E: Basis of connections NEC4 ECC

In this appendix the underlying basis on the connections made in conclusion 3.1.3 is explained. In underlying table, each connection is shown with the corresponding source on which it is based. The table reads as follows: in the column 'NEC4 ECC method' the methods found in the NEC4 ECC are placed, in the column 'Factor that stimulated collaboration' each factor with whom the NEC4 ECC method is linked is placed. The height of the cell of the first column sets the boundaries of the factors in the middle column. For instance, the first method 'good faith obligation' is linked to 'trust' and 'no blame culture. In the last column 'basis of connection' the source that that particular connection is placed. For instance, the connection 'good faith obligation' and 'trust' is based on the sources (Chao, 2017; Cheung L., 2015).

Table 24: Basis of connection between NEC4 ECC and aspects of collaboration

NEC4 ECC method	**Factor that stimulates collaboration**	**Basis of connection**
Good faith obligation	Trust	(Chao, 2017; Cheung L. , 2015)
	No-blame culture	(Downing et al., 2017)
Communications	Communication	(ICE, 2017b; Wu G. , 2013; Harmon, 2003)
	Effective performance measurement	(Wu G., 2013; Harmon, 2003)
Early warning	Mutual objectives	(Gould, 2008; Gerrard, 2014; ICE, 2017b)
	Trust	(Cheung L. , 2015; ICE, 2017b)
	Communication	(Gould, 2008; ICE, 2017b)
	Joint problem solving	(Shaw, 2002; Forward, 2002, p. 24; Gould, 2008; ICE, 2017b))
	Effective performance measurement	(Shaw, 2002)
Contractor proposals	Mutual objectives	(ICE,2017b; Van Wassenaer & Thomas, pp. 131-132; Kent & Becerik-Gerber, 2010)
	Joint working	(Van Wassenaer & Thomas, pp. 131-132; Kent & Becerik-Gerber, 2010)
Programme and planning	Communication	(Bennett & Baird, 2001; Hide, 2009
	Joint problem solving	(Barnes, 2002; ICE, 2017b)
	Effective performance measurement	(Bennett & Baird, 2001; ICE, 2017b; Hide, 2009)
Compensation events	Communication	(Broome & Hayes, 1997, p. 258; ICE, 2017b)
	Fair risk allocation	(Thompson et al., 2000; Broome & Hayes, 1997, p. 258)
Contractors share	Mutual objectives	(Broome & Perry, 2002)
	Gain and pain sharing	(ICE, 2017b; Broome & Perry, 2002)
	Trust	(Cheung L. , 2015)
	Fair risk allocation	(Broome & Perry, 2002)
Resolving disputes	Communication	(ICE, 2017b)

	Joint problem solving	(ICE, 2017b)
Bonus for early completion	Mutual objectives	(ICE, 2017b)
Whole life costs	Mutual objectives	(ICE, 2017b; Kovacic & Zoller, 2015)
Early contractor involvement	Mutual objectives	(Ahola et al., 2008) Eriksson and Westerberg (2011) (Eriksson, 2008a)
	Trust	(Rahman & Alhassan, 2012)
	No-blame culture	(Rahman & Alhassan, 2012) Eriksson and Westerberg (2011)
	Joint working	(Rahman & Kumaraswamy, 2004b) (Eriksson, 2008a) Eriksson and Westerberg (2011)
	Communication	(Rahman & Kumaraswamy, 2004b) (Eriksson, 2008a)
	Joint problem solving	(Eriksson, 2008a) (Cameron & Duff, 2007)
	Fair risk allocation	(Rahman & Alhassan, 2012)
	Continuous learning	Eriksson and Westerberg (2011)

Appendix F: Basis of connection Project DOEN

In this appendix the underlying basis on the linkages made in conclusion 3.2.3 is explained. In underlying table, each connection is shown with the corresponding source on which it is based. How this table works is explained in appendix E. In the table provided here the same abbreviations for the project managers are used as in chapter 3.2.1 which are PM1 for the project manager from the client and PM2 for the project manager from the contractor.

Table 25: Basis of linkages between Project DOEN and aspects of collaboration

Project DOEN method	**Factor that stimulates collaboration**	**Basis of connection**
Collaborative procurement	Mutual objectives	(Projectteam DOEN, 2016; PM2)
	Trust	(Projectteam DOEN, 2016; PM1; PM2)
	No-blame culture	(Projectteam DOEN, 2016; PM1; PM2)
	Joint working	(Projectteam DOEN, 2016; PM1)
	Communication	(Projectteam DOEN, 2016; PM1; PM2)
	Continuous learning	(Projectteam DOEN, 2016)
Removal of financial pressure	Mutual objectives	(Projectteam DOEN, 2017; PM1)
	Trust	(PM1; PM2)
	No-blame culture	(Projectteam DOEN, 2017; PM1; PM2)
	Joint working	(Projectteam DOEN, 2017; PM1)
Early contractor involvement	Mutual objectives	(Projectteam DOEN, 2016; PM2; PM1)
	Trust	(PM1)
	No-blame culture	(PM2; PM1)
	Joint working	(Projectteam DOEN, 2016; PM2; PM1)
	Communication	(Projectteam DOEN, 2016; PM2; PM1)
	Joint problem solving	(Projectteam DOEN, 2016; PM2)
	Fair risk allocation	(Projectteam DOEN, 2016; PM2)
	Continuous learning	PM2
Joint risk allocation	Mutual objectives	(PM1; PM2)
	Gain and pain sharing	(Projectteam DOEN, 2017)
	Trust	(PM2)
	No-blame culture	(PM1; PM2)
	Joint working	(Projectteam DOEN, 2017; PM1; PM2)
	Communication	(PM2)
	Fair risk allocation	(Projectteam DOEN, 2017; PM1; PM2)

Joint project team	Mutual objectives	(Projectteam DOEN, 2017; PM1; PM2)
	Joint working	(Projectteam DOEN, 2017; PM1; PM2)
	Communication	(Projectteam DOEN, 2017; PM2)
	Joint problem solving	(Projectteam DOEN, 2017; PM2))
	Continuous learning	(PM1; PM2)
Continuous process reflection	No-blame culture	(Projectteam DOEN, 2017; PM2; PM1)
	Communication	(Projectteam DOEN, 2017; PM2; PM1)
	Effective performance measurement	(Projectteam DOEN, 2017; PM2; PM1)
	Continuous learning	(Projectteam DOEN, 2017; PM2)
Continuity	Trust	(Projectteam DOEN, 2017; PM2; PM1)
	Joint working	(PM2)
Joint problem or conflict resolution	Mutual objectives	(PM2; PM1)
	No-blame culture	(Projectteam DOEN, 2017; PM2; PM1)
	Joint working	(Projectteam DOEN, 2017; PM2; PM1)
	Communication	(Projectteam DOEN, 2017; PM2; PM1)
	Joint problem solving	(Projectteam DOEN, 2017; PM2; PM1)
	Effective performance measurement	(PM1)
Optimization incentive	Mutual objectives	(Projectteam DOEN, 2017)
	Gain and pain sharing	(Projectteam DOEN, 2017; PM2)

Appendix G: Case study protocol

In the case studies, semi-structured interviews are used for the exploration of methods that can facilitate or improve collaboration in integrated contracts in the Dutch construction industry. Since both interviewer and interviewee are native Dutch speakers, the protocol is in Dutch. Translations are available on request.

I. Introductie	Doel

- Voorstellen aan elkaar
- Toestemming opnemen interview
- Achtergrondinformatie over het onderzoek geven gezamenlijk met het doel van het interview
- Korte uitleg van de case vragen
  ○ Algemeen verloop van de case
  ○ Bijzonderheden
- Rol van de interviewde binnen het project
	Kennismaking en context van het interview schetsen. Kan worden gebruikt om richtingen te geven aan het interview door bijv. bijzonderheden in de case. Tevens kan het aanvullende achtergrondinformatie over de case opleveren

II. Samenwerking in algemene zin	Doel
1. Hoe is de samenwerking tussen opdrachtgever en opdrachtnemer verlopen gedurende het project? - Wat heb je als positief ervaren binnen deze relatie en wat als negatief? - Was er naar jouw mening voldoende aandacht besteed aan het creëren en faciliteren van goede samenwerking? - Veranderde de intensiteit van samenwerking gedurende het project? Zo ja, waarom?	Algemeen beeld krijgen van het project, de geïnterviewde een context laten beschrijven van de samenwerking binnen het project. Maakt duidelijk hoe de gang van zaken was binnen het project, dit kan gebruikt worden in de vervolgvragen
2. Wat was uw verwachting betreft de relatie tussen opdrachtgever en opdrachtnemer?	Beeld krijgen van hoe is men het project is ingegaan
3. Had de samenwerking tussen opdrachtgever en opdrachtnemer beter gekund? - Zo ja, op welke manier dan? En waarom is dit niet gebeurt? - Zo nee, waardoor is de samenwerking zo goed verlopen?	De geïnterviewde zelf een beeld laten schetsen van wat hij een goede samenwerking vindt en wat hij mogelijk miste in de samenwerking in dit project zonder dat ik methodes aandraag voor samenwerking. Interessant om te bekijken of de geïnterviewde zelf met methodes komt die tijdens de literatuurstudie zijn geïdentificeerd

4. Welke processen / methodes zijn er gebruikt in het project om samen te werken en een goede relatie te creëren? Aannemer vroegtijdig betrekken / duidelijk (schriftelijk) afspreken eerlijk met elkaar om te gaan / duidelijke communicatie afspraken / heldere gezamenlijk gedragen planning / bonus voor vroeg opleveren / scope optimalisatie incentives / delen van winst en verlies / samenwerkingsgerichte aanbesteding / weghalen financiële druk / gezamenlijk risico's alloceren / gezamenlijk project team / doorlopende reflectie / continuïteit / gezamenlijk conflicten oplossen - Wat waren volgens jou de belangrijkste processen / methodes die geresulteerd hebben in de relatie die je gehad hebt met de andere partij? (dan wel positief dan wel negatief)	Een duidelijk beeld krijgen van de gebruikte methodes tijdens de case. Daarnaast een overzicht krijgen welke methodes de geïnterviewde zelf het belangrijkst vindt Het inzicht welke hier wordt verkregen wordt gebruikt om gerichte vragen te stellen in deel 3 van het interview

