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How to Create an Effective and Efficient Building Process

A New Situational Framework for Value Optimization in the Build Environment

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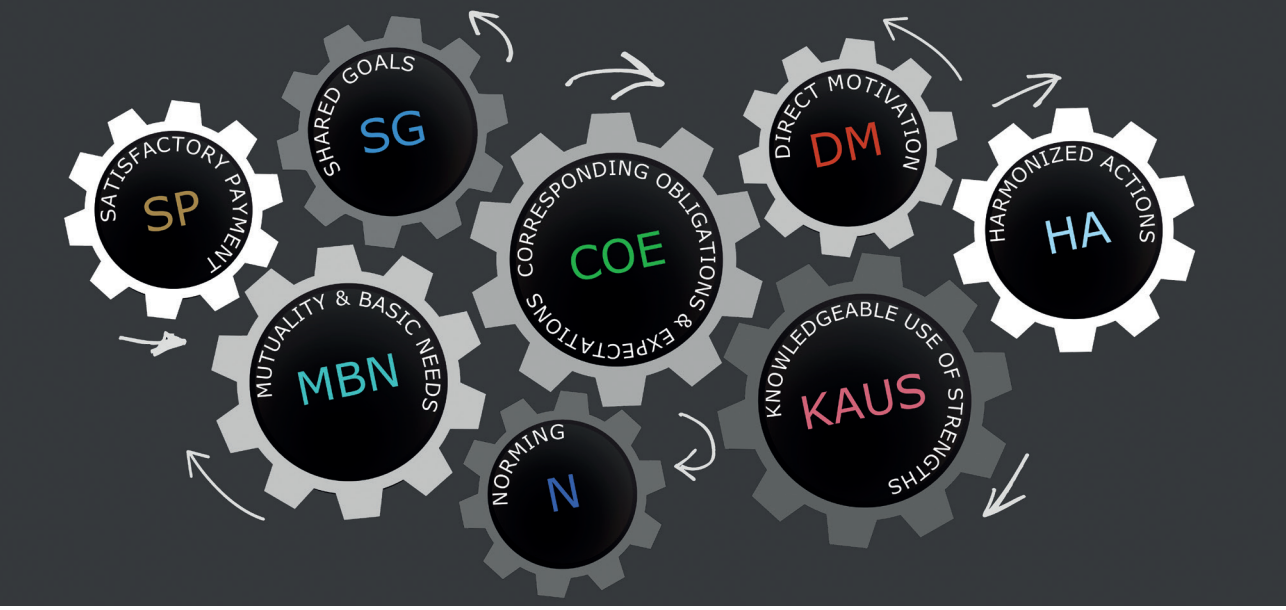

HOW TO CREATE AN EFFECTIVE AND EFFICIENT BUILDING PROCESS

A NEW SITUATIONAL FRAMEWORK FOR VALUE OPTIMIZATION IN THE BUILD ENVIRONMENT

BY
KRISTIAN DITLEV BOHNSTEDT

DISSERTATION SUBMITTED 2015

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AALBORG UNIVERSITY
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2014

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2013

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This thesis has been submitted for assessment in partial fulfillment of the PhD degree. The thesis is based on the submitted or published scientific papers which are listed above. Parts of the papers are used directly or indirectly in the extended summary of the thesis. As part of the assessment, co-author statements have been made available to the assessment committee and are also available at the Faculty. The thesis is not in its present form acceptable for open publication but only in limited and closed circulation as copyright may not be ensured.

ENGLISH SUMMARY

This PhD thesis contains the results of a three year research process carried out at Aalborg University. The thesis is entitled “How to Create an Effective and Efficient Building Process - A New Situational Framework for Value Optimization in the Build Environment” and does together with the appended papers serve as documentation for the conducted research.

Collaboration between construction organizations has always been the basis of construction project success. Several articles, books, companies, and research institutions have long been concerned with the issue of poor collaboration. It seems that regardless of context and scope, collaboration is consistently attributed to be an essential determinant of success in construction projects. However, there has been almost no empirical work done to assess objectively the importance of collaborative components on various aspects of collaboration to project success. It implores the question why no systematic effort has been made to make explicit this purported all-important link between collaborative components and effective and efficient collaboration. Therefore, it is in this area - providing a quantification of the linkage between collaborative components and effective and efficient collaboration - that this thesis makes its contribution.

This thesis attempts to fill this research gap by presenting an agile framework enabling construction teams, parties and organizations’ to choose the right set of collaborative components in different situations thus making collaboration more efficient and effective. The thesis implores the question of why no systematic effort has been made to make a link between collaborative components and effective and efficient collaboration. Therefore, the main objective is to enhance the collaborative capabilities in the project organizations and shift in parties from project to project through an EESC Framework (Effective and Efficient Situational Framework).

The findings were based on sequential data collection; qualitative interviews followed by quantitative surveys. This research design followed the mixed methods tradition and was designed as a sequential mixed data analysis in two phases, the first phase was qualitative and second phase was quantitative, while the analysis of the two phases were linked. This sequential approach was exploratory, descriptive and correlational since the qualitative stage intended to identify and construct themes under which the level and use of collaborative elements could be validated, quantified and examined for correlations in the second phase.

Collaborative themes were derived through a preliminary investigation, where the outset was to explore previously obtained knowledge in the field of collaboration using partnering as a lens. The themes were a contraction of identified aspects and

elements in partnering and general collaboration through the past two decades in the Danish construction industry. In the quest of defining new collaborative elements the themes and partnering elements were included in an interview study. The study consisted of 16 qualitative interviews focusing on exploring the themes and elements. The observations made through the semi-structured interviews were transformed into concepts and a relationship was found between these concepts. The new elements from the theoretical perspectives of the literature study, the initial archival study on lessons learned and the interview process were assessed using a survey. The survey reached a total of 57 responses and the distribution of respondents was considered acceptable. Use of theories made the effects and structures of the elements visible and elaborated on how these specifically complemented each other. Through evaluation of the structural coherence of the elements components became visible. A total of eleven pre components were identified; Relations, Mutuality, Basic needs, Corresponding obligations and expectations, Knowledge about and use of strengths, Targeted communication, Norming, Direct motivation, Satisfactory payment, Shared goals and Harmonized actions.

With the ambition of transforming the pre components into an applicable model, and in the acknowledgement that the framework needs to be situational, the components were linked to contract forms via a larger survey. The survey was set up to measure both the degree to which the components were already in use within the selected contract form and how well it facilitates effective and efficient collaboration. This made it possible to draw conclusions about which components that need more effort to facilitate and improve collaboration. The survey reached a total of 288 valid responses and the distribution of respondents was considered extremely acceptable. It was found that all EESC components were relevant to all forms of contracting. A table was created to clarify which of the EESC components that are currently in use and on which special attention should be paid in a given situation. The purpose of the table was to illustrate the situations in which the parties had found special needs of EESC components in order to improve collaboration and thus the overall efficiency and effectiveness. As a final part of the thesis the EESC framework was produced. The empirically identified elements were tied to a suitable theory and divided into eight components in a clockwork where the components work as cogwheels setting EESC in motion. In practical application a “poster” was made with the eight components. The poster shows which areas, components, the client or project team should be particularly aware of.

Through this research it was discovered that the development of an applicable EESC framework provides methods and tools to increase the effectiveness and efficiency of the building process by articulating components. The new insights that further added to the academic field of research were the identification of relations between collaborative elements and components that should be integrated building process.

DANSK RESUME

Denne ph.d.-afhandling indeholder resultaterne af en treårig forskningsproces udført på Aalborg Universitet. Afhandlingen har titlen "How to Create an Effective and Efficient Building Process - A New Situational Framework for Value Optimization in the Build Environment" (Dansk: Hvordan skabes en effektiv byggeproces – Et nyt situationsbestem værktøj til værdioptimering i det bebyggede miljø) og tjener sammen med de medfølgende artikler som dokumentation for udført forskning.

Et godt sammenspil mellem byggeriets parter har altid været grundlaget for et godt samarbejde og succesfuldt byggeprojekt. Den oplevede erkendelse er dog, at den danske byggebranche har et stort behov for udvikling der kræver handling. Branchen er igennem mange år blevet mødt af kritik fra omgivelserne, offentlige instanser og byggeriets organisationer. I kritikken peges der på problemer med produktivitet, innovation og kvalitet i branchen. Det uddybes at for høje omkostninger, lang produktionstid, udvikling af passende virksomheder og byggeprocessen ligeledes er en del af årsagen. Byggeriets udvikling er en ond cirkel. Årsagerne har været en priskonkurrence, der har ført til begrænset udvikling og således en stagnerende branche. Produktiviteten lider simpelthen når ringe produkt- og procesudvikling forekommer. Lav udvikling er ikke kun øgede omkostninger under produktion, det har ligeledes en samfundsmæssige konsekvens i form af produkter, der ikke giver brugerne de bedst mulige forhold og værdi. Positiv udvikling i branchen, der skaber værdi for alle, vil således også komme samfundet til gode. Der er behov for nye toner i byggebranchen og samarbejdet mellem byggeriets parter er identificeret som kernen. Omfanget af empirisk arbejde har imidlertid været begrænset. Evidensbaseret evaluering af kooperative komponenters betydningen for og indflydelse på et samarbejde og projekts succes er udeblevet. Uanset kontekst og omfang, kan samarbejdet konsekvent tilskrives at være den væsentligste faktor for succes i byggeprojekter. I konstatering af dette vil afhandlingen bidrage med produktion af ny viden i form af en forståelse af, hvad samarbejde er i byggebranchen. Dette gøres gennem et studie af sammenhængen mellem kooperative komponenter og effektiv situationsbestemt samarbejde.

I denne afhandling søges det at udfylde dette gap i forskningen ved at præsentere et agilt værktøj til byggeriets teams, parter og organisationer. Værktøjet skal sætte dem i stand til at vælge den rigtige kombination af kooperative komponenter i forskellige situationer og dermed gøre samarbejdet mere effektiv. Afhandlingen imødekommer således spørgsmålet ”hvorfor der ikke er gjort en systematisk indsats for at synliggøre sammenhæng mellem kooperative komponenter og effektivt samarbejde” ved at præsentere værktøjet Effective and Efficient Situational

Framework (EESC Framework). EESC vigtigste mål er at styrke den kooperative kapabilitet i byggeprojektets organisation og skift i parter fra projekt til projekt.

Resultaterne er baseret på en sekventiel dataindsamling; interviews efterfulgt af spørgeskemaundersøgelser. Forskningsdesignet fulgte en mixed method tradition og blev designet som en sekventiel data- indsamling og analyse i to faser, den første fase var kvalitativ og anden fase kvantitativ. Den sekventielle tilgang var både sonderende, beskrivende og korrelativ idet den kvalitative fase havde til formål at identificere og konstruere temaer hvorunder niveau og brug af kooperative elementer kunne valideres, kvantificeres og undersøges for sammenhænge i den anden fase.

Kooperative temaer blev afledt gennem en indledende undersøgelse, hvor udgangspunktet var at undersøge tidligere opnåede viden inden for området *samarbejde* ved brug af partnering som optik. Fundne temaerne var en sammentrækning af identificerede aspekter og elementer i partnering og erfaringer fra samarbejde i forsøgsbyggerier gennem de seneste to årtier i dansk byggeri. I jagten på at uddybe og opformere de fundne kooperative elementer og temaerne blev der udført en række interviews. Denne del bestod af 16 interviews med fokus på at udforske fundne temaer og elementer. Observationerne foretaget gennem de semistrukturerede interviews, de teoretiske perspektiver fra litteraturstudiet og erfaringerne fra tidligere forsøgsbyggerier blev valideret gennem en spørgeskema undersøgelse. Anvendelse af teorier i analysen af data fra spørgeskema synligjorde virkninger og strukturer af elementerne og uddybede hvordan disse specifikt suppler hinanden. Gennem evaluering af den strukturelle sammenhæng i elementerne blev foreløbige samarbejdskomponenter synlige. Med ambitionen om at omdanne disse foreløbige komponenter til et anvendeligt værktøj, og i erkendelse af at værktøjet skulle være situationsbestemt, blev komponenterne knyttet til forskellige udbudsformer via en større spørgeskemaundersøgelse. Undersøgelsen formål var at udmåle i hvilken grad komponenter allerede var i brug samt deres evne til at imødekomme og højne effektivt samarbejde. Dette gjorde konklusioner om hvilke komponenter der har brug for en større indsats for at fremme og forbedre samarbejdet muligt. Med op mod 300 gyldige besvarelser og en yderst acceptabelt fordelingen af respondenter kunne det konstateres at alle EESC komponenter var relevante for alle udbudsformer. Resultaterne af en grundig databehandling blev transformeret til en tabel. Formålet med tabellen var at illustrere de situationer, hvor parterne havde fundet særlige behov for EESC komponenter for at forbedre samarbejdet og dermed den samlede effektivitet. For praktisk anvendelse er en "plakat" blev lavet med de otte komponenter. Plakaterne viser hvilke områder, komponenter, bygherren eller projektgruppen bør være særligt opmærksomme på.

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This research was conducted in collaboration with the Construction Management group at the Department of Civil Engineering at Aalborg University. There are a number of people, who have been involved in making this PhD possible was possible because of the support provided by a number of people to whom I owe a great deal of thanks. Completing a PhD is a task that cannot be accomplished without the support and assistance of others. I would like to express my gratitude to all of those who assisted me throughout the process, but in particular to the following people:

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Enjoy the reading.

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CHAPTER 1. INTRODUCTION

In this chapter the background and motivation for the research, and the point of departure are presented. Furthermore, the research problem and related hypothesis are outlined, together with the thesis structure, including the dividing of the main thesis and the appendices.

1.1. BACKGROUND AND MOTIVATION

For decades the construction industry has been criticized for its low productivity (Manley et al. 2009), and in the 1990s the industry began to focus on lack of collaboration as one of the causes (Pedersen and Kristensen, 2008; Høgsted and Olsen, 2006). The construction industry is quite simply heavily influenced by a need for better collaboration (BAT kartellet, 2010; Værdiskabende Byggeproces, 2012). The structure of the construction industry, where a project team is created for each project and then broken down, is a barrier to productivity growth, technological improvements, and innovation (Bolig- og Byministeriet, 1998). Thomassen et al. (2014) point to an inability to establish firm and long-term collaboration in the construction industry, and Værdiskabende Byggeproces (2012) argues that the lack of collaboration is the reason for construction projects exceeding cost, time and quality. At the same time Jørgensen et al. (2013) define collaboration as an essential part of a good construction process. The general perception is that the construction industry is a sector plagued by disputes (Brooker and Lavers, 1997), which leads to limited collaboration (Bresnen and Marshall, 2000).

Collaboration is purported to be vital to construction project effectiveness and efficiency. Collaboration between construction organizations has always been the basis of construction project success (Latham, 1994; Bennett and Jayes, 1995, 1998; Barlow et al., 1997). It seems that regardless of context and scope, collaboration is consistently attributed to be an essential determinant of success, effectiveness and efficiency in construction projects. However, there has been almost no empirical work done to assess, objectively, the importance of collaborative components on various aspects of collaboration. Also, there has been, as yet, less to none empirical work done to quantify explicitly the extent to which different collaborative components, in relation to other components, improves construction project effectiveness and efficiency. It seems that regardless of context and scope, collaboration is consistently attributed to be an essential determinant of success in construction projects. However, there has been almost no empirical work done to assess objectively the importance of collaborative components on various aspects of collaboration to project success. It implores the question why no systematic effort

has been made to make explicit this purported all-important link between collaborative components and effective and efficient collaboration.

Lars Holten placed the construction industry's collaboration issues on the agenda in the 1990s with the article "Tør vi tænke positivt? (Do we dare think positive?)" (Høgsted and Olsen, 2006). The construction sector was characterized by a rhetorical way of solving problems and conflicts, cost overruns, disputes, and legal battles. The culture of collaboration was characterized by distrust, intolerance, dis-respect, and antipathy between the key partners of the construction project. The problems that Lars Holten brought forward in the 1990s are seen constantly today, albeit reduced. Apelgren et al. (2005) specifically point at the ability to get continuity in the project and not at the technical construction skills of the parties. It is necessary to examine the entire value chain, because one of the main features of failure is the complex chain of errors committed by one player and the problems posed by a second one (EBST, 2004; Apelgren et al., 2005). Concurrently, the advantages and disadvantages of planning and quality assurance rarely lie with a single player, which may result in an unequal distribution of benefits and limited incentive (EBST, 2004).

Therefore, it is in this area - providing a quantification of the linkage between collaborative components and effective and efficient collaboration - that this study makes its contribution. The findings in this paper can be generalized to international collaboration more generally, suggesting the need for new research and theory into which specific components that would promote effective and efficient situational collaboration. The study is relevant because the construction industry has long been challenged with productivity problems and the need for change to create a development. A well-developed built environment meets the users, the construction industry, and the community, and so it creates development for more than merely the construction industry parties. The essence of such a development is effective and efficient collaboration.

This thesis attempts to fill this research gap by presenting an agile framework enabling construction teams, parties and organizations' to choose the right set of collaborative components in different situations thus making collaboration more efficient and effective. The thesis implores the question why no systematic effort has been made to make this explicit purported all-important link between collaborative components and effective and efficient collaboration.

The motivation for this PhD is to challenge the collaborative culture within the project organizations' in the construction industry. These organizations operate in the industry and are depending on the knowledge efficiency and effectiveness of the workforce in the various projects. This raise the question: "how can the construction industry become more efficient and effective in delivering value to the build environment?" One of the main challenges is how to capture the tacit and

spoken experience and knowledge of different parties in construction project organizations' and utilize this in the development of an efficient and effective situational collaborative framework.

1.2. RESEARCH AREA

The most frequent challenges appearing in the construction industry are the fragmented and project based structure, the lowest-cost tender selection, the prescriptive specifications, and adversarial relationships. The result is projects with cost and time overruns and consequently dissatisfied parties due to poor collaboration. This situation is also considered the main reason of the low level of value creation in the industry (Manley & McFallan, 2006). Construction organizations are continuously stressed with the need for delivering a better service more effectively to its clients and customers. As the industry problems are addressed and linked particularly to poor productivity and quality, collaboration has repeatedly been put into focus. Low quality and productivity are known problems in the industry that need improvement to facilitate a positive development. Phua and Rowlinson (2004) points out that collaboration provides insight into the entrenched barrier that the construction industry must break to set the basis of construction project success. The very act of working together can be defined in several ways as collaboration and collaboration, these words are often use interchangeably, but represent essentially different ways of adding value to a group or team in a project and each comes with its own dynamic forces and control structures that help form groups in different ways. Collaborating means people work together, co-labor, on a single shared goal (Bennett and Jayes, 1995). Cooperating means people perform together, co-operate, while working on selfish nevertheless common goals (Bennett and Jayes, 1995). The logic here is "*If you help me, I will help you*", and it allows for the unprompted kind of involvement that energies systems and teams. In the forthcoming, collaboration will be used interchangeably.

Essentially, collaboration means two or more persons carrying out work with a common goal. The nature of collaboration is in itself in conflict with the current way of working in the construction industry, as the industry is characterized by many different parties, each with its own objectives, and according to Høgsted and Olsen (2006) selfish goals will often have a highest priority due to limited trust. Bolig- og Byministeriet (1998) explains that it creates sub-optimization and thus a lost focus on the common goal. It creates a lack of responsibility for the totality of the construction process (Bolig- og Byminis-teriet, 1998). Høgsted and Olsen (2008) describe distrust as a prerequisite in the traditional way of cooperating in the construction industry, based on the parties' self-interest, inter alia, experience by poor optimization, avoidance of the consequences of their own errors, and request for claims for losses on other parties' failure. The parties are behaving based on opportunistic human nature and trying to maximize their own benefits (Loosemore and Qu, 2015). Høgsted and Olsen (2008) compare the construction process to the

"blame game" where waste is accepted as long as it only occurs to the other parties. The traditional way of collaboration can be described as an antonym to the above definition of collaboration. The lack of effective and efficient collaboration in the construction industry is striking in light of the productivity problems, failure, and bad judgments that Holten (1996) and Høgsted and Olsen (2008) illustrate. Collaboration is the cornerstone for a positive development in the construction industry, and the need for improvement in the Danish construction industry is evident.