III. Specifieke methodes voor samenwerking	**Doel**
Algemene uitleg Dit deel van het interview gaat in op de specifieke methodes voor samenwerking welke zijn geïdentificeerd uit de NEC4 ECC en Project DOEN. Methodes die terugkomen in de case worden bevraagd over hoe ze werkten, of ze de samenwerking bevorderd hebben, of ze het gewenste resultaat hebben gehad en of de geïnterviewde aanraadt de methode te gebruiken. Over methodes die niet terugkomen in de case wordt gevraagd waarom een dergelijke methode niet is gebruikt, of de geïnterviewde denkt dat het de samenwerking had kunnen bevorderen (of waarom niet) en of de geïnterviewde denkt dat het toegepast had kunnen worden in de context van het project (of waarom niet)	
Vervolgvragen Bij elk van de onderstaande vragen wordt een vervolgvraag gesteld welke afhankelijk is van het antwoord van de geïnterviewde. Wanneer het antwoord wordt gegeven dat een aspect is toegepast wordt de vraag: **'Werkte dit naar verwachting en voegde het waarde toe aan het project?'** en **'Was dit positief voor de samenwerking en op welke manier?'** gesteld. Wanneer een aspect niet terugkomt wordt de vraag **'Had dit in uw ogen waarde kunnen toevoegen aan het project / de relatie met de andere partij?'** en **'Kan een dergelijke methode naar uw mening worden toegepast in Nederlandse geïntegreerde bouwcontracten?'** gesteld. Ook zal de **'waarom?'**, **'hoe?'**, **'kun je dat toelichten?'**, **'waar bleek dat uit?'** en **'kan je er een voorbeeld van geven?'** vragen worden gesteld om een duidelijk beeld van de situatie te krijgen. Het doel hiervan is om inzicht te krijgen of elk van de geïdentificeerde methodes samenwerking kan bevorderen en als dat mogelijk is op welke manier ofwel welke factoren voor goede samenwerking (geïdentificeerd in de literatuurstudie) de methode kan stimuleren. Door dit te doen wordt de tabel uit de conclusie van hoofdstuk 3 getoetst.	
5. Is de aannemer in een vroeg stadium betrokken geweest bij het project?	Identificeren of er sprake was van 'early contractor involvement' en in hoe verre dit positief is (kan zijn) voor samenwerking

6. Is er in het begin van het project expliciet uitgedrukt op welke manier jullie wilden samenwerken (bijv. eerlijk en best-for-project)	Identificeren of er sprake was van een 'good faith obligation' en in hoe verre dit positief is (kan zijn) voor samenwerking
7. Zijn er duidelijke afspraken gemaakt betreft communicatie waar beide partijen zich in kunnen vinden?	Identificeren of er sprake was van goede 'communications' en in hoe verre dit positief is (kan zijn) voor samenwerking
8. Is er een duidelijke planning bestaande uit deadlines die breed draagvlak hebben en beide partijen haalbaar vinden?	Identificeren of er sprake was van een goede 'programme and planning' en in hoe verre dit positief is (kan zijn) voor samenwerking
9. Waren er incentives (prikkels) om de scope te optimaliseren? - Zo ja, wat waren deze incentives? (pain/gain, bonus, vast winstbedrag)	Identificeren of er sprake was van 'scope optimalization' en in hoe verre dit positief is (kan zijn) voor samenwerking
10. Is er aandacht besteed aan het creëren van een goede relatie / basis voor samenwerking tijdens de aanbestedingsfase?	Identificeren of er sprake was van 'collaborative procurement' en in hoe verre dit positief is (kan zijn) voor samenwerking
11. Was het financiële belang zo veel mogelijk buitenspel gezet om conflicten over kosten te voorkomen?	Identificeren of er sprake was van 'removal of financial pressure' en in hoe verre dit positief is (kan zijn) voor samenwerking
12. Werden de risico's gezamenlijk gealloceerd op een manier welke als eerlijk werd beschouwd door beide partijen?	Identificeren of er sprake was van 'joint risk allocation' en in hoe verre dit positief is (kan zijn) voor samenwerking
13. Was het project team een geïntegreerd project team bestaande uit individuen van zowel de opdrachtgever als de opdrachtnemer waarin bijvoorbeeld sommige rollen maar 1x voorkomen?	Identificeren of er sprake was van 'joint project team' en in hoe verre dit positief is (kan zijn) voor samenwerking
14. Was er gedurende het project constante reflectie op zowel het project als het proces?	Identificeren of er sprake was van 'continuous process reflection' en in hoe verre dit positief is (kan zijn) voor samenwerking
15. Was er continuïteit in het project team waardoor mensen elkaar beter wisten te vinden en vertrouwen/kennis behouden bleef?	Identificeren of er sprake was van 'continuity' en in hoe verre dit positief is (kan zijn) voor samenwerking
16. Werd er aandacht besteed om problemen of conflicten gezamenlijk te voorkomen?	Identificeren of er sprake was van 'joint problem or conflict resolution' en in hoe verre dit

- Werd er expliciet aandacht aan besteed om de andere partij te helpen met het managen/voorkomen van risico's? - Wanneer problemen of conflicten waren gedurende het project werden ze dan gezamenlijk opgelost op een manier die voldoening gaf voor beide partijen?	positief is (kan zijn) voor samenwerking

IV. Weging van methodes	**Doel**
17. Van de zojuist besproken methodes voor samenwerking, welke zijn volgens u methodes die het belangrijkst zijn voor goede samenwerking?	Bepalen of er methodes zijn waarvan de geïnterviewde denkt dat die goed kunnen werken om samenwerking te verbeteren
18. Zitten er tussen de zojuist besproken methodes methodes tussen waarvan u denkt dat die moeilijk zijn te implementeren in de Nederlandse bouwsector? - Zo ja, waarom?	Bepalen of er methodes zijn waarvan de geïnterviewde denkt dat die niet goed zal werken om samenwerking te verbeteren in de Nederlandse bouwsector

V. Open vragen / discussie	**Doel**
19. Zijn er andere dan de zojuist besproken methodes of processen gebruikt om de samenwerking in het project te faciliteren of verbeteren?	Inzicht krijgen of er methodes zijn gebruikt voor goede samenwerking buiten de geïdentificeerde methodes uit NEC4 ECC en Project DOEN. Hierdoor kan een bredere aanbeveling worden gedaan zowel aan de bouwsector als voor vervolgonderzoek
20. In hoe verre hebben deze methodes of processen invloed gehad op de samenwerking?	Een inzicht krijgen over hoe veel invloed deze methodes of processen hebben gehad hierdoor kan bepaald worden hoe significant deze methodes zijn

VI. Afsluiting	**Doel**
- Uitwerking ter validatie opsturen - Anonimiteit garanderen als gewenst - Mogelijk tot aanvullende vragen per mail bespreken - Mogelijke interesse in het uiteindelijke rapport bespreken	Laatste formaliteiten regelen en de mogelijkheid tot nader contact over de mail bespreken

Appendix H: Case 1 semi-structured interview results

Not available in public version

Appendix I: Case 2 semi-structured interview results

Not available in public version

Appendix J: Case 3 semi-structured interview results

Not available in public version

Appendix K: Case 1 – data analysis and interpretation

In this appendix the data gathered in the cases in analysed and interpreted. This is done based on the factors of collaboration as defined in paragraph 2.4. For each factor of collaboration methods are identified that correlate with this factor. All correlations that are mentioned by at least half of the respondents for that case are elaborated here. Correlations that are mentioned by less than half of the respondents are not further elaborated because they can either be mentioned by chance or were not very important in the project. The goal of this analysis and interpretation is to provide the reader with a clear insight into how table 6 is created, what the basis and source of the connections in this table are, and what these connections mean in a broader context.

1. **Mutual objectives**
   - **Early contractor involvement**: all the interviewee's stated that there was a connection between mutual objectives and early contractor involvement. Both client respondents and contractor respondents indicate that early and active contractor involvement was key in creating mutual goals (statement 2, 6, 8 and 12, 16, 21, 22 respectively). This shows that the method was perceived similarly by all respondents which strengthens the likelihood that these benefits exists and are not mentioned by chance.

   - **Optimization incentive**: two respondents argue that optimization incentives deviate the contractor from mutual goals (statement 24, 27). This is however mainly because incentives were not necessary in the case (statement 23, 26, 27). Therefore the true effect of this method remains uncertain.

   - **Joint risk allocation**: three of the four respondents stated this connection. The fourth respondent was not involved in the joint risk allocation. Therefore it said that all respondents who were involved in the joint risk allocation indicated that connection existed. The client and contractors state that due to this method they were able to find solutions that satisfied both parties (statement 29 and 32, 33 and 35 respectively). Which indicates that they were able to fulfil mutual project goals and the goals of the parties respectively.

   - **Joint problem or conflict resolution**: this connection is only stated by the contractor respondents. They state that by discussing the problem together, and trying to solve it jointly, a better understanding of each other is obtained (statement 43, 48). It enabled the teams to make best-for-project solutions or even identify minor issues before they became problems (statement 49, 50). Interesting is that the clients did not state this connection. They mainly experienced the ability to better and quicker solve problems due to this method (statement 40, 41).

   - **Good faith obligation**: client and contractors stated that this method enabled them to be on the same page and enter the project in a like-minded way with mutual understanding (statement 51, 52, 53). Having a like-minded start allowed them to start the project in a collaborative way, the client states (statement 52). This is a strong indicator that this method might create a basis for good collaboration.

- **Programme and planning**: all of the respondents stated that a programme and planning scheme helped them to set mutual goals or solve problems in a way that suited these mutual goals. The clients stated that due to the planning the mutual objective could be served (statement 70, 72, 73). The contractor respondents state that the planning was a clear expression of the mutual goal and was used as a premise in all decisions made, allowing them to meet the deadlines (statement 74, 75).

- **Collaborative procurement**: all respondents stated that collaborative procurement allowed them to set mutual goals. One client and contractor respondent stated that collaborative procurement allowed them to create a process together and thereby create a process they both wanted to have (statement 78, 79, 87 respectively). The other client respondent states that because they could share their problem early on, the contractor was fully aware of what was expected of them (statement 83). Both contractors even state that it allowed them to add value to the project and optimise the process (statement 91, 95 and 96). This method caused a high level of involvement in the teams which contributed to the creation of a clear mutual goal (statement 93).

- **Removal of financial pressure**: Three respondents stated that this connection was present. Both client and contractor stated that this method allowed them to work better together and make best for the project decisions (statement 98 and 101 respectively). The other contractor respondent states in that due to this process this project had a calm and pleasant working atmosphere (statement 105).