The overall research area is centered on the development of an effective and efficient situational collaboration framework [EESC].

1.3. HYPOTHESIS AND RESEARCH QUESTIONS

The main topic of this research was the development of an effective and efficient situational collaboration framework to heighten the value creation in the build environment. The collection of empirical data and test of methods are centered on the Danish construction industry, here it should further be stressed that this research was centered on main participants at a project organization level.

The main objective of this thesis is to enhance the collaborative capabilities, the readiness and agility for change in the project organizations and shift in parties from project to project through an Effective and Efficient Situational Framework (EESC Framework).

The thesis takes its starting point in the following hypothesis (H):

- (H) Effectiveness and efficiency in the building process can be improved; this can be achieved by improving collaboration through a new situational framework for value optimization in the build environment.

In the research the following research questions (R) will be answered:

- (R1) What lessons are learned in the Danish construction industry when considering development of collaborative approaches?

- (R2) Which themes encompasses in effective and efficient collaboration in a historical perspective?

- (R3) Which elements contribute positively or negatively to the building process according to the parties in the industry?

- (R4) How should different elements facilitating effective and efficient collaboration be composed into components, depending on the situation and how are these specifically complementary to each other?

- (R5) Which components contribute positively or negatively depending on the situation to the building process and should therefore be integrated into a framework customized to the diverse construction industry as a project organization?

- (R6) How are components linked to a contract form so that conclusions about which components that need more effort to facilitate and improve collaboration can be made, thus making them situational?

1.3.1. DEFINITIONS AND CLARIFICATIONS

This Section should clarify some of the key terms that are often used in a more general context, but it is important to understand the perspectives in which they are used in this research.

Collaboration and cooperation is two different things that need clarification. All though they may seem the same collaboration and cooperation have in fact two different meanings. Researchers such as Dillenbourg et al. (1996) and Roschelle and Teasley (1995) agree that it is important to make a distinction between cooperation and collaboration. While collaborative learning can be defined as "working together to accomplish shared goals" (Smith 1995), collaborative learning is "a method that implies working in a group of two or more to achieve a common goal, while respecting each individual's contribution to the whole" (McInnerney and Robert 2004). Roschelle and Teasley (1995) describe collaborative work as a task that is accomplished by dividing it among participants, where "each person is responsible for a portion of the problem solving," and they see collaborative work as "the mutual engagement of participants in a coordinated effort to solve the problem together". The main difference between these approaches is that cooperation is more focused on working together to create an end product, while collaboration requires participants to share in the process of knowledge creation (Dillenbourg et al. 1996; Roschelle and Teasley 1995). In other words, cooperation can be achieved if all participants do their assigned parts separately and bring their results to the table; collaboration, in contrast, implies direct interaction among individuals to produce a product and involves negotiations, discussions, and accommodating others' perspectives. According to Nelson (2008), cooperation is a protocol that allows you not to get in each other's way as you work. The two concepts should not be seen as pure forms of "working together", but may be seen as a continuum of the degree of dependence on others during tasks. The concepts suit different characteristics. Cooperative work is best suited for closed tasks with predictable processes related to a known product. This type of work is characterized

by a focus on the production. Collaborative work is best suited for open undefined tasks with unpredictable processes related to a new and unique product. The focus in this thesis is on the development and design of a framework coinciding with collaborative characteristics.

Efficiency is about doing things in an optimal way, for example doing it the fastest or in the least expensive way. It could be the wrong thing, but it was done optimally. Efficiency on the building site is the time it takes to a task. Efficient workforce and project managers finish tasks in the minimal amount of time possible with the minimal amount of resources possible by using certain time saving strategies. (Bejder & Wandahl, 2011)

Effectiveness is about doing the right task, completing activities and achieving goals, it is the level of results from the actions of workforce and managers. Demonstrating effectiveness in the workplace helps produce high-quality results. The effectiveness of a workforce has an huge impact on the quality of a product or service. (Bejder & Wandahl, 2011)

Efficiency and effectiveness are mutually exclusive, in short effectiveness is only goal oriented whereas efficiency consider effort, process and time.

Elements are defined as a constituent part of a **Component**. Elements a connected subset of a component, not contained in any other connected subset of the components. **Components** are defined as a combined set of **Elements**.

1.1. OUTLINE AND THESIS STRUCTURE

This thesis is based on a collection of papers, where the central elements of the research are based on the papers each contributing to the different chapters. The structure of the thesis consists of a cover and two appendices (A and B), where the cover summarizes the PhD research in terms of introduction, hypothesizes, research questions, research design and the overall conclusions. Appendix A is the collective appendices, directly related to the cover. Appendix B is the full collection of papers.

The structure of the cover is divided into the following chapters.

CHAPTER 1 – INTRODUCTION

This chapter presents the background and motivation for the PhD, the research background and the research question, and finally some general definitions on important terms used in this thesis.

CHAPTER 2 – RESEARCH DESIGN

The chapter presents the overall research design consideration, the scientific paradigm, and the final research design with a step-by-step description of the PhD research process.

CHAPTER 3 – DEVELOPMENT OF AN EESC FRAMEWORK

This chapter contains the main research conducted in this PhD. Each Section deals with the main themes investigated in this PhD research, and thus elaborate upon the research, presenting the findings and draw some partial conclusion. Additionally, in this chapter the main contributions are presented. The papers are not presented and elaborated in a separate chapter, but are in the sections of this chapter directly included in terms of introductions, methods, findings and partial conclusions.

CHAPTER 4 – CONCLUSION AND PERSPECTIVES

This chapter serves to conclude on the findings of the research, and draws the overall conclusion of the PhD research process and the partial conclusions presented in the cover. Finally, this chapter gives some overall perspective on the research topic and possible future research.

APPENDIX A

This appendix is the collection of the different appendices (A.x-A.x) that directly are related to the chapters and themes elaborated in the thesis. These appendices support the main thesis with the information and elements, which are not essential to get the general understanding of the research presented.

APPENDIX B

In appendix B the full collection of papers, in the format they were submitted for publication, thus, to ensure the original layout of models, figures, tables, schemes, etc., are kept. This, also to ensure that the original papers are presented in the way they were designed, and to give the reader the correct impression of the research and presentation of findings.

CHAPTER 2. RESEARCH DESIGN

The overall planning of the research is presented in this chapter. This includes philosophical considerations and assumptions, methodological choices, analysis and writing process. Furthermore, the key concepts of scientific paradigm, ontology, epistemology and methodology are clarified in forming a research design in relation to this research. Some key philosophical considerations and assumptions must be taken in to account when designing research. These notions need to be joined in a design to ensure credibility and trustworthiness of the research (Guba & Lincoln, 1994).

The chapter is structured in sections in which the following issues are investigated:

- Scientific paradigm
- Ontology
- Epistemology
- Methodology
- Research Design

2.1. SCIENTIFIC PARADIGM

A research paradigm is a way of observing the world. It is composed of certain philosophical assumptions that guide and direct action and thinking. Traditional the main worldviews and paradigms that are presented as being fundamentally opposed are positivism/postpositivism and constructivism/interpretivism (Creswell & Plano Clark, 2007; Morgan, 2007). Mixed methods research has been addressed as a response to the ongoing debates discussing the advantages and disadvantages of qualitative versus quantitative research as a result of the paradigm battle.

The positivist notion is that a singular reality and only one truth that are out there waiting to be objectively and value-free discovered which underpins quantitative research methods. In contrast and with the idea that there is no such thing as one single objective reality and that subjective investigation is the only kind possible to do and for that reason constructivists favor qualitative research methods (Creswell & Plano Clark, 2007; Erlandson et al., 1993). Despite significant developments made by poststructuralist, postmodernist, feminist and critical researchers among others within these broad paradigms, these two paradigms are still dominating textbooks and epistemological debates (Hughes & Sharrock, 2007; Teddlie & Tashakkori, 2009). Advocates of mixed methods research strive for an integration of qualitative and quantitative research strategies but even so this method does not fall comfortably within either of the worldviews described above. In accommodating the diverse nature of such research, researchers have attempted to

construct an alternate framework. Thus, there appears to be little agreement amongst mixed methods researchers on the nature of this framework. (Creswell & Plano Clark, 2007) Creswell and Plano Clark (2007) defines three alternate positions on the paradigm issue whereas Greene, Benjamin, and Goodyear (2001) mentions four different frameworks or paradigms for mixing methods, and even though Tashakkori and Teddlie in 1998 only discusses one framework in detail, they include another framework, explicitly the transformative perspective, in their latest book on mixed methods research (Teddlie & Tashakkori, 2009). The most commonly associated approach with mixed methods research is pragmatism (Teddlie & Tashakkori, 2009), pragmatism offers an alternate worldview different to positivism/postpositivism and constructivism by focusing on the researched problem and the consequences of the research in the "real world" (Brewer & Hunter, 1989; Tashakkori & Teddlie, 1998; Miller, 2006; Creswell & Plano Clark, 2007). The practical significance of pragmatism to research methodology has been highlighted by mixed method research, as a relevant research paradigm for all types of research and in particular to mixed methods research (Denscombe, 2008).