- **Joint project team**: all respondents in this case stated that having a joint project team helped them to create mutual goals. The clients state that this method was enabled the parties to jointly work on the mutual objectives (statement 107, 109, 112, 115). Similarly, the contractor state that this method helped to create mutual goals and act accordingly to these goals (statement 118, 121).

2. Gain and pain sharing

- **Joint risk allocation**: One client and one contractor stated this connection. The client states that difficult risks were discussed until an allocation with control measures was found that satisfied both parties (statement 29). One contractor respondent explains that because they helped each other with the risks (‘pain’) they were able to do jointly what was economically in best interests of the project (‘gain’) (statement 35).

- **Joint problem or conflict resolution**: two respondents stated that this connection existed. A client respondent stated that because they understood each other’s pain they could create gain by better managing risks (statement 41). The contractor respondent states that helping each other and thinking along worked both ways to create best for project solutions (statement 43).

3. Trust

- **Early contractor involvement**: all respondents stated that this connection exists. One client stated that the contractor received the responsibility to make the contract (statement 1, 2). It enabled them to make a solution best for all involved, creating trust among the teams. As a result, the client did not have to constantly check the

contractor (statement 10). Overall this method allowed them to form a real team and better understand each other by sharing expertise and experiences (statement 12, 15, 20).

- **Joint risk allocation**: two respondents stated that this connection existed, one from the client and one from the contractor. The client stated that the joint risk allocation enabled them to allocate the risks in a way that satisfied both parties (statement 29, 30). The contractor states similarly that the risk allocation was done jointly, trust was the key word in this process (statement 31).

- **Joint problem or conflict resolution**: three of the respondents stated this connection. Both client and contractor explain that they separated the contractual from the construction process. Due to this, the contractual discussions had no influence on the relation, atmosphere and trust in the project (statement 38, 47). The contractors stated that this method allowed them to help each other and create best-for-project solutions by thinking along with each other actively (statement 42, 43, 46, 48).

- **Communications**: three respondents stated that proper communication helped them to gain trust among the teams. Both the client and contractors stated that by because the everyone was open and honest in their communication and kept its promises they started to trust each other, giving confidence to the team and forming the basis for collaboration (statement 57, 59, and 61, 63, 69 respectively).

- **Collaborative procurement**: all respondents stated that collaborative procurement resulted in trust among the teams. The clients state that the contractor was chosen because the client trusted this contractor (statement 77 and 82). Both client and contractor stated that this method formed the basis for trust and understanding among the teams (statement 80, 84, 86 and 89, 90, 94 respectively).

- **Removal of financial pressure**: one client and one contractor responded stated this connection. Both the client and contractor state that this method allowed them to work based on trust due to the removal of financial pressure (statement 98, 100 and 103 respectively).

- **Joint project team**: one client and one contractor responded stated this connection. The client states that this method helped to get to know each other better and form respect towards each other (statement 108, 110). The contractor mainly states that the trust this method brought enabled them to go the extra mile (statement 116, 117).

- **Continuity**: all respondents stated the existence of a linkage between continuity and trust. All respondents stated similarly that continuity is important to keep trust in the team (statement 129, 130, 132, 133). This method thus might be beneficial to keep trust in the team, but not to form trust within the team.

4. No-blame culture

- **Early contractor involvement**: all respondents stated that this connection existed in the project. The clients state that the contractor had to make the contract. Due to this,

they were fully aware of the situation preventing discussions during execution (statement 4, 8). Similarly, the contractors state that due to this method they better understood each other and thereby avoid conflict (statement 12, 14, 20).

- **Joint risks allocation**: one client and one contractor stated this connection. They both state that this process allowed them to discusses risks in all openness to ensure the parties were not faced with unpleasant surprises (statement 29 and 31 respectively).

- **Joint problem or conflict resolution**: three respondents stated that the joint problem solving helped them create a no-blame culture. Both the client and contractors stated that this mainly was because due to this method they better understood each other, thereby avoiding unpleasant discussions (statement 41 and 42, 44, 45, 49, 50 respectively). Also, one contractor states that separating financial and project discussions helped them to keep a positive relation and atmosphere (statement 47).

- **Good faith obligation**: one client and one contractor respondent state this connection. They both state that this method mainly causes that the parties start the project like-minded enabling them to collaborate (statement 51, 52).

- **Communications**: one client and one contractor stated this connection. They both state that by being open and honest they had a good relation (statement 56, 61, 63). The client also states that they separated contractual and technical procedures. By doing so the process could not negatively influence the other (statement 55).

- **Programme and planning**: only both contractors stated this connection. They state in a similar way that due to the method they could clearly discuss problems, create mutual understanding and prevent unpleasant surprises (statement 74, 75).

- **Collaborative procurement**: all respondents stated this connection. Both client and contractor state that because they created the process together at the start of the project they could make a process that suited both parties best and as a result they also better understood each other (statement 78, 86 and 89, 91, 95 respectively).

- **Removal of financial pressure**: this connection is stated by one client and two contractors. The client stated that most conflicts are about costs and due to this method they were able to prevent such conflicts (statement 99). The contractors state that everyone understood where the costs came from and thus there were no unpleasant surprises about costs resulting in conflicts (statement 102, 104, 105).

- **Joint project team**: one client and one contractor stated this linkage. The client emphasises that this method resulted in respect and appreciation among the teams (statement 110, 111). The contractor states that in a team it is important to get to know all individuals. By better understanding people you can respect each behaviour and thereby reduce conflict (statement 119).

- **Continuous process reflection**: one client and two contractors stated this connection. They both state that this method allowed them to better understand their own and

each other's behaviour (statement 123, 126, 127). It ensured that no negative feelings remained within the team (statement 124). This was beneficial for their collaboration and it helped them align their visions.

5. **Joint Working**
   - **Early contractor involvement**: all respondents stated that joint working was stimulated by early contractor involvement. Both client and contractor state that because of this method the teams started to work jointly from the start of the project and thereby jointly create a solution (statement 1, 2, 3, 7 and 12, 18, 19 respectively).

   - **Joint risk allocation**: one client and one contractor stated this connection. The client states that the method allowed them to work together by creating mitigation measures that suited both (statement 29). The contractor explains that it enabled them to combine expertise and jointly create a better solution (statement 35).

   - **Joint problem or conflict resolution**: one client and both contractors stated this connection. Both client and contractors state briefly that this method enabled them to solve problems jointly as a result of thinking along with each other (statement 39 and 45, 48 respectively).

   - **Collaborative procurement**: all respondents stated that this method stimulated joint working. Both the clients and the contractors stated that due to this method they were able to work jointly from the start of the project enabling them to create a process together (statement 78, 81, 85 and 87, 88, 92, 95, 96 respectively).

   - **Removal of financial pressure**: one client and both contractor respondents stated this connection. The client mainly states that by removing the financial pressure the change of conflict can be reduced enabling you to better work together (statement 98). The contractors place focus on that due to this method they were able to jointly create a solution and optimise this solution (statement 102, 103).

   - **Joint project team**: all respondents stated that a joint project team stimulates joint working. Both the client and contractor respondents state that because the teams were (especially at the start of the project) a joint team they could successfully work together (statement 107, 110, 113, 114 and 118, 120 respectively).

   - **Continuity**: both clients and one contractor stated that continuity is important to keep successfully working together during the project (statement 129, 130 and 132 respectively). Also, one client stated that when continuity could not be maintained they worked together to find a suitable replacement (statement 131).

6. **Communication**
   - **Early contractor involvement**: all respondents stated the existence of this linkage. The clients and contractors state similarly that this is mainly because the contractor was actively involved from the start of the project stimulating discussions to optimise the process (statement 2, 8 and 12, 19, 22 respectively).

- **Joint risk allocation**: one client and both contractor respondents stated the existence of this linkage. They state similarly that this method allowed them to open the discussion about the risks resulting in a better risk mitigation and corresponding control measures (statement 28, 29, 31, 32, 33).

- **Joint problem or conflict solving**: all respondents stated that this connection was present. The clients state that because they separated contractual and technical communication these two communication lines could not negatively influence each other (statement 37, 38). One client and both contractors state that due to this method they could communicate problems and obtain a understanding of the problem, allowing them to better solve it (statement 41 and 44, 48, 50 respectively).

- **Good faith obligation**: one client and both contractors stated this connection. All three state similarly that this method opened the discussion about how to collaborate, resulting in a like-minded start and managed expectations (statement 51, 52, 53).

- **Communications**: all respondents stated this (more obvious) linkage. The respondents state that their communication was good for collaboration because it was open, honest and clear (statement 54, 56, 57, 58, 59, 61, 63), direct (statement 60, 62, 64), everyone dared to discuss everything (statement 67), and there was bilateral contact between the disciplines (statement 69).

- **Programme and planning**: all respondents experienced this connection. Both client and contractor stated that this method provided a clear communication tool to show the process and keep everyone up-to-date (statement 72 and 76 respectively). Also, this method resulted in open discussions regarding the possibilities with the planning, due to this no unpleasant surprises occurred (statement 70 and 74 respectively).

- **Collaborative procurement**: all respondents stated that collaborative procurement stimulated communication. Both client and contractor state similarly that this is because from the start of the project they had an active and joint process enabling them to communicate about how the process could be optimised (statement 78, 83, and 87, 89, 91, 95 respectively).

- **Joint project team**: All four respondents explained that having a joint project team enabled them to communicate better. Both client and contractor state that due to this method there was more formal and informal communication which enabled them to get to know each other better, solve problems more effectively and prevent unpleasant surprises (statement 107, 108, 113, and 118, 120, 121 respectively).

- **Continuous process reflection**: all respondents stated this connection existed. However, both client and contractor stated that no formal reflection was needed, all reflection was informal and all matters were discussed immediately (statement 122, 125, and 126, 128 respectively). This shows that the informal reflection resulted in more and direct communication. The effects of formal reflection remain uncertain.

- **Continuity**: both contractors state that this connection was present. They state that continuity is important for communication because without it you have to re-build relationships and get to know each other again (statement 132, 133). Continuity can thus be beneficial to keep good communication and not to obtain good communication according to these statements.

7. Joint problem solving

- **Early contractor involvement**: all respondents stated that this linkage existed. Both client and contractor state that due to this method they could solve problems jointly from the start of the project enabling them to make optimal solutions and to quickly solve problems (statement 2, 3, 5, 7, 11 and 12, 15, 18, 21 respectively).

- **Joint risk allocation**: one client and one contractor stated this connection. They both state similarly that due to this method they helped each other control the risks and solve problems together when the risk occurred (statement 30 and 35 respectably).