Paradigms imply models or patterns organizing structures and philosophical positions relating to the nature of a phenomena and social structures (Kuhn, 1962). Using a paradigm this way relates it directly to research as an epistemological position (Morgan, 2007). In this way a paradigm guides research efforts and the exclusion of other paradigms (Kuhn, 1962). Consequently, from the subjective multiplicity of interpretivism over the contextualized causal understanding of realism to the objective and measurable reality of positivism, paradigms could be construed as dogmatic and as requiring particular research methods and even excluding others (Greene et al., 2001). Kuhn (1962) noted that in that sense, a paradigm could restrict academic creativity and curiosity, and even blind researchers to aspects of new phenomena and theories, thus limiting the imagination (Mills, 1959). Even if not verbalized or made explicit, research questions reflects the researcher's epistemological understanding of the world. Also, any interpretation of findings will show the researchers' underlying philosophies drawing on and extending the notion that all knowledge is knowledge from some point of view (Fishman, 1978; Mounce, 1997). Most notable when regarding pragmatism as an alternate paradigm is that it evades the argumentative issues of truth and reality. Pragmatism accepts, in a philosophical stance, that there are both single and multiple realities exposed to empirical investigation, thus, positioning itself toward practical problem solving in the "real world" (Dewey, 1925; Rorty, 1999; Creswell & Plano Clark, 2007). This allows the researcher to be free of practical and conceptual constrictions imposed by the forced "choice" duality between positivism and constructivism (Creswell & Plano Clark, 2007), leaving the researchers outside the prison of a particular research method or technique (Robson, 1993). The quantifiable world relates more closely to existentialism in the pragmatists' view (Dewey, 1925). This is an orientation to a more "lessons learned" world consisting of different elements and layers, where some are objective, some

subjective, and some a mixture. The different layers can be stable or uncertain (Dewey, 1925), layers of "*completeness, order, recurrences which make possible prediction and control, and singularities, ambiguities, uncertain possibilities, processes going on to consequences as yet indeterminate*" (Dewey, 1925). Pragmatists argue that research should not only aim at how to most precisely represent reality (choice and outcome affected by ones paradigm), meaning to provide an paradigm-accurate account of how things are in themselves but instead ensure usefulness, meaning to aim at creating value in the "real world" (Rorty, 1999). The concept of "useful" calls for instinctive and reflective research practice. This type of research proposes the questions, which need to be considered to make research more than an attempt to reflect reality, of "what and who it is for" and "how do the researchers values and views influence the research". Translating paradigmatic and epistemological concerns, in this thesis, into research methodology, a pragmatic paradigm poses both some methodological questions and answers. Given a phenomenon that has different layers that needs to be measured or observed pragmatic mixed methods research offers to fill this gap by using quantitative methods to measure some aspects of the phenomenon in question and qualitative methods for others.

2.1.1. ONTOLOGY

Ontology can be explained as the focus on what reality is and what it entails. Ontological assumptions relates to how reality is perceived and the existence of, and relationships between, the individuals and the world in general. When studying reality, the general ontological continuum is either understood as relativist or realist. Relativists assume a reality created by individuals and their actions, activities and social relations whereas realists refer to the assumption that social reality exists independently of individuals, social relations and activities. (Guba & Lincoln, 1994).

The use of metaphysical concepts such as truth and reality has mostly been avoided by pragmatists (Teddlie & Tashakkori, 2009). There is no problem with acknowledging both a single "real world" and that all individuals have their own unique interpretations of that world in a pragmatic approach. Instead of treating incommensurability (unparalleled) as an "all or nothing" obstacle between mutual understandings, pragmatists deals with intersubjectivity as a key component of social life. Knowledge should, in a pragmatic view, be created through joint actions or projects that groups or individuals can achieve together (Morgan, 2007). Efficiency and effectiveness of research as the criteria for judging the value of research could be used, instead of correspondence of findings to some *true* condition in the real world (Maxcy, 2003). Efficiency and effectiveness of research is viewed as starting that the results *work* in respect to the specific problem. Maxcy (2003) noted that: "*What is healthy about a pragmatic social science of mixed and multiple methods is...it allows a number of projects to be undertaken without the*

need to identify invariant prior knowledge, laws, or rules governing what is recognized as 'true' or 'valid' only results count!" This is in sharp contrasts with the other paradigms that put emphasis on the nature of reality and possibility of one objective truth. The one most defining feature of pragmatism is an emphasis on what difference it makes to believe one thing or to act one way rather than another (Morgan, 2007).

My philosophical position as a researcher is pragmatism. My "pragmatic" standpoint focuses on evaluating the quality of solutions for given issues, which I find much more likely to settle a debate about problems than general methodological arguments derived from normative philosophical positions such as positivism and interpretivism. One the central features of pragmatism are that it rejects the difference between realism and relativism, which has been the central issue of debates about positivism versus interpretivism. For pragmatist, there is truly such a thing as reality, but it is ever shifting, based on our actions. So attempts to find a lasting, external reality are doomed to fail. The insistence on actions and their consequences creates a gap between most versions of interpretivism and pragmatism as removes the idea that we are free to construe our experiences in whatever way we see fit e.g. relativism. Instead, our actions have outcomes that are habitually predictable, and we create our lives around experiences that link actions and outcomes. I think that philosophy will be most fruitful when it acts as an extension of successful problem based research, rather than as a kind of "philosophy" that works "before" or "above" problem solution oriented research.

2.1.2. EPISTEMOLOGY

Epistemology is a way of framing knowledge, it defines how it can be produced and augmented. Pragmatism as an epistemological approach accentuates the reasoning of theories and concepts by studying their consequences and goals, values and interests they support. There numerus isms and some of the most dominant epistemological ideologies besides pragmatism, among other, is empiricism (phenomenalism, positivism, scientism and logical positivism) where the world is seen as external (Carson et al., 1988), where research phenomenon's and situations exists in a single objective reality not influenced by the researcher's perspective or belief (Hudson and Ozanne, 1988).

On the other hand, the position of constructivism (interpretivism) in relation to epistemology is that interpretivists believe that multiple socially constructed realities exists (Hudson and Ozanne, 1988). Between the two before mentioned we find rationalism which holds that knowledge is derived from priori processes or is innate in the form of concepts or intuitive (Lacey, 1996) and representationalism where the world we see is not the real world itself, but more like a miniature virtual internal representation (Lloyd, 1991; Thau, 2002).

Instrumentalism is a methodological view where theories and notions are seen as instruments, and their value is measured by how effective and efficient they are in explaining and predicting a phenomena. Theories are not seen as truth evaluating by instrumentalism (Popper, 1959; Dewey, 1984; Thagard, 2002; Van Fraassen, 2002). Pragmatism is a branch of instrumentalism - "a similar concept", which holds that something is true only when it "works" and "has practical consequences". Thus, the pragmatic view of knowledge entails that theories or findings will, or at least help, achieve specific goals, while at the same time counteract other goals. In other words, the criterion of what defines valid knowledge is evaluated based on the objectives and goals that this knowledge brings. The most important is to always consider what differences it makes for practice and not if a given theory is regarded as true. Also concepts should be constructed in ways which allow them to assist us in achieve the goals implied by using those concepts. (Tashakkori & Teddlie, 1998) Instead of positioning oneself as a relational researcher, distanced observer or socially and historically contextualized researcher, the pragmatist is able to study phenomena's of interest and value, study it in different ways of choice (best fit), and "*utilize the results in ways that can bring about positive consequences within the desired value system*" (Tashakkori & Teddlie, 1998). Placing the research question central, as proposed in this study and by the pragmatic paradigm, data collection methods are chosen as those most likely to deliver insights into the question with no philosophical loyalty to any alternate paradigm (Creswell, 2003).

The aim of this thesis is to assess the effect of collaborative components on the outcome of a building project. The knowledge that is sought is the extent to which the different components affect outcomes differently in terms of different contract forms. To gain this knowledge, it will be necessary to assess project outcomes against criteria that will measure the level of success attained though the extent and use of different collaborative components. In a parallel exercise, the attitudes of the project participant's collaborative components will be investigated. However, to establish what precisely is being measured, the strength of the attitude held must be given a context (pervious project, previous experience, contract form) within which it is measured. Following these investigations, the components and their effective situations that could have contributed to positive and negative project outcomes will be identified. An assessment of the participant attitudes towards these components will then be conducted. The assessment exercise will identify the outcomes that appear to have been influenced by specific components. This will result in an answer to the research question. Consequently, whilst this research will lead to knowledge of the potential effect of components on project outcomes, it will be a descriptive, explanatory, correlational, qualitative and quantitative study and by nature pragmatic.

2.1.3. METHODOLOGY

Types of research are often termed as being of a qualitative or of a quantitative nature. Quantitative research relies on clearly measurable "hard" data and on statistical data processing techniques. It seeks to provide an objective response to a question based on observable consequences and effects. Whilst this is the preferred approach in widespread scientific research (Silverman, 2000; Bryman, 1988) it is also used in social science research through methods such as, here applied on more "soft" topics: surveys, variables, analysis of official statistics, structured observation, analysis of content of mass media products, experiments using control groups. Numerous examples of application of quantitative research is exemplified including scientific experimentation on the use on products and processes, traffic surveys, and the sampling of voters in order to predict election outcomes (Zikmund, 1997). All based on systematic data collection followed by an objective statistical analysis relating the data to a theory. One may ask why we need any other type of research with such an approach being applied.

Conversely, when only using quantitative statistical analysis to reach conclusions researchers can only predict what might happen rather than explain what happen in a specific case. (Silverman, 2001) Subsequently, one such study of a particular set of circumstances relating to actions of individual human beings may not always be fully explained by quantitative research. If the goal is to develop an understanding of the circumstance that caused an event to occur a different approach that examines the action of individuals, may be more suitable. Such an approach carried out through interviews or by observation of individuals rather than through sampling and the use of closed surveys, is known as qualitative research. (Bryman, 2007; Silverman, 2000) There are pros and cons of and against each approach but it is still quite possible that a research project could have or even need elements of both approaches depending on the nature of the data needed at different points during the research project. This is known as mixed method research. (De Vaus, 2001; Bryman, 2007; Silverman, 2000)

This thesis on how effectiveness and efficiency in the building process can be improved by improving collaboration through a new situational framework for value optimization in the build environment is based on sequential data collection, starting with qualitative interviews followed by a quantitative survey. As a starting point the research applies semi-structured research interviews and on this basis develops and identifies themes, elements and components making a frame for a survey. The following section discusses, as a continuation of Section 2.1.3, key considerations when combining qualitative and quantitative methods in the data collection, processing and analysis.