- **Joint problem or conflict resolution**: all respondents stated this connection. The client state that because they separated the technical and contractual part they were able to solve problems jointly while not negatively influencing the other process (statement 37, 38). One client and both contractors state that by discussing matters as soon as possible they were able to successfully solve problems jointly or prevent problems from occurring (statement 39, 40 and 43, 45, 48, 50 respectively).

- **Communications**: one client and one contractor stated the existence of this linkage. Both state similarly that direct contact helped them to solve problems effectively and create best-for-project solutions (statement 60 and 64, 67 respectively).

- **Programme and planning**: one client and both contractors stated this connection. The client stated that due to the constant joint consultation on the planning they could identify and solve problems quickly (statement 70). The contractors state similarly that the planning helped to jointly identify and solve problems (statement 74, 75).

- **Collaborative procurement**: two respondents state this linkage, one client and one contractor. They both state similarly that because the parties made the contract together they could solve and prevent problems in the earliest stage of the project and thereby create win-win situations (statement 79 and 87 respectively).

- **Joint project team**: all respondents stated this connection. Both client and contractor stated that during the execution, when they worked as two separate teams with a lot of direct communication, they were able to solve problems quickly and efficiently because the client was often on site and the different disciplines had direct (bilateral) contact with each other (statement 106, 114 and 118, 120 respectively).

8. Fair risk allocation

- **Early contractor involvement**: one client and one contractor stated that early contractor involvement helped them to create a fair risk allocation. Both state that

because the contractor was involved early on risks could be managed properly and thereby allocated properly (statement 3 and 14 respectively).

- **Joint risk allocation**: one client and two contractors stated this connection. The client that did not mention the connection was not active in this part of the project and therefore did not make a statement. Both the client and the contractors explain that due to this method risks could be allocated logically in a best-for-project way and control measures could be created that satisfied all (statement 28, 29 and 31, 32, 33, 34, 35 respectively).

- **Removal of financial pressure**: one client and one contractor stated this connection. The client stated that due to this method the pressure regarding risks is taken away, as a result the contractor did not have to take on large risks (statement 97, 98). The contractor adds that it was clear where the costs of these risks originated from, enabling them to make clear and proper control measures (statement 104).

9. Effective performance measurement

- **Communications**: both clients and one contractor stated this connection. Both clients state that due to the open and clear communication they always were fully aware of the state of the project (statement 56, 58). The contractor states similarly that the bilateral contact ensured that the entire team was up-to-date (statement 69).

- **Programme and planning**: all respondents stated that this connection existed in their project. Both clients state that the because the planning was constantly updated it enabled them to have a continuous insight into the status of the project (statement 70, 72). Similarly, the contractors state that the planning allowed them to clearly communicate how the works were proceeding and what possible future problems where (statement 72, 74, 76).

10. Continuous learning

- **Early contractor involvement**: both clients and one contractor stated this linkage. The contractor states that because they created the project together they could learn from each other and exchange expertise resulting in new insights (statement 12, 17). Similarly, both clients state that because they could create the project together they could increase the feasibility of the solution and reduce failure costs (statement 3, 11).

- **Continuous process reflection**: Both contractors stated this connection. They state that by means of reflection they learned to better understand the client which helped to align their visions (statement 126, 127).

Appendix L: Case 2 – data analysis and interpretation

The data analysis and interpretation conducted in this chapter is executed in a similar way as in appendix K. An explanation of how the analysis and interpretation is conducted and what the goal of the analysis is can be found in that chapter. The difference between the chapters is that this chapter focusses on analysis and interpretation of the data from case 2.

1. **Mutual objectives**
   - **Early contractor involvement**: all respondents stated this connection. Both client and contractor state similarly that this method helped them to create mutual goals (statement 135, 137 and 141, 144). This enabled them to optimise (statement 135), kick-off collaboration (statement 137), create win-win situations (statement 141) and obtain better solutions (statement 144).

   - **Optimization incentive**: one client and both contractors stated this connection. The client stated that this method can be used to place emphasis on one goal and as a result a mutual goal can be created out of this goal (statement 145). Both contractors state similarly to the client that the method can be used to place emphasis on a goal and thereby create better solutions for this goal, they explicitly state safety as an example for which a mutual goal can be created (statement 152, 153).

   - **Programme and planning**: both clients stated this connection. The method helped them to create solutions best for the mutual objective (statement 200) and even create win-win situations by matching their objectives (statement 202). Interestingly, the contractors do not state this, they mainly state that the method is a good discussions tool.

2. **Gain and pain sharing**
   - **Optimization incentive**: both contractors stated this connection. Both explain that a pain/gain method can be useful for complex risks that are important for both parties, for instance safety. They state that they you share this risks (pain) you can create a better solution that benefits both parties (gain).

3. **Trust**
   - **Early contractor involvement**: one client and both contractor state very similarly that early contractor involvement helped to set the basis for good collaboration and trust among the teams (statement 138, 142, 143). It is interesting that they state this in such a similar way which indicates that they experienced the process in the same way.

   - **Optimization incentive**: all respondents stated a negative relation between this method and trust. Both clients explain that when you have good collaboration or trust among the teams this method should not be necessary (statement 147, 150). Both contractors state that when for instance fines are used on (semi) deadlines it displays distrust to the contractor (statement 151, 154). This is interesting because according to the respondents this method has several benefits, but without due care it can cause distrust.

- **Joint problem or conflict resolution**: one client and one contractor stated this connection. They both state similarly that by solving problems together the trust level in the team increased (statement 166, 167, 173). The contractor also stated that solving problems together strongly correlates with trust (statement 173). This indicates that it is likely that this connection might exists in practice.

- **Programme and planning**: both contractors stated this linkage. One client states that due to this method they had a good insight in the contractors process. Because the contractor was this transparent and realistic they earned the trust of the client (statement 198, 199, 201). The other clients adds that because this helped each other meet deadlines trust was formed within the team (statement 203).

- **Collaborative procurement**: in this project there was no collaborative procurement. However, both clients state that it could have added value to the project. One client stated that forming trust in the beginning of the project is very important (statement 212) and that this method can help create this trust (statement 214). Both the clients state that this method can form the basis for trust (statement 210, 213).

- **Continuity**: both the clients and the contractors stated this connection. All four state similarly that continuity is important in the project, without continuity trust has to be regained when new people enter the project (statement 234, 235, 237, 238). This method thus not create trust, but it can keep trust in the teams.

4. **No-Blame culture**
   - **Early contractor involvement**: one client and both contractors stated this connection. The client states that the method enabled them to help each other and thereby better understand each other (statement 136, 139). This reduced irritations and set the basis for good collaboration. The contractors state that due to this method they better understood the client (statement 144) enabling them to have a good relation and collaboration resulting in a more enjoyably project (statement 140, 142, 143).

   - **Joint risk allocation**: one client and one contractor stated this linkage. The client states that the open communication of risks improved the their relation with the contractor (statement 156). The contractors explains that due to this method you can start the project positively because they felt treated fairly as contractor (statement 161).

   - **Joint problem or conflict resolution**: all respondents stated this connection. Both clients state that due to this method they could make all problems discussable and thereby gain understanding of the view of the other party which improved the collaboration (statement 163, 165). Also, one client states that they quickly escalated difficult problem to prevent that this had a negative impact (statement 162). The contractors state that this method helped to understand each other, smooth out the process and thereby prevent irritations (statement 168, 170, 171)**.**

   - **Good faith obligation**: one client and both contractors state this connection. The client states that due to this method you better understand each other and it can be used to boost the project in the right direction (statement 176, 177). The contractors

state that due to this method you can enter the project in a good spirit and gain understanding among the teams which enabled them to better work together (statement 178, 179, 180).

- **Communications**: all respondents stated this linkage. Both clients stated that due to open, honest and professional communication they better understood each other, enabling them to reduce the chance of conflicts and solve problems respectfully (statement 182, 184, 187, 188, 189). The contractors state similarly that the method helped to understand the other party and reduce irritations (statement 193, 195).

- **Programme and planning**: one client and one contractor stated this connection. The client and contractor both stated that this method enabled them to better understand each other (statement 202 and 207 respectively).

- **Removal of financial pressure**: this method was not used in the project, however one client and both contractors stated that it could have had several benefits in the project. All three state that this method could have avoided unpleasant discussions about that finances allowing them to focus on the project (statement 219, 220 221). Due to this they could have had a positive working relation (statement 221).

- **Continuous process reflection**: all respondents stated that this method helped to create a no-blame culture. The both the clients and contractors state very similarly that this method enabled them to discuss irritations due to which they better understood each other and could resolve the irritation together (statement 226, 229, 230 and 231, 232 respectively).

5. **Joint working**
   - **Early contractor involvement**: both the clients and contractors stated this connection. The clients and contractors state similarly that this method allowed them to work together from the start, resulting in a optimised and better solutions (statement 135, 137, 139 and 141, 144 respectively).

   - **Joint risk allocation**: Both clients and one contractor stated this linkage. The clients state that the method enabled the parties to discuss the risks together and help each other manage the risks (statement 155, 157). The contractor adds that it enabled the parties to help each other manage the risks (statement 159).

   - **Joint problem or conflict resolution**: All respondents stated this linkage. The clients state that the method helped them to solve problems jointly in a successful way (statement 164, 166). The contractors mainly focus on that jointly working on a problem often results in a better solution and a pleasant working atmosphere and they therefore encourage doing so (statement 169, 170, 171, 172).

   - **Good faith obligation**: both clients and one contractor stated this connection. Both clients state that this method can help set the basis for good collaboration and joint working because it provides clear expectations (statement 174, 176). The contractors

provides a similar insight, he states that by sharing expectations regarding collaboration the parties are better able to collaborate (statement 180).

- **Communications**: one client and one contractor stated this connection. The client stated that due to good communication they were able to work together on problems and find solutions together (statement 184). The contractor state that due to good communication they could jointly make discussions effectively and that without good communication working together is not possible (statement 191, 192).

- **Programme and planning**: one client and one contractor stated this linkage. The client stated that when the planning is updated jointly you obtain a more realistic and up to date planning (statement 200). The contractor stated that when the planning is discussed jointly win-win situations can be created (statement 206). This indicates that the method does not necessarily stimulates joint working, but when the teams jointly work on the planning potential benefits can be obtained.

- **Collaborative procurement**: this method was not used in the project, yet all respondents stated that it could have stimulated joint working if it was used. Both clients stated that this method stimulated joint working from the start of the project (210, 212, 213). The contractors that the method even helps to better work together (statement 215, 216). This indicates that the method might stimulate and improve joint working.