SEQUENTIAL METHOD COMBINATION

Whether it is at all possible to combine qualitative and quantitative methods meaningful is a debate that draws threads to division between the ideals positivism and interpretivism (Heshusius & Smith, 1986; Kristensen, 1996; Bergman, 2008). Qualitative studies rely on a relativistic / constructivist paradigm, while quantitative studies reversed based on an objectivist / positivist paradigm: ”*In the end, the two sides may be close to speaking different languages – a neutral scientific or value free language versus a value laden language of everyday discourse*” (Heshusius & Smith, 1986). It is claimed that qualitative research is based on assumptions about one or more constructed realities, while quantitative research attributed to the assumption of the existence of only one objective reality. Consequently, Heshusius & Smith sees qualitative and quantitative research tradition as incompatible (Heshusius & Smith, 1986). These ideas of ontological and epistemological incompatibilities arise, according to Manfred Max Bergman, however, on a false premise that it is possible to conclusively establish the characteristics of qualitative and quantitative research tradition. Bergman sees the two approaches as heterogeneous groups with such great internal variations, that in practice it is pointless to maintain a sharp distinction between them. According to Bergman a study’s philosophical basis is independent of whether the data collection process is done through interviews, surveys, etc., and he advocates that the fundamental epistemological considerations should be separated from how the empirical data are collected and analyzed (Bergman, 2008). This view is shared by Bent Flyvbjerg, as he finds method combination advantageous:

”God samfundsvidenskab må stå for et „både--og“ og forkaste „enten eller“ i spørgsmålet om kvalitative kontra kvantitative metoder. God samfundsforskning er problemorienteret og ikke metodeorienteret i den forstand, at den bruger de metoder, der i forhold til en given problematik bedst kan besvare de relevante forskningsspørgsmål. I mange tilfælde vil en kombination af kvalitative og kvantitative metoder kunne løse opgaven bedst” (Flyvbjerg, 2010).

“Good social science must stand for a "both, yes and no" and reject "all or nothing" in the question of qualitative versus quantitative methods. Good social science is problem-oriented and not method-oriented in the sense that it must use the methods in relation to a given problem that can best answer the research question. In many cases, a combination of qualitative and quantitative methods could solve the problem in the best way” (Flyvbjerg, 2010).

However, method combination requires, according to Bergman, that (1) there is a clear distinction between methods for data collection and data analysis, (2) paying attention to what aspects of the different analytical phases that are inductive and deductive, (3) to secede from the "traditional thinking" of research (not all quantitative analysis is hypothesis-testing, and not all qualitative analysis are social constructivist) and (4) to focus on explicitly argumentation for approaches in

relation to the issue, empirical needs, theoretical framework and research design (Bergman, 2008).

This research project follows the mixed methods tradition and is designed as a sequential mixed data analysis in two phases, the first phase is qualitative and second phase is quantitative, while the analysis of the two phases are linked (Tashakkori & Teddlie 2009). This sequential approach is exploratory, descriptive and correlational since the qualitative stage intends to identify and construct themes under which the level and use of collaborative elements can then be validated, quantified and examined for correlations in the second phase.

The first phase is predominantly inductive, but is also semi-structured from existing literature, theory and previous studies. In addition, the explorative and descriptive approach to the interviews resulted in an iterative approach on data collection, where the findings continuously have been involved in setting the agenda for new interviews. Second phase contrasts deductive aspects, were most of the questions in the survey were closed and based on the interview findings, the literature study and the theoretical framework. This approach is adopted to identify and map how effectiveness and efficiency in the building process can be improved by improving collaboration through a new situational framework for value optimization in the build environment. Thus, there is a need for a design that allows for an open and at the same time quantifying data collection that can be interpreted on the basis of the theoretical framework. Using a sequential mixed design (Teddlie & Tashakkori, 2009), different methods were meant to inform and supplement each other because they addressed different aspects of the study meaning different layers of the phenomenon as they are taken from different research strategies. In Denscombe's (2008) terms, methods were mixed to avoid the biases inherent to the use of mono-method design, and as a way of building on the initial findings. The surveys in this thesis were designed to follow the semi structured interviews sequentially to explore in more detail the interviews findings, thus, quantifying it.

Semi structured interviews were thought to be the method most suitable for exploring the processes of take-off. The interview data were analyzed in three separate stages, first "quantitatively" reducing (where possible) in-depth discursive answers to categorical responses to the questions posed and analyzing them. Also, raw interview data were analyzed using a qualitative approach by grouping responses according to questions and emerging themes, condensing meaning. Finally, the raw interview material, interviews were analyzed by re-reading interview transcripts and listening to interviews again looking out for well-rehearsed metaphors, slogans or narratives.

The specific methods used in this study are presented in the next Section, where the research design and processes are elaborated.

2.2. RESEARCH DESIGN

The research in this thesis was conducted in a six step approach, each having its own scientific contribution (Table 2-1). At each step, methods, output, reasoning level, and the initiatives undertaken to ensure validity and reliability are presented. Furthermore, each step contributes to an increased understanding of the challenges and as guidance to the research throughout the research period.

Table 2-1 The six steps in which the PhD thesis is conducted.

Description	Method	Output	H/RQ
1 Point of reference - Literature review To identify the point of reference for a partnering approach, an analysis of the construction industry and general conditions in the industry will be conducted. What is the research trend in top tier journals for partnering and research on collaboration in the construction industry? What is the state-of-art within the research area in top tier journals classified by "upcoming" trends? **Processed in Section 3.1**	Method: *Reviewing and classification of literature*	Paper 1	
2 Lessons learned in the construction industry Archival/document analysis An archival based design will be used to assess lessons learned about collaboration in the Danish construction industry. By systematically reviewing reporting's from experimental buildings projects in the Danish construction industry different collaboration related elements were identified. The reports are from the period 1991-2015. A subsequent discussion of the elements produced new themes for further research. **Processed in Section 3.2**	Method: *Reviewing and classification of literature* *Desktop analysis* *Discussion* *Synthesis*	Paper 2	
3 Defining collaborative components in an effective and efficient collaboration in a construction project Qualitative interviews focusing on exploring the themes derived from Step 2, themes that were derived from a contraction of the identified aspects in collaboration through the past two decades in the Danish construction industry. The themes will be examined to conclude on which of the themes are actually encompassed in effective and efficient collaboration; according to the collaboration	Method: *Expert Interview* *Desktop analysis* *Synthesis* Analytical: *Content and language analysis*	Paper 3	

partners, this will generate collaborative elements. There will also be a fixed focus on which of the themes and elements that is theoretically included in an effective and efficient collaboration and how these are related to practical implication in collaboration in the industry. **Processed in Section 3.3**			
4 Quantitative assessment of collaborative components in an effective and efficient collaboration in construction Based on interpretation of the interviews a survey was prepared with the aim of verifying previous found collaborative elements. Different theories will be used which makes the effects and structures of the elements visible and elaborates on how these specifically complementary to each other. The theories touch specific parts of the elements and thus the structures that constitute the active parts of the elements which will help enhance collaboration. Through the evaluation of the structural coherence of the elements components become visible; these components are thus helping form the backbone of the model for Effective Situational Collaboration, EESC. **Processed in Section 3.4**	Method: *Survey* *(Pilot)* Analytical: *Analytical survey* *Statistics*	Paper 4	
5 Selecting the right collaborative components in a construction project Can partnering be justified from an efficiency perspective seen though the optics of contract theory? Is partnering either seen as something that neutralizes opportunism when there is an incomplete contract or something that reduces transaction costs for renegotiation of complete contracts when new information arises? The previous steps which consists of interviews, follow-up surveys and a comprehensive theoretical processing has determined precisely the components that pushes collaboration to the next level of collaboration, i.e. resulting in better effectiveness and or efficiency in the Danish construction industry. Therefore, it is in this area - providing a quantification of the situational linkage between collaborative components and effective and efficient collaboration this step excels.	Method: *Survey* *(Full)* Analytical: *Analytical survey* *Statistics*	Paper 5	

Components will be linked to a contract form via a survey, which measure the degree to which the components are already in use within the selected contract types and to draw conclusions about which components that need more effort to facilitate and improve collaboration. When this is done, the component has now transferred into Efficient and Effective Situational Collaboration Components or EESC in short. Making the components situational means linking the components to selected forms of contracting and construction parties, it also means to investigate which of the components that should be most focused on in a given situation. Selected contract forms are trade, general and design and build (D&B) and public private partnership light (PPP light) contracts. **Processed in Section 3.5**			
6 Development of generic framework Development of generic Efficient and Effective Situational Collaboration (EESC) framework model. **Processed in Section 3.6**		Final thesis	

Table 2-1 summarizes the framework of the research conducted, and provides an overview of, how each step in this research is presented in the following chapter, and how the research and research questions are related to the steps in the framework and the sections of the chapter.

Both quantitative and especially qualitative research can be influenced or biased by the researcher. To ensure the reliability and validity, emphasis is put on addressing Guba (1981)'s criteria for trustworthiness of research; credibility, transferability, dependability, and confirmability. These criteria are evaluated and addressed for each step, see Appendix A1.

STEP 1

The first step of the research process was to To identify the point of reference for a partnering approach and construct a theoretical landscape, the method used was an extensive and systematic literature study, for a full description see Appendix B – paper 1. The input to the literature study was keywords based on prior experience and the iterative review process. The articles were reviewed and exposed to a

content analysis with the purpose of identifying general conditions in the construction industry. What the research trend in top tier journals for partnering and research on collaboration in the construction industry was. Thus, identifying state-of-art within the research area in top tier journals classified in "upcoming" trends. The output of this step is summarized in Paper 1 Appendix B.

STEP 2

An archival based design was used to assess lessons learned about collaboration in the Danish construction industry. By systematically reviewing reporting's from experimental buildings projects in the Danish construction industry different collaboration related elements were identified. The reports are from the period 1991-2015. A subsequent discussion of the element produced new themes for further research. This step was a preliminary study where the outset was previously obtained knowledge and theory on the field of collaboration (partnering outset) and the general settings of the construction industry. These elements formed the base of knowledge to the research question. The output of this step is summarized in Paper 2, Appendix B.

STEP 3

This step was undertaken as an exploratory semi structured interview study with 16 participating companies. The interviews focused on exploring the themes derived from Step 2, themes that were derived from a contraction of the identified aspects in collaboration through the past two decades in the Danish construction industry. The themes was examined to conclude on which of the themes are actually encompassed in effective and efficient collaboration; according to the collaboration partners, this will generate collaborative elements. There was a fixed focus on which of the themes and elements that were included in an effective and efficient collaboration and how these related to practical implication in collaboration in the industry. For a full overview of the study research in step 3 see Appendix B – Paper 3.

STEP 4

Step 4 was an verification of the data gathered in step 3 in form of a survey. Based on interpretation of the interviews the survey was prepared with the aim of verifying previous found collaborative elements. Different theories will be used to make the effects and structures of the elements visible and elaborate on how these specifically complement each other. The theories touch specific parts of the elements and thus the structures that constitute the parts of the elements which will help enhance collaboration. Through the evaluation of the structural coherence of the elements components become visible; these components are thus helping form the backbone of the model for Effective Situational Collaboration, EESC. The full description of this part of the research can be seen in Appendix B – Paper 4.

STEP 5

The previous steps including interviews, survey and a comprehensive theoretical processing has determined precisely the components that pushes collaboration to the next level of collaboration, i.e. resulting in better effectiveness and or efficiency in the Danish construction industry. Therefore, it is in this area – step 5 is providing a quantification of the situational linkage between collaborative components and effective and efficient collaboration this step excels. Components found in step 3 and 4 will be linked to a contract form via a survey, which measure the degree to which the components are already in use within the selected contract types and to draw conclusions about which components that need more effort to facilitate and improve collaboration. When this is done, the component has now transferred into Efficient and Effective Situational Collaboration Components or EESC in short. Making the components situational means linking the components to selected forms of contracting and construction parties, it also means to investigate which of the components that should be most focused on in a given situation. Selected contract forms are trade, general and design and build (D&B) and public private partnership light (PPP light) contracts. The full description of this part of the research can be seen in Appendix B – Paper 5.

STEP 6

Step 6 is the last and final step were the development of generic Efficient and Effective Situational Collaboration (EESC) framework model is done and the thesis is written.

An illustration of the steps can be seen in Figure 2-1.

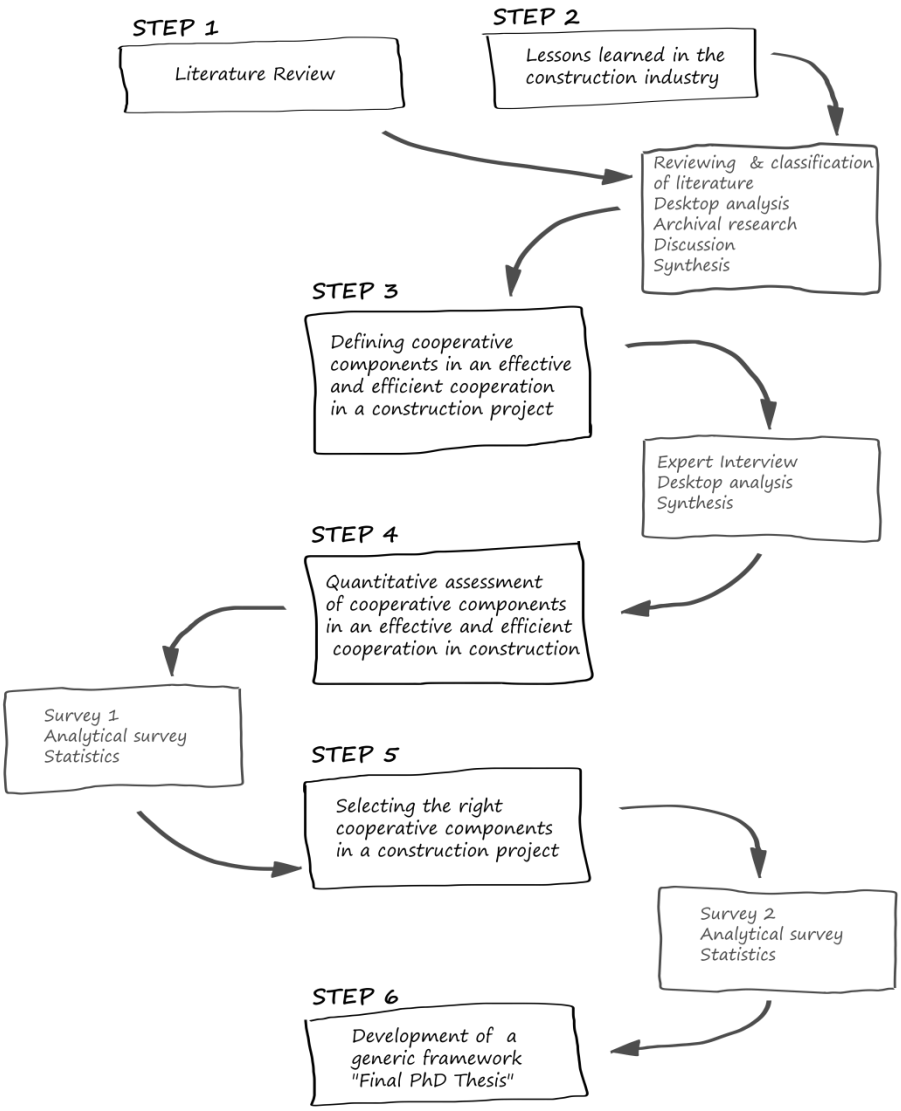

Figure 2-1 Figure illustrating the structure of the six steps in the research process

CHAPTER 3. DEVELOPMENT OF THE EESC FRAMEWORK

In this chapter all of the research carried out, to gain insights to develop a situational framework for value optimization in the build environment, is presented. The methodological approaches and findings presented in this chapter, is based on the research design presented in Table 2-1. During the chapter, the different research activities are regularly linked to the published papers in Appendix B, where the full scope of the different research activities is presented in its intended form.

3.1. PARTNERING AS AN APPROACH

To get a better understanding of past research trends and literature, a literature review was carried out. The objective of this review was to explore the current literature by systematically reviewing and summarizing research trends in leading top-tier construction management journals between 2002 and 2012, addressing how the themes in partnering related publications change across this period. For the full work on this research see Paper 1 in Appendix B.

This part of the research is not directly related to the research questions, but should be seen as a standpoint for further research.

3.1.1. INTRODUCTION

A systematic review of past research trends and literature is essential for any academic research (Webster and Watson, 2002). Before initiating any study the need to discover what is already known in the body of knowledge should not be underestimated. Since its beginning in the early 1980s partnering in construction has been overexposed from theoretical exploration to practical application (Cook and Hancher, 1990), lacking an overview of the current status and partnering research clarifying a gap for future trends of research. In a follow-up on partnering research trends up until 2009 Hong et al. (2012) state that because of the diversification in research topics under the partnering models with unsatisfactory analysis of partnering related issues, there is a need review and summarize the research trends of partnering related research to fill the aforementioned gap. One can argue that there is a gap where integration and classification of literature within the domain of partnering may prepare the ground for impending researchers to obtain a more clear understanding of the topic, thus conduct supplementary research more effectively and efficiently. To gain comprehensive overview and insight into research trends within the area of partnering in construction projects review of

academic journals can be considered as the furthermost effective approach (Hong et al., 2012; Bygballe et al., 2010). Tsai and Wen (2005) argue that being aware of some important academic journals helps to understand the field of science more widely, thus having a methodical analysis of articles published in top tier academic journals may well assist researchers to explore the current status and future trends of one specific topic. However, only a few of such critical analyses have been undertaken in the field of partnering to date only covering up until 2009 (Black et al., 2000; Hong et al., 2012; Tang et al., 2006).

In this part of the thesis is therefore attempted systematically to review partnering related literature, only concerning the construction industry, and to uncover research trends of partnering related articles in leading top tier journals on construction management between 2002 and 2012, addressing:

1. Coverage of partnering related research in construction journals
2. Contribute to partnering related research and applications
3. Variations in research topics

This expands on the current literature by systematically reviewing the past research trends and literature, thus providing a critical overview of the development in the academic field of partnering and hence, creating a solid reference platform for further research to obtain more useful insights into partnering related issues.

3.1.2. THE PROCESS OF THE LITERATURE STUDY

Despite the large number of studies in the area of partnering conducted since the early 1980s, little attempt has been made to translate these findings systematically into a comprehensive review of current knowledge, thus compiling an overview of the current body of knowledge. This review was based widely on the review methods used by Pittaway et al. (2005), Tsai and Wen (2005), Hong et al. (2012), Levy and Ellis (2006) to illustrate research output published in the top tier journals in the chosen topic, partnering.

To enable a transparent and thorough investigation of partnering trends, a three stage literature review method was adopted, designed to provide a systematic and explicit method for the review. For the full work on this method see Paper 1 in appendix B

In stage 1 keywords on the subject based on prior experience were identified. The keywords were identified using a form of brainstorming. They included, for example, partnering, relationship, alliances, strategic, collaboration, project, construction, among others. Papers with these specific terms included in the keyword, title or abstract met the needed requirements of this study, search result: 3,585 papers.

The results were indexed in EndNote and used to identify further keywords for the main search. For example, additional words, such as relationship, partner, collaboration and alliance were found to be important during the analysis.

In stage 2 a new search string was used in six search engines to identify four key citation indexes for the review. These were chosen based on the volume of citations relevant to the basic search string, search result: 612 papers.

To elaborate the method of selecting the target journals for the final search of articles in the third stage, the criteria for selecting journals were as follows:

1. Construction related journals with a considerable number of publications and H-index on partnering related research.

2. Construction journals ranked within the top 20 in the ranking list derived from academic research engine brought by Microsoft.