- **Joint project team**: in this project there was no joint project team. Yet, the client states that having two teams can also stimulate joint working as long as there is direct communication (statement 223). The contractors stated having a joint project team can cause the team members to better work together (statement 224, 225). It is interesting that the contractors mention these benefits where the client does not, this indicates a difference in perception and willingness to fully collaborate.

- **Continuous process reflection**: one client and one contractor stated this connection. They both state similarly that due to this method irritations could be removed from the project allowing the teams to better work together (statement 229 and 232 respectively). This shows that this method does not stimulate joint working, but it can improve it.

6. Communication

- **Early contractor involvement**: both clients and one contractor stated this connection. One client mainly states that this method stimulated the start of communication early on (statement 135). The other client and the contractor stated that by having communication early on they were able to successfully start the project and collaborate (statement 138 and 140 respectively). This indicates that this method might stimulate communication and that having this early communication helps to create good collaboration.

- **Joint risk allocation**: all respondents stated this connection. The client stated that this method resulted in open communication regarding the risks (statement 155, 156, 157,

158). The contractors state that this method enabled them to share expertise and open the discussion about risks resulting in better control measures (statement 159, 161). This shows that the method can both stimulate communication and cause better control measures due to this communication.

- **Joint problem or conflict resolution**: both the clients and the contractors stated this linkage. The clients stated that this method enabled them to make problem discussable and jointly discuss what the best solution would be (statement 163, 164, 165). The contractors stated that the communication helped to solve problems timely in a better way (statement 168, 171) which shown that this method had different benefits for both parties, but was overall good for the project.

- **Good faith obligation**: all respondents stated this connection. Both the clients and the contractor state similarly that this method helped to open the discussions about how to collaborate (statement 174, 175, 176, 177 and 178, 179 , 180). This helped them to create clarity among the project teams and start the project with good collaboration and communication (statement 176, 178, 179, 180).

- **Communications**: all respondents stated this (more obvious) connection. They stated that direct and clear (statement 182), professional (statement 184), timely (statement 185, 190, 195), open and honest (statement 189) communication helped them to have proper communication in the project. This helped them to solve problems more effectively (statement 193, 196) and ensure that everyone was up-to-date (statement 186, 194, 197).

- **Programme and planning**: each of the respondents stated this connection. The clients stated that they could use this method as a communications tool and discuss the current state of the project (statement 201, 202) enabling them to create win-win situations. Similarly, the contractors explain that the planning can be used as a communication tool due to which potential benefits can be obtained and everyone can be kept up-to-date (statement 205, 206, 207).

- **Collaborative procurement**: this method is not used in the project, despite this one client and one contractor stated that it could have been beneficial for collaboration. The client states that it could enable them to obtain input of both parties and thereby create an optimal process (statement 208, 210). The contractor stated that it would enable them to communicate more effectively (statement 215)

- **Joint project team**: in this project there was no project team, still all respondents state that this connection exists. The clients state that direct communication between the teams enables quick decision making (statement 222, 223). The contractors state that a joint team shorten the communication lines and results in more effective communication (statement 224, 225).

- **Continuous process reflection**: all respondents stated this connection. Both the clients and the contractors state similarly that this method helps to open the

discussion about irritations or misunderstandings, this helped to maintain a positive working atmosphere (statement 226, 229 and 231, 232 respectively).

- **Continuity**: both the clients and the contractors stated this linkage. They state similarly that continuity helps to maintain open and effective communication in the project (statement 234, 235, 237, 238). From this it follows that continuity does not provide good communication, but it can maintain it when it is achieved.

7. Joint problem solving

- **Early contractor involvement**: all respondents stated this linkage. Both clients and contractors stated similarly that this method enabled them to solve problems early on in the process jointly and effectively (statement 135, 138 and 140, 142, 143, 144 respectively).

- **Joint risk allocation**: one client and both contractors stated this risk. The client states that this method enabled them to best tackle problems at hand (statement 156). The contractors mainly state that this method enabled the parties to jointly make control measures and thereby prevent problems from occurring (statement 159, 161).

- **Joint problem or conflict resolution**: all respondents stated this (more obvious) connection. Stated is that the method enabled the parties to faster and better solve problems (statement 163, 164), create solutions that are best for both parties (statement 165, 169, 172) and create a better working atmosphere (statement 170, 171).

- **Communications**: both the clients and the contractors stated that this method enabled them to solve problems jointly, quickly and effectively (statement 183, 188 and 193, 196 respectively). This shows that communicating is essential to solve problems in a joint way.

- **Collaborative procurement**: this method was not used in this project. Still, one client and both contractors stated that it could have been beneficial in the project. The client states that it would help to solve problems in the earliest stage of the project (statement 213). The contractors state that it would enable them to better solve problems together (statement 215) and create better solutions (statement 216).

- **Joint project team**: there was no joint project team in this project. The clients state however that when there are two teams that communicate directly can also result in joint problem solving (statement 222, 223). The contractors state that it joint project team would be beneficial for joint problem solving as it promotes quicker and better problem solving because the problem can be solved jointly (statement 224, 225).

- **Continuous process reflection**: one clients and both contractors stated this method. The client stated that due to reflection they were able to solve problems together more effectively (statement 230). The contractors state similarly that the method enabled them to solve irritations and other problems together (statement 231, 232).

8. **Fair risk allocation**
   - **Joint risk allocation**: all respondents stated this connection. The clients place focus on communication, when the risks are always communicated and all information is provided a fair risk allocation can be made (statement 156, 157). The contractors state that when a risk allocation is done jointly you can create a fairer risk allocation because you can make a better estimation of the risks (statement 159, 161).

9. **Effective performance measurement**
   - **Communications**: one client and both contractors stated this linkage. The client stated that periodic meetings created clarity in the process of the project (statement 181). Both the client and the contractors also state that they always mailed to everyone in the project team ensuring that everyone was up-to-date and that were no unpleasant surprises (statement 186 and 194, 197 respectively).

   - **Programme and planning**: all respondents stated this connection. One client states that this method provides clarity in the process enabling them to properly plan ahead (statement 198). The other client and the contractors state that this method ensures everyone was up-to-date about how the project is doing (statement 204 and 205, 207 respectively).

10. **Continuous learning**
   - **Continuous process reflection**: both clients stated this connection. They state that this method enabled them to better learn to understand each other and to learn from their own behaviour (statement 226, 230). Due to this they had experienced a smooth process and effective problem solving.

Appendix M: Case 3 – data analysis and interpretation

The data analysis and interpretation conducted in this chapter is executed in a similar way as in appendix K. An explanation of how the analysis and interpretation is conducted and what the goal of the analysis is can be found in that chapter. The difference between the chapters is that this chapter focusses on analysis and interpretation of the data from case 3.

1. **Mutual objectives**
   - **Optimization incentive**: the contractor states that a pain/gain mechanism allows you to experiment and optimize, due to this mutual goals can be defined (statement 246).

   - **Joint problem or conflict resolution**: both client and contractors stated this connection. The client states that it enabled them to experiment and create an innovative work that better meted their needs (statement 252). The contractors stated that it helped to place focus on what was important, and it allowed them to solve mutual goals and create new ones (statement 253, 255).

   - **Good faith obligation**: the contractor stated that this method enabled them to set mutual goals because it creates clarity on what the benefits are of good collaboration (statement 258). The client does not state this and focusses on preventing miscommunication due to this method.

   - **Communications**: the contractor stated that having informal contact is the backbone of good collaboration, it allows the teams to be on integrated team with mutual goals (statement 270).

   - **Collaborative procurement**: Even though there was no collaborative procurement method used in this project both the client and the contractors state this linkage. The client states that the method can help create mutual goals in the tender phase (statement 277). Similarly, the contractor explains that in the process of this method clear common goals can be formed resulting in optimizations (statement 279).

2. **Gain and pain sharing**
   - **Joint problem or conflict resolution**: the client stated that due to this method they could be lenient to the contractors sometimes when they were not obliged to. Due to this the client believes that the contractor would go the extra mile for them on other aspects (statement 251). Because they shared the pain on one point they could have gains on another aspect.

3. **Trust**
   - **Early contractor involvement**: the client states that this method enables the client to help to contractor solve complex issues. This can create a basis of trust among the teams (statement 242).

   - **Optimization incentive**: the contractors state that this method can cause distrust. He explains that it can be counterproductive because (or instance) fines only result in people proofing to you what they did, showing a lack of trust form the client (statement 245).

- **Joint problem or conflict resolution**: the client states that by understanding the problem of the other party and solving it together can create trust among the teams (statement 250).

- **Communications**: both the client and the contractor stated this connection. The client states that open and informal communication stimulates trust among team members (statement 264). The contractor explains similarly that active and positive communication helps to build trust among the teams (statement 267).

- **Collaborative procurement**: this method was not used in the project. Still both client and contractor state that this method can create trust among the teams (statement 276 and 279 respectively). It is interesting that they acknowledge that this method can create trust, but decided not to use it.

- **Joint project team**: the contractor states that working together in a joint project team can facilitate trust (statement 285). The client does not state this and prefers two separate teams.

- **Continuity**: both client and contractor stated this connection. The client states that continuity enables the team members to develop a relation based on trust (statement 290). The contractor states that it can ensure that trust relationships stay in the project (statement 292). This shows that continuity might both cause and preserve trust.

4. No-blame culture

- **Joint problem or conflict resolution**: both client and the contractors stated this connection. The client stated that the method enabled them to understand the other's problem and help each other to solve it (statement 250). Similarly, the contractor states that due to this method they better understood the client enabling them to create better solutions.

- **Good faith obligation**: the client and contractor both stated this connection. They state similarly that this method enables the parties to better understand each other and that it can set the basis for good collaboration (statement 256, 257). The contractor also stated that it can ensure that everyone knows what possible benefits can be obtained from collaboration. This can help to create a common understanding about collaboration (statement 258).

- **Communications**: both the client and the contractor stated that by communication everything with each other openly and also informally helps to better understand each other (statement 260, 261 and 266 respectively). The client also states that by being on the same location you can better and more communicate and thereby better understand each other (statement 263).

- **Collaborative procurement**: even though this method is not used in the project, both the client and the contractor stated this linkage exists. The client states that when teams are selected on interpersonal qualifications they are more likely to get along

and successfully collaborate (statement 275, 276). The contractor also states that due to this method the teams can better understand each other (statement 280).