3. Construction journals rated as top ranked and most valuable for peer review.

Criterion 1 was defined according to the search result of the Web of knowledge search engine. Amongst all journals publishing partnering related research papers shown in this search engine, only the top ranked included in the search result. Criterion 2 was mad to ensure that only top ranked journals were selected. Criterion 3 was selected as a control, so that journals with high impact factors according to ISI Journal Citation Report were selected for additional analysis. Exclusion of other construction related journals from analysis is primarily because they are either not among the top ranked journals with relatively high impact factors or they have published very few papers related to partnering.

In stage 3 a more attentive search of selected journals was made using the same search engines, search result: 282 papers.

The now more detailed search in the four selected databases gave a total of 282 results evenly distributed in the following manner ABI Proquest (96), Science Direct (78), Web of Knowledge (44) and Emerald (64). It was obvious that not all journals were covered equally in the four databases, which meant that many duplicates appeared, a total of 61 articles were downloaded more than once in the search, when a more detailed review in EndNote was conducted the number of duplicated articles were as follows ABI Proquest (50), Science Direct (28), Web of Knowledge (20) and Emerald (32) which meant that the total number of articles was reduced to 221. By further analysis another 79 articles were excluded due to their insignificance to partnering research after a critical evaluation, so the total of

partnering related papers came down to 141. The new distribution was as follows ABI Proquest (66), Science Direct (22), Web of Knowledge (30) and Emerald (23).

An important note to be made here is that covering a comprehensive set of partnering related articles on the basis of subjective judgment for identifying partnering related papers is difficult, if not impossible.

The phase of coding the themes in the articles was done using the program Endnote to generate a general impression of the themes that arose from the articles. The themes that emanated from the coding are illustrated in Appendix B – paper 1.

3.1.3. CONSTRUCTION PARTNERING OVER TIME

Partnering emerged in the late 1980s as a new project collaboration method which sought to create a win/win assertiveness among all construction parties in ideal situations (Smyth, 1999; Lazar, 2000). In order for this to work partnering must create a trust-based environment, thus encouraging participants on a project to make firm contributions to achieving the completion of a successful project thus creating a win/win situation for all (Cowan, 1992; Scott, 2001; Construction Industry Institute, 1991; Millard, 1992; Zhang et al., 2006). Since the 1980s partnering has been used increasingly in the construction industry, especially during the past fifteen years. Recently, further advancement to partnering termed “partnering-light” has also been successfully used in the industry. Besides containing key factors from partnering, partnering-light uses a risk allocation with gain and pain share to control the process. In this light model of partnering, parties contractually commit to their contribution and required profit and then place these at risk in undertaking the project. Even though partnering to some degree has shown to increase quality and value (Tang et al., 2006, Larson, 1995, Davis and Love, 2011, Eriksson et al., 2007), competitive tendering seems to be coming back with a vengeance. In the future, would we think that "partnering" was just a candy-trendy-word in the industry, flavored with a salad topping named "collaborative and collaborative working", or is there still something overlooked in the message increased value creation as Bennett & Jayes state back in 1995 in their book Seven Pillars of Partnering.

3.1.4. RESEARCH THEMES IN PARTNERING RESEARCH

Hong et al. (2012) and Li et al. (2000) classify research on partnering before 2000 and now again in 2012, Li et al. (2000) propose in their paper on partnering research in construction that it could be divided into two general groups an empirical and non-empirical study. Both of these categories are divided into four subcategories to generalize the research topics for the empirical studies, specifically research on; project partnering, research examining partnering relationship, research having an international focus and research highlighting a special use. The non-

empirical were divided into the following four topics; type of partnering, models of partnering, partnering process, and structure. But, with another thirteen years past, the latitude of partnering research has been covering a much more wide ranging level (Bygballe et al., 2010).

This study identified ten distinctive research themes within the last 11 years by summarizing and differentiating the research interests in partnering papers, that is as follows: Barriers to implementation; Advantages, inducements of implementation; Feasibility analysis; Critical success factors; Performance measurement, assessment; Review of development and application; Strategies and recommendations for implementation; Supply chain management, use in partnering; Theory and model and Trust. Deciding on which theme represents the scope of each paper seems uncertain and subjective, in the review it was attempted to be as objective as possible by minimizing or even eliminating any variations in review. An important note here is that the study was conducted merely for comparison purposes and to gain more knowledge in the startup phase of this Ph.D. study.

An in depth review of the published papers showed that research in partnering mostly involved the following: examining the use and impact of trust in construction partnering e.g., Rahman and Kumaraswamy (2012), Davis and Love (2011) Laan et al. (2011) and Badenfelt (2010); Reviewing feasibility and exploring the applicability of adopting a partnering approach on a single project or the entire construction industry of a region or country e.g., Bower (2002), Lu and Yan (2007) and Mohan et al. (2007); Detailing benefits and clarifies the incentives for implementation e.g., Lu and Hong (2007), Kenneth et al. (2006), Eriksson (2010) and Deborah et al. (2012); Highlights of barrier to implementation and indications on how these can be overcome e.g., Pan and Sidwell (2011), Bresnen (2010), Per Erik et al. (2009), Phua (2006) and Chan et al. (2003); Providing evaluation, strategies, and recommendations for partnering implementation e.g., Bresnen (2009), Kadefors et al. (2007), Eriksson (2007), Swan and Malik (2007).

As seen in this study of partnering research over the last decade, review of development and application of partnering is becoming moderately mature as exemplified by an increasing amount of published papers after 2007. On the other hand research on trust, feasibility, advantages, inducements of implementation and barriers to implementation is emerging, in which investigation has been conducted by many researchers to set a case example of partnering in construction in recent years.

3.1.5. PARTIAL CONCLUSION

Partnering gained popularity for achieving better value for money within the construction industry. In the era 2002 and 2012, 142 papers related to partnering studies in construction were published in these journals. An in-depth review of the

papers indicated that research in partnering have been increasing gradually over the years, thus taking a turn from a theoretical to at more solution-oriented research on review of partnering development and application as well as benchmarking and overcoming barriers. Ten categories were classified as the primary research interests in partnering papers. The new approach to partnering research reflects that the fundamentals of partnering are known; now all we need is to use it (Eriksson, 2010; Bresnen, 2009; Gadde and Dubois, 2010).

This overview provides a solid reference platform to gain more insight into partnering related issues and trends, thus an overview of the development of construction collaboration and collaboration in the academic field were gaps and new trends provide ideas for further research.

The initial aim was to work with partnering as a set of elements and components, and the target was a definition that would help partnering organizations to make informed choices about these elements and components. The background was a vague and non-unambiguous definition of partnering with the need for structural flexibility. It has become evident, when reading through all the articles that partnering is not necessarily the backbone for the EESC framework, it is rather a step stone. Partnering is based on collaboration and collaboration; and one of the newest presented forms incorporating a plethora of elements and this is why partnering will be used as lens when looking at lessons learned in the next step.

3.2. THE GENERIC BASE – LESSONS LEARNED

In this chapter all of the research carried out, to gain insights in lessons learned about collaboration, is presented. This was a preliminary study where the outset was to explore previously obtained knowledge in the field of collaboration (using partnering as a lens) and uncover collaborative themes for further research based on prior knowledge from experimental projects.

3.2.1. INTRODUCTION

Collaboration is a fundamental challenge in the Danish construction industry, because it requires the parties to work towards common accepted goals. When realizing the importance of collaboration for value creation in the future built environment, the author wonders how a model for collaboration should look for the Danish built environment to contribute to value creation in line with the development. The construction industry needs to create higher efficiency and effectiveness. In order to elucidate the issue further, a widespread of past and present ways of collaboration is investigated. In the forthcoming the further investigation of collaboration in the Danish construction industry will be based on the last 20 years of significant measures for innovation in collaboration and the concept of partnering to which the key initiatives relate. Several measures have been tried to improve collaboration, but it has not had a strong impact. Partnering was introduced in Denmark in the early 2000s, but has never gained foot-hold. These attempts only created a vague definition of what effective and efficient collaboration should be, thus no strong coherent "recipe". An archival based design was used to assess lessons learned about collaboration in the Danish construction industry. By systematically reviewing reporting's from the period of 1991 to 2015 on experimental buildings projects in the Danish construction industry different partnering related collaborative elements were identified. These elements are vital as they create the base themes for research on new "value creating" elements for the components in the EESC framework. The findings of this research should likewise provide insights to the objectives highlighted in R1 and R2.

(R1) What lessons are learned in the Danish construction industry when considering development of collaborative approaches?

(R2) Which themes encompasses in effective and efficient collaboration in a historical perspective?

3.2.2. AN OVERVIEW OF COLLABORATION

Collaboration between construction organizations has always been the basis of construction project success (Latham, 1994; Bennett and Jayes, 1995, 1998; Barlow et al., 1997). Several articles, books, companies, and research institutions have long been concerned with the issue of poor collaboration (Bresnen and Marshall, 2000). It seems that regardless of context and scope, collaboration is consistently attributed to be an essential determinant of success in construction projects. However, there has been almost no empirical work done to assess objectively the importance of collaborative elements on various aspects of collaboration to project success.

Quality and productivity are known problems in the industry that need improvement to facilitate a positive development. Phua and Rowlinson (2004) points out that collaboration provides insight into the entrenched barrier that the construction industry must break to set the basis of construction project success. The very act of working together can be defined in several ways as collaboration and collaboration. These words are often use interchangeably, but represent essentially different ways of adding value to a group or team in a project and each comes with its own dynamic forces and control structures that help form groups in different ways. Collaborating means people work together, co-labor, on a single shared goal (Bennett and Jayes, 1995). Cooperating means people perform together, co-operate, while working on selfish nevertheless common goals (Bennett and Jayes, 1995). The logic here is "*If you help me, I will help you*", and it allows for the unprompted kind of involvement that energies systems and teams. In the forthcoming, collaboration will be used interchangeably. Essentially, collaboration means two or more persons carrying out work with a common goal.