- **Removal of financial pressure**: this method is not used in this project. Still, the contractor states that it could have been beneficial for the creation of a no-blame culture. The contractor states that due to this method you can avoid unpleasant discussions about costs during the project because you already discussed all costs components upfront (statement 282).

- **Joint project team**: the contractor states that due to a joint project team the team members can better understand each other. Due to this the team members are likely to be able to better work together (statement 285).

- **Continuous process reflection**: both the client and the contractor stated this linkage. The client stated that the method allowed them to reduce irritations and smoothen out the process (statement 287). Both client and contractor state that the method enabled them to better understand each other which helped them to work together (statement 287 and 289 respectively).

- **Continuity**: both respondents stated this linkage. The client and the contractor state similarly that continuity enables the team members to better understand each other (statement 290 and 293 respectively).

5. **Joint working**
   - **Early contractor involvement**: this method is not used in this project, however, both client and contractor stated that this method can stimulate joint working. They state similarly that this method can provide a basis for collaboration (statement 239, 243). The contractor also states that this method can result in optimizations due to the joint working it stimulates (statement 243).

   - **Optimization incentive**: the contractor stated that this method and especially a pain/gain mechanism can result in joint optimization (statement 246). Because the risks can be shared the teams can work together to optimize the solution.

   - **Joint risk allocation**: both client and contractor stated this connection. The client states that this method stimulated to discuss risks together and help the contractor to make a good estimation of the risk (statement 247, 248). The contractor stated that this method enabled joint working on the risks resulting in appropriate control measures (statement 249).

   - **Joint problem or conflict resolution**: both client and the contractors stated that the joint solving of problems is beneficial for joint working (statement 250, 253, 255). When the parties solve problems together they automatically work together, therefore it can be said that this is a more obvious connection.

   - **Good faith obligation**: both the client and the contractor stated that this method can stimulate joint working in two ways. The first is that this method enables joint working

from the start by looking together how to collaborate (statement 256, 257). The second is that this method can set the basis for good collaboration, enabling the parties to successfully work together in the project (statement 256, 259).

- **Communications**: both client and contractor stated this linkage. The client stated that by working on the same location they could better communicate and as a result better work together (statement 263). The contractor stated that due to open communication they could work together properly (statement 265). He also stated that informal communication is necessary for collaboration (statement 270). These are strong indicators that good communication is necessary to work in a joint way.

- **Programme and planning**: both the client and contractor stated this connection. The client stated that due to this method they could spot problems and solve these together (statement 271). The contractor states similarly that due to this method they worked together on the planning and were able to work better together as a result (statement 271).

- **Collaborative procurement**: this method was not used in the project. Still, both client and contractor stated that it can be beneficial for joint working. They both state similarly that this method stimulated collaboration and thereby can result in successful collaboration (statement 276, 277, 278). It is interesting that both acknowledge the potential of this method, but this chose not to use it.

- **Removal of financial pressure**: this method is not used in the project. Still, both the client and the contractor stated that this method could enable them to better work together on problems that occurred (statement 281, 282). They think this because it would remove the financial pressure allowing them to focus on the problem jointly.

- **Joint project team**: there was no joint project team in the project. The contractor states however that he does think that it would have been beneficial for joint working. He states that it would have enabled them to better work together (statement 285). The client prefers two separate teams and does not see benefits in a joint team.

6. Communication

- **Optimization incentive**: the client states that this method can help open up the discussion about a certain problem because it indicates that the client sees as important (statement 244). The contractor does not agree as he mainly talks about distrust is relation to fines.

- **Joint risk allocation**: the client stated that due to this method they discussed all risks together (statement 247). The contractor does not state this explicitly, but does state that the method helps to better allocate the risks and create control measures because risks can be tackled together (statement 249). This indicated that this method can help to communicate about risks and thereby better allocate these risks.

- **Joint problem or conflict resolution**: the client states that this method enabled them to discuss problems and thereby gain understanding of the problem the other was

facing (statement 250). The contractors explains that it enabled them to discuss the big picture and focus on this that really mattered (statement 253). This shows that this method can make problems discussable and by doing so place focus on the ones that are important for the project overall.

- **Good faith obligation**: both the client and the contractor stated that this method allowed them to start the project with clear communication (statement 256 and 259 respectively). Furthermore, they state that it reduces miscommunication (statement 256), and creates an open (statement 258) and good (statement 259) communication.

- **Communications**: both client and contractor stated this (more obvious) connection. Key outtakes from client and contractor that had a positive influence are: informal (statement 261, 264, 269, 270), formal (statement 262), open (statement 263, 265, 266, 268), active (statement 267) and quick (statement 268) communication, and being on the same location (statement 263). This resulted in a good communication that had many benefits for both client and contractor such as better understanding and more effective problem solving.

- **Programme and planning**: the client and the contractor state similarly that this method provided a clear communication tool resulting in good communication (statement 271 and 273 respectively). This shows that a proper planning can be used to communicate with each other in an understandable way.

- **Collaborative procurement**: the contractor states that this method can result in teams that can communicate clearly with each other (statement 278). However, this method is not used in this project. The client does not state this connection, he does state that it can be beneficial for collaboration overall.

- **Joint project team**: the client does not feel the need for a joint project team. He does state that when there are two teams clear communication is necessary to help each other (statement 283). The contractor has an opposing view and states that a joint project team can result in better communication (statement 284). This shows a different perception of the possibilities of the joint project team.

- **Continuous process reflection**: both the client and the contractor stated that this method enabled them to communicate and discuss collaboration, which helped them to resolve irritations (statement 287 and 288 respectively). The client also states that due to the continues process reflection they were able to communicate better and more effectively (statement 283).

- **Continuity**: the contractor stated that this method can reduce miscommunications (statement 293). Meaning that this method does not stimulate communication but it might ensure there is clear communication.

7. Joint problem solving

- **Early contractor involvement**: both respondents stated this connection. The client states that the method enabled the parties to solve problems early on in the project,

that a better estimation of risks can be obtained and that the contractor can be helped in areas where there are difficulties (statement 240, 241, 242). The contractor mainly states that it enables them to optimize together and thereby add value to the project (statement 243). This is a clear distinction, the clients wants to help to contractor overcome issues, but the contractor mainly wants to optimize.

- **Joint risk allocation**: the contractor states that due to this method control measures can be made jointly (statement 249). By doing so the parties can help each other to manage the complex risks. This shows that the method might prevent problems form occurring or have impact because the parties help each other with the complex risks.

- **Joint problem or conflict resolution**: both respondents stated this (more obvious) linkage. They mainly state the benefits of joint problem solving, being: trust (statement 250), going the extra mile (statement 251), innovate (statement 252), effective problem solving (statement 253), creation of understanding (statement 254), create mutual goals (statement 255). It is interesting that the client and the contractor mention different benefits, this indicates a different perception of the method.

- **Good faith obligation**: the client stated that this method enables the parties to set clear guidelines about collaboration. He stated that these can be used when collaboration is not going as expected. The parties can jointly solve the problems by use of the guidelines (statement 256).

- **Communications**: both the client and the contractor state similarly that due to open and effective communication they were able to overcome and solve problems quickly and effectively together (statement 260, 263 and 265, 266, 268 respectively).

- **Programme and planning**: the client stated that this method was a good tool to spot problems. By placing emphasis on this method they were able to solve problems together more effectively (statement 271). Furthermore, both the client and the contractor stated that the method enabled them solve problems together and thereby keep the planning realistic (statement 272 and 274 respectively).

- **Collaborative procurement**: this method was not used in the project. Despite this the contractor thinks it could have been beneficial for joint problem solving. He states that due to this method they probably would be able to solve problems more effectively and create more innovative solutions (statement 278, 279).

- **Removal of financial pressure**: both the client and the contractor stated similarly that due to this method they would be able to better focus on joint problems solving (statement 281 and 282 respectively). This is mainly because they do not have to focus on the financial aspect of the solution, but instead can focus on the solution itself.

- **Continuous process reflection**: the contractor stated that due to this method the teams better understand each other due to which they could tackle problems together (statement 289). This shows that understanding the other party might be an important factor necessary to solve problems together.

- **Continuity**: the client stated that this method enabled the teams to get to know each other. Due to this they were better able to solve problems together (statement 291). Similarly as described above, this is an indicator that understanding among the teams might be important for joint problems solving.

8. **Fair risk allocation**
   - **Early contractor involvement**: the client states that due to this method both the client and the contractor are better prepared for the project and as a result a better risk estimation can be make (statement 241). Due to this risks can be calculated and the change of unexpected problems decreases.

   - **Joint risk allocation**: both the client and the contractor stated this connection. The client stated that by discussing risks together and helping each other a proper and fair risk allocation could be made (statement 247, 248). The contractor states that this method can result in better risk allocation because you can help each other manage the risks (statement 249).

   - **Collaborative procurement**: the contractor stated that due to this method you better understand the other party which allows the parties to make a better and estimation and allocation of the risks (statement 280). This shows that, again, understanding among the teams is an important factor.

   - **Removal of financial pressure**: the contractor states that due to this method there is likely to be clarity about the risks (statement 282). This is because the parties were able to allocate the risks upfront together in a way that is best for the project. This reduces the likelihood of having unpleasant discussions about risks because the parties were able to better allocate the risks.

9. **Effective performance measurement**
   - **Communications**: both the client and the contractor state this connection, they do however have a different perception. The client states that formal communication can be an effective way to keep track of the progress (statement 262) while the contractor states that informal communication is a good way to stay up-to-date (statement 269). This contradiction is interesting as both form of communication might have different benefits for different situations.

   - **Programme and planning**: the client and the contractor state similarly that due to this method they jointly updated the planning (statement 272 and 273 respectively). Due to this both parties had a good understanding of how the project het proceeding.

   - **Continuous process reflection**: both respondents state similarly that by use of constant reflection you obtain a good insight in how the project is proceeding and how it can be improved (statement 286, 288). This shows that reflection can be used to discover where in the project to place extra emphasis.

10. Continuous learning

- **Continuous process reflection**: the client and the contractor state similarly that by use of reflection you learn what aspects are not doing as expected in the project (statement 286, 287 and 288 respectively). By use of this the process can be improved which can result in an overall improvement of collaboration in the project.

Appendix N: Ranking of methods and clauses case study 1

Not available in public version

Appendix O: Ranking of methods and clauses case study 2

Not available in public version

Appendix P: Ranking of methods and clauses case study 3

Not available in public version

Appendix Q: Merging process cross-case analysis

In this appendix the process used to go from three separate tables displayed in case 1, 2 and 3 to one merged table which shows the results of the cases combined. The process is shown in figure 22. Each step is further elaborated below.

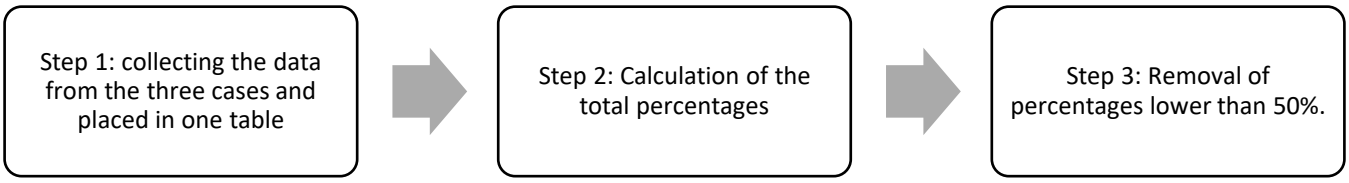

Figure 22: Table merging process cross-case analysis

Step 1:

The data of table 6, 8 and 10 is gathered and placed in one table. The result in presented in table 62. In this table the results from the first case are shows in orange with an 'a' in front of the percentage, the results of the second case in blue with a 'b' in front of the percentage and case three in green with a 'c' in front of the percentage. This table shows in percentages how mange respondents of each case stated a certain linkage.

Table 26: Merged table cross-case analysis step 1

Factors stimulating collaboration / NEC4 ECC & Project DOEN clauses/methods	Mutual objectives	Gain and pain sharing	Trust	No-blame culture	Joint working	Communication	Joint problem solving	Fair risk allocation	Effective performance measurement	Continuous learning
Early contractor involvement (N)(D)	a100% b100%	b25%	a100% b75% c50%	a100% b75%	a100% b100% c100%	a100% b75%	a100% b100% c100%	a50% b25% c50%		a75% b25%
Optimization incentive (D) & CS (N) & WLC (N) & CP (N) & BEC (N)	a-50% b75% c50%	a25% b50%	b-100% c-50%	b25%	b25% c50%	b25% c50%	b25%	b25%	b25%	
Joint risk allocation (D) & Compensation events (N)	a75% b25%	a50%	a50% b25%	a50% b50%	a50% b75% c100%	a75% b100% c100%	a50% b75% c50%	a75% b100% c100%		
Joint problem or conflict resolution (D) & EW & RD (W3) (N)	a50% b25% c100%	a50% c50%	a75% b50% c50%	a75% b100% c100%	a75% b100% c100%	a100% b100% c100%	a100% b100% c100%			
Good faith obligation (N)	a75% b25% c50%		b25%	a50% b75% c100%	a25% b75% c100%	a75% b100% c100%	c50%			
Communications (N)	a25% c50%		a75% b25% c100%	a50% b100% c100%	a25% b50% c100%	a100% b100% c100%	a50% b100% c100%		a75% b75% c100%	a25%
Programme and planning (N)	a100% b50%		a25% b50%	a50% b50%	b50% c100%	a100% b100% c100%	a75% b25% c100%	a25%	a100% b100% c100%	
Collaborative procurement (D)	a100% b25% c100%		a100% b50% c100%	a100% c100%	a100% b100% c100%	a100% b50% c50%	a50% b75% c50%	b25% c50%		a25%
Removal of financial pressure (D)	a75% b25%		a50%	a75% b75% c50%	a75% b25% c100%	b25%	b25% c100%	a50% b25% c50%		b-25%
Joint project team (D)	a100%		a50% c50%	a50% c50%	a100% b75% c50%	a100% b100% c100%	a100% b100%			
Continuous process reflection (D)			b25%	a75% b100% c100%	b50%	a100% b100% c100%	b75% c50%		a25% c100%	a50% b50% c100%
Continuity (D)			a100% b100% c100%	c100%	a75% b25%	a50% b100% c50%	c50%			a-25%

Step 2:

In this step the separate percentages are merged into one percentage. This is done using a weighted average per case. Because this is a case research each case must have a same weight. Therefore, the percentages are calculated as follows: 1/3*[percentage case 1]+1/3*[percentage case 2]+1/3*[percentage case 3]. By calculating the percentage like this the statements made in case 1 and 2 have less impact than statements made in case 3. This is a limitation of this research. This method is however still preferred because otherwise the cases would not have a similar impact, the connections found in case 1 and 2 would have a larger impact than the connections found in case 3. All connections are equally true and therefore must obtain the same weight.

Table 27: Merged table cross-case analysis step 2

Factors stimulating collaboration / NEC4 ECC & Project DOEN clauses/methods	Mutual objectives	Gain and pain sharing	Trust	No-blame culture	Joint working	Communication	Joint problem solving	Fair risk allocation	Effective performance measurement	Continuous learning
Early contractor involvement (N)(D)	67%	8%	75%	58%	100%	58%	100%	42%		33%
Optimization incentive (D) & CS (N) & WLC (N) & CP (N) & BEC (N)	25%	25%	50%	8%	25%	25%	8%	8%	8%	
Joint risk allocation (D) & Compensation events (N)	33%	17%	25%	33%	75%	92%	58%	92%		
Joint problem or conflict resolution (D) & EW & RD (W3) (N)	58%	33%	58%	92%	92%	100%	100%			
Good faith obligation (N)	50%		8%	75%	67%	92%	17%			
Communications (N)	25%		67%	83%	58%	100%	83%		83%	8%
Programme and planning (N)	50%		25%	33%	50%	100%	67%	8%	100%	
Collaborative procurement (D)	75%		83%	67%	100%	67%	58%	25%		8%
Removal of financial pressure (D)	33%		17%	67%	67%	8%	42%	42%		-8%
Joint project team (D)	33%		33%	33%	75%	100%	67%			
Continuous process reflection (D)			8%	92%	17%	100%	42%		42%	67%
Continuity (D)			100%	33%	33%	67%	17%			-8%

Step 3:

In the final step of the process all percentages lower than 50% are removed from table 63. The result of doing so is displayed in the cross-case analyses chapter in table 12. These percentages are removed from the table because of one of three reasons:

- These linkages likely did not have a large impact in the projects. If there was a large impact of the linkage more respondents would have likely mentioned the linkage;
- The linkage is mentioned by chance. Sometimes respondents want to provide the interviewer with a satisfying answer or an experience from a different case is shared. This has to be corrected for. Because it is unlikely that 5 or more respondents all state a linkage that did not play a large role in the project is small, removing these percentages will likely correct for this statement by chance;

- The linkage only occurred (strongly) in one case. This indicates that this linkage cannot be generally used and only has value is a specific situation. This study aims to provide an advice that can be generally used and therefore these linkages are out of scope.

Appendix R: Dutch validation survey statements

In this chapter the Dutch version of table 17 (shows in chapter 6.1) is presented. The Dutch statements shown here are the original statements that are shows to the industry experts.

Table 28: Statements used to validate connections in the expert validation (Dutch)

#	Method	Statement presented in the validation	Factor of collaboration the statement aims to validate
1.	Early contractor involvement	Early contractor involvement komt ten goede van de samenwerking doordat het gezamenlijk problemen oplossen stimuleert.	Joint problem solving
2.	Early contractor involvement	Early contractor involvement komt ten goede van de samenwerking doordat er begrip tussen de teams van opdrachtgever en opdrachtnemer ontstaat waardoor het vertrouwen toeneemt.	Trust
3.	Optimization incentive	Optimalisatie incentives hebben geen positieve impact op samenwerking doordat het wantrouwen uitstraalt naar de aannemer.	Trust
4.	Joint risk allocation	Het gezamenlijk alloceren van de risico's en daarbij gezamenlijk beheersmaatregelen opstellen komt ten goede van de samenwerking doordat het resulteert in een eerlijke risico allocatie.	Fair risk allocation
5.	Joint risk allocation	Het gezamenlijk alloceren van de risico's komt ten goede van de samenwerking doordat de partijen gezamenlijk beter in staat zijn om passende beheersmaatregelen op te stellen.	Joint working
6.	Joint problem or conflict resolution	Het gezamenlijk oplossen van problemen of conflicten heeft een positieve impact op de samenwerking doordat het zorgt voor begrip voor de problemen waar de andere partij tegen aanloopt.	No-blame culture
7.	Joint problem or conflict resolution	Het gezamenlijk oplossen van problemen of conflicten heeft een positieve impact op de samenwerking doordat het de discussie over de problemen opent, waardoor de partijen het problemen effectief kunnen oplossen.	Communications
8.	Joint problem or conflict resolution	Door het gezamenlijk oplossen van problemen of conflicten ontstaat er vertrouwen tussen de teams. Dit heeft een positieve impact op de samenwerking.	Trust
9.	Good faith obligation	Deze methode komt ten goede van de samenwerking doordat de partijen elkaar beter begrijpen waardoor het project kan worden ingericht op een manier waarin beide partijen zich kunnen vinden.	No-blame culture