COLLABORATION IN THE DANISH CONSTRUCTION INDUSTRY

For decades the construction industry has been criticized for its productivity and in the 1990s the industry began to focus on collaboration as one of the causes (Pedersen and Kristensen, 2008; Høgsted and Olsen, 2006). The construction industry is quite simply heavily influenced by a need for better collaboration (BAT kartellet, 2010; Værdiskabende Byggeproces, 2012). The structure of the construction industry, where a project team is created for each project and then broken down, is a barrier to productivity growth, technological improvements, and innovation (Bolig- og Byministeriet, 1998). Thomassen et al. (2014) point to an inability to establish firm and long-term collaboration in the construction industry, and Værdiskabende Byggeproces (2012) argues that the lack of collaboration is the reason for construction projects exceeding cost, time and quality. At the same time Jørgensen et al. (2013) define collaboration as an essential part of a good construction process. The general perception is that the construction industry is a sector plagued by disputes (Brooker and Lavers, 1997), which leads to limited collaboration (Bresnen and Marshall, 2000).

Lars Holten placed the construction industry's collaboration issues on the agenda in the 1990s with the article "Tør vi tænke positivt? (Do we dare think positive?)" (Høgsted and Olsen, 2006). The construction sector was characterized by a rhetorical way of solving problems and conflicts, cost overruns, disputes, and legal battles. The culture of collaboration was characterized by distrust, intolerance, disrespect, and antipathy between the key partners of the construction project. The problems that Lars Holten brought forward in the 1990s are seen constantly today, albeit reduced. Apelgren et al. (2005) specifically point at the ability to get continuity in the project and not at the technical construction skills of the parties. It is necessary to examine the entire value chain, because one of the main features of failure is the complex chain of errors committed by one player and the problems posed by a second one (EBST, 2004; Apelgren et al., 2005). Concurrently, the advantages and disadvantages of planning and quality assurance rarely lie with a single player, which may result in an unequal distribution of benefits and limited incentive (EBST, 2004).

The nature of collaboration is in itself in conflict with the current way of working in the construction industry, as the industry is characterized by many different parties, each with its own objectives, and according to Høgsted and Olsen (2006) selfish goals will often have a highest priority due to limited trust. Bolig- og Byministeriet (1998) explains that it creates sub-optimization and thus a lost focus on the common goal. It creates a lack of responsibility for the totality of the construction process (Bolig- og Byministeriet, 1998). Høgsted and Olsen (2008) describe distrust as a prerequisite in the traditional way of cooperating in the construction industry, based on the parties' self-interest, inter alia, experience by poor optimization, avoidance of the consequences of their own errors, and request for claims for losses on other parties' failure. The parties are behaving based on opportunistic human nature and trying to maximize their own benefits (Loosemore and Qu, 2015). Høgsted and Olsen (2008) compare the construction process to the "blame game" where waste is accepted as long as it only occurs to the other parties. The traditional way of collaboration can be described as an antonym to the above definition of collaboration. The lack of effective and efficient collaboration in the construction industry is striking in light of the productivity problems, failure, and bad judgments that Holten (1996) and Høgsted and Olsen (2008) illustrate. Collaboration is the cornerstone for a positive development in the construction industry, and the need for improvement in the Danish construction industry is evident.

THE CONSTRUCTION INDUSTRY IN A FUTURE CONTEXT

The perception of the construction industry must be changed in the future. The focus must move from individual technical parts to a focus on the benefits for users in a larger societal perspective (Værdiskabende Byggeproces, 2012; EBST, 2006a). Only the most valuable must survive in the development of the construction industry where focus must be on processes and products (EBST, 2006). In their vision for the year 2020 EBST (2006a) requests a "Byggeri med mening

(Construction with meaning)" which focuses on creating meaningful projects for the users, society, and the construction sector. Both recognized and non-recognized user needs to be the focal point when creating construction with increasingly higher quality and, therefore, added value to users throughout the lifespan of the structure. Quality is not just a built environment made of good materials; it has to meet customer needs, thus enhancing quality of life. The needs are practical, emotional, and spiritual as they are changeable and require buildings that create identity, promote creativity, and are flexible so that they have maximum value both today and in the future. The value is also increased as the work can be characterized by fault-free products; a result of effective and efficient collaboration throughout the process. (EBST, 2006a)

Innovation should significantly contribute to heightening the productivity and thus be a catalyst for development in the productivity. Innovation must take place across the industries where construction enterprises must explore possibilities and knowledge of companies in other industries. Construction should be characterized by mutual trust with a special focus on collaboration (Bygballe and Ingemansson, 2014). Design and manufacturing must be two parts of the same process, instead of two separate processes, in order to achieve greater value. The tradition-bound mistrust and poor optimization should be replaced with partnering that promote both process and product, and that ensures success for all parties involved in the construction project. (EBST, 2006a) Construction should no longer be perceived as the technical capacity to create buildings, but be seen in the broader context of the built environment. A good built environment creates value in other parts of the economy through good conditions for users and a positive impact on society. (EBST, 2006a) Improvements will come through higher efficiency and effectiveness. Today’s focus is on capital costs rather than the ultimate value in terms of value added in the industry, society, and the environment. Both clients and contractors must realize that decisions made in the planning and construction phases have large consequences downstream.

There are no incentives for change, because most clients have short-term goals, and suppliers with long-term goals are therefore not rewarded (Moreira and Silva, 2014). At the same time, the suppliers and contractors have no incentive to focus on building life cycle. There is a need for an improved delivery model, because the model currently lacks integration and prevents improvements (Bhote, 1989; Gobbi et al., 1999). There have been several attempts in Britain where collaboration has proved to be central to a good delivery. To achieve focus on the built environment lifecycle it is necessary to develop an integrated design model where the focus moves from the lowest price and instead to where the entire supply chain collaborates (Bejder et al., 2008). The supply chain must unite, and parties should be weaned not to lead the risk away from them. (Constructing Excellence, 2009) It has been realized in the industry that the current direction is not a solution; change

is needed. There are two ways to go: back to the old habits or towards effective and efficient collaboration. (Constructing Excellence, 2009)

EBST (2006a) and Constructing Excellence (2009) are just two among many reports that attempt to shed light on the challenges in the industry. In Denmark, several reports from industry associations, public bodies, and the environment are released. Internationally, the UK, Australia, USA, and Hong Kong distinguished themselves with releases about collaboration in the construction industry in the construction-related journals (Bohnstedt, 2013). Common to all is that all are looking towards an improved industry where collaboration rather than working against parties is customary in a construction industry that focuses on value in a life cycle perspective. There are calls for cohesion in the delivery of a project so that it lives up to the expectations of the future built environment, and the Danish construction industry must overcome several obstacles in order to progress to the new more efficient and effective construction industry, as called above. Collaboration characterized by good ethics is identified as an essential need in this context, and the perception of the construction industry should be extended from single construction projects to the entire built environment.

3.2.3. PAST INITIATIVES

Since the realization of the challenges in the construction industry in 1990s, several initiatives been initiated with the aim to innovate collaboration in the industry to tackle the aforementioned problems. These measures should have improved the productivity and quality in the construction industry from different points of view, which is why the means of innovation have differed. The professional organizations, companies, educational and research institutions of the construction industry and the government have been driving initiatives and participated in the debate on the future of the construction industry. The state has participated in the construction industry development through experimental construction projects and debates and, on this basis, demanded and released guidelines for public and publicly funded construction projects. Among other things, there is for an example a requirement to consider quality, public-private partnership (PPP), and the overall economy (Order no. 1179 of 04.10.2013). Thus, enabling contractors and suppliers to be involved in a different way and manage the construction operations for a predetermined period. Among the organizations that have tried to contribute to the development of the industries is the Benchmark Centre for the Danish Construction Sector (BCDCS) and the Client Association (CA). BCDCS has initiated several measures for innovation through thematic groups that examine the Danish construction development and opportunities. CA is working with committees and networks that prepare guidelines for clients. The BAT Cartel has helped putting the construction industry problems on the agenda through the publication of reports. The industry organizations have also in collaboration prepared guidelines in the hope that it will inspire companies in the industry. In addition, companies, industry

organizations, and research institutions have done similar work and thus contributed with new collaboration initiatives. Over time there has also been initiated several think tanks, but it is the authors' experience that only one of them is still in use today; that is "ValueBuild" (Værdibyg).

Table 3-1 shows the most important initiatives in collaboration made in the Danish construction industry since the 1990s. Based on the implemented initiatives, the forms of collaboration used for innovation, what the impact has been, and what new forms of collaboration used in the construction industry today are identified. The selected initiatives have had a direct focus on collaboration, and it should be noted that the initiatives "The Digital Construction" and "Lean Construction" are pictured in Table 3-1, because they have indirect effect on collaboration. The initiatives have stimulated various aspects of the study on innovation. Overall, the aspects can be formulated as collaboration through logistics, collaboration at the construction site and value creation in the construction process through collaboration. Table 3-1 shows an overview of the distribution of aspects by initiatives.

Table 3-1 Initiatives in collaboration made in the Danish construction industry since the 1990s

The experimental projects are characterized by a difficult dilemma of innovation versus productivity in the innovation process according to Clausen (2002). Companies always have goals for productivity on the basis of existing knowledge, because they are profit makers and, at the same time, have to generate new knowledge. It is a relatively large disadvantage of experimental projects as the cast may be subject to the same productivity targets as in an ordinary building project and, therefore, have limited resources for the learning part. This means that great time pressure and the need for ad hoc problem-solving moves focus to productivity instead of learning and innovation must at times give way to traditional practices. (Clausen, 2002)

INTERNATIONAL PARTNERING IN A DANISH CONTEXT

During the 1990s focus was on the collaboration challenges in the Danish construction industry, and the concept of partnering became a buzzword based on experience with the new form of collaboration abroad (Holten, 1996). Partnering was first taken up in the US in the late 1980s and well over a decade later in the Danish construction industry (Højland, 2002). The partnering concept later became a form of collaboration in the Danish construction industry as a result of the increased innovation initiative