10.	Good faith obligation	Deze methode komt ten goede van de samenwerking doordat het de discussie over samenwerken opent waardoor vanaf het begin van het project kan worden bepaald hoe de partijen met elkaar gaan samenwerken.	Communication
11.	Communications	Deze methode heeft een positief effect op samenwerking doordat het er voor zorgt dat er duidelijk en tijdelijk gecommuniceerd kan worden waardoor iedereen op de hoogte is van de status van het project.	Effective performance measurement
12.	Communications	Deze methode heeft een positief effect op samenwerking doordat het zorgt voor begrip voor de problemen waar de andere partij tegenaan loopt doordat de partijen beter op de hoogte zijn van elkaars voortgang en problematiek.	No-blame culture
13.	Programme and planning	Deze methode heeft een positief effect op de samenwerking doordat de methode een duidelijk inzicht geeft in het verloop en (toekomstige) obstakels van het project.	Effective performance measurement
14.	Programme and planning	Deze methode heeft een positief effect op de samenwerking doordat het de communicatie bevordert tussen te teams. De clause zorgt voor een duidelijk inzicht in de status van het project, hierdoor kan de methode als communicatie tool gebruikt worden. Zo kunnen de partijen elkaar goed op de hoogte houden.	Communication
15.	Collaborative procurement	Deze andere manier van aanbesteden is goed voor de samenwerking omdat vertrouwen tussen de partijen kan ontstaan gedurende de aanbestedingsfase door het vroeg in gesprek gaan met elkaar en het intensieve voortraject.	Trust
16.	Collaborative procurement	Door deze andere manier van aanbesteden wordt er een aannemer geselecteerd met wie de opdrachtgever goed kan samenwerken.	Joint working
17.	Collaborative procurement	Deze andere manier van aanbesteden is goed voor de samenwerking doordat er gemeenschappelijke doelen kunnen worden gedefinieerd wat leidt tot het gezamenlijk werken aan deze doelen.	Mutual goals
18.	Removal of financial pressure	Deze methode kan grote impact hebben op de samenwerking doordat het opportunistisch gedrag tegengaat.	No-blame culture
19.	Joint project team	Deze methode brengt geen voordelen voor samenwerking in Nederland. Opdrachtgevers hebben hier geen baat bij en/of hebben er de capaciteit/kennis niet voor. Werken met 2	Sub-conclusion based on statements made in the cases

		gescheiden teams met directe communicatie tussen de disciplines verloopt beter.	
20.	Joint project team	Deze methode heeft een positieve impact op samenwerking doordat er een teamspirit ontstaat waardoor het een echt gezamenlijk project word.	Joint working
21.	Joint project team	Deze methode heeft een positieve impact op samenwerking doordat er sneller en effectiever problemen kunnen worden opgelost.	Joint problem solving
22.	Continuous process reflection	Het hebben van continue proces reflectie is goed voor de samenwerking. Dit komt doordat deze methode zorgt voor begrip en inzicht in de problemen van de ander.	No-blame culture
23.	Continuous process reflection	Deze methode is goed voor de samenwerking doordat de partijen hierdoor kunnen leren van hoe het proces tot dusver verliep en het proces kunnen aanpassen om het zo te verbeteren.	Continuous learning
24.	Continuity	Continuïteit in de project teams is belangrijk om vertrouwensrelaties binnen de project teams te behouden. Hierdoor heeft het een positief effect op de samenwerking.	Trust
25.	Continuity	Continuïteit in de project teams is belangrijk om directe communicatielijnen binnen de project teams te behouden. Hierdoor heeft het een positief effect op de samenwerking.	Communication

Appendix S: Validation results interpretation

In this appendix each validated connection is elaborated upon. For each connection the score is presented together with key take-outs from the explanation given by the experts. The full explanations for each expert are in a separate (large) excel file which is available on request. Key take-outs from the experts are combined and discussed jointly. Based on the key take-outs and the score the method is validated, rejected or it remains unclear if the experts validate the method.

Early contractor involvement – joint problem solving | *Score: 3.6* | **Validated**
Key take-outs: This can work of the client and contractor have the same responsibilities, the client and contractor have the same knowledge level and the contractor involved in this process is the same as the one conducting the project. If this is the case the method can work to solve problems together and have a positive impact on collaboration.
Conclusion: Due to the high score and the explanation of the experts, the method is validated.

Early contractor involvement – trust | *Score: 3.9* | **Validated**
Key take-outs: can cause higher understanding between the parties which can result in trust. It is however necessary that the parties show true interest in the other.
Conclusion: Mainly due to its high score the connections is validated, the explanation from the experts is limited.

Optimization incentive – distrust | *Score: 2.4* | **Rejected**
Key take-outs: the method can be beneficial for collaboration when there is a good balance between fines and bonusses, fines can show distrust but bonusses are positive for trust. You should not only use one, it is about balancing the two. Also, the method must be integrated with due care, to high fines can result in perverse incentives.
Conclusion: The statement is rejected. This means that if the method is implemented with due care and there is a healthy balance between fines and bonuses the method can be beneficial for trust and collaboration overall.

Joint risk allocation – fair risk allocation | *Score: 4.0* | **Validated**
Key take-outs: For this to work there must be equality between client and contractor. It is a great method to have in every project and wise to use.
Conclusion: Due to the high score and the explanation of the experts, the method is validated.

Joint risk allocation – joint working | *Score: 4.0* | **Validated**
Key take-outs: Jointly discussing the risks and control measures is good for collaboration. This is the core for good risk management.
Conclusion: Due to the high score and the explanation of the experts, the method is validated.

Joint problem or conflict resolution – no-blame culture | *Score: 3.8* | **Validated**
Key take-outs: This can work. It can however not be the case that the client must help the contractor when the contractor is making mistakes. Also, this is how it always should be, that it does not happen is likely due to the building culture is the Netherlands.
Conclusion: The high score shows that the method can work for a no-blame culture, however from the explanation it follows that obtaining this effect can be difficult.

Joint problem or conflict resolution – communications | *Score: 3.7* | **Validated**
Key take-outs: Can work to open the discussion on problems that interest both parties in an open setting.
Conclusion: Due to the high score and the explanation of the experts, the method is validated.

Joint problem or conflict resolution – trust | *Score: 3.9* | **Validated**
Key take-outs: Solving problems together it is good for the trust among the teams.
Conclusion: Due to the high score and the explanation of the experts, the method is validated.

Good faith obligation – no-blame culture | *Score: 2.8* | **Unclear**
Key take-outs: Can work when the parties also do what they agree on. It is however no panacea. Also, there a doubts by many experts if the method really works in practice.
Conclusion: The experts are in doubt if the method will work, some think it will other think it won't, therefore no conclusion can be drafted from the validation.

Good faith obligation – communication | *Score: 3.4* | **Validated**
Key take-outs: communicating about expectations is the basis of collaboration. Having a code of conduct helps to have good communication. It also improves meta-communication.
Conclusion: Even though the score is below 3.5 the connection is validated due to the positive explanation of the experts.

Communications – effective performance measurement | *Score: 3.0* | **Unclear**
Key take-outs: This can work but it is what is expected from every professional. Enforcing this contractual seems compulsive and preposterous.
Conclusion: It follows that having communication is beneficial for effective performance measurement, enforcing this in a contract seems unwanted. Due to this ambiguity it is unclear what the effect of the method will be.

Communications – no-blame culture | *Score: 2.4* | **Rejected**
Key take-outs: Due to this there are only more rules regarding communication which reduces common understanding.
Conclusion: Due to the low score and the explanation of the experts, the method is rejected.

Programme and planning – effective performance measurement | *Score: 3.6* | **Validated**
Key take-outs: This gives clear insight in the interests and status of both parties. For less complex situations this however seems unnecessary.
Conclusion: Due to the high score and the explanation of the experts, the method is validated.

Programme and planning – communication | *Score: 3.4* | **Unclear**
Key take-outs: no explanation is given.
Conclusion: The score is below 3.5 and no explanation is given that indicates that the connection is validated, therefore it is unclear if this connection is validated.

Collaborative procurement – trust | *Score: 3.4* | **Unclear**
Key take-outs: there is doubt if this method will work. Mainly because the world after procurement is different than the one before. As soon as the financial part comes into play

people start behaving differently. Also, it is difficult to keep the procurement team together during the execution phase. It can set the basis for trust but it gives no guarantees.
Conclusion: The score and explanations indicate that the method might work but that it will be difficult to implement and to maintain trust during the project. This shows that the experts are unclear is the method will cause trust in the Netherlands.

Collaborative procurement – joint working | *Score: 3.5* | **Validated**
Key take-outs: This can be true, the real test will however come when financial problems occur. It sets the basis for joint working but it gives no guarantees.
Conclusion: The score together with the explanation suggest that the method does cause set the basis for joint working but it given no guarantees that this will continue when difficult (financial) problems occur.

Collaborative procurement – mutual goals | *Score: 3.4* | **Validated**
Key take-outs: This works but it can be the case that when money comes into play goals change. Also, there will always be a difference between project goals and the individual goals of the parties. How to deal with this can be discussed in this process and as long as the individual goals are met it can increase the likelihood that the joint goals will be met.
Conclusion: Even though the score is below 3.5 the connection is validated due to the positive explanation of the experts.

Removal of financial pressure – no-blame culture | *Score: 3.3* | **Unclear**
Key take-outs: This can reduce perverse stimuli. The question arises how achievable this is because not everything can be foreseen due to which not all risks can be priced. It can also be difficult to implement this under Dutch procurement law.
Conclusion: Due to the neutral score and the explanations that the method can work but that it will be difficult because not everything can be foreseen, no conclusion can be made if this connection will work in practice.

Joint project team – unfit for Dutch construction sector | *Score: 2.5* | **Rejected**
Key take-outs: This method can work in situations as long as the goals and rewards are similar. Knowledge can be easily exchanged due to which double roles can be reduced, something that currently causes inefficiency. In complex projects in which the outcome is uncertain this method can work perfectly by bundling expertise and knowledge.
Conclusion: Even though the score is not below 2.5 this statement in rejected. This is because many of the experts state that the method can work (perfectly) in the Netherlands and if even preferred by some experts over two separate teams, only not in all situations.

Joint project team – joint working | *Score: 4.1* | **Validated**
Key take-outs: This can increase joint working tremendously but only when contractually imbedded and if goal, profit and risks are shared equally.
Conclusion: Due to the high score and the explanation of the experts, the method is validated. There are however conditions to this method.

Joint project team – joint problem solving | *Score: 3.7* | **Validated**
Key take-outs: This can increase joint problem solving as long as it is according to the contractual agreements.

Conclusion: Due to the high score and the explanation of the experts, the method is validated.

Continuous process reflection – no-blame culture | *Score: 4.3* | **Validated**
Key take-outs: This can work really well, the process is often underestimated. Even better results can be obtained when high level management from both client and contractor are also involved.
Conclusion: Due to the high score and the explanation of the experts, the method is validated.

Continuous process reflection – continuous learning | *Score: 4.0* | **Validated**
Key take-outs: No explanation was given by any of the experts.
Conclusion: Due to the high score, the method is validated.

Continuity – trust | *Score: 3.8* | **Validated**
Key take-outs: Continuity keeps trust within the team but for this to work there first need to be trust. when people cannot work properly together it can be good to replace people in the teams. Also, not all expertise are needed in every phase, therefore it is not applicable to the entire team only to a few key-roles.
Conclusion: Due to the high score and the explanation of the experts, the method is validated.

Continuity – communication | *Score: 3.4* | **Unclear**
Key take-outs: Few experts gave an explanation to their score. The few that did stated it can help but it is more important to have the right people in place. Sharing project experiences helps to work more efficient, this can increase communication but not as a goal on itself.
Conclusion: The connection has a neutral score. Also, there are few comments made by the experts. The few that are made state that it can help but not as a goal by itself. Due to this, it is unclear if continuity has a positive effect on collaboration by stimulating communication.

Appendix T: Overview of cases and respondents

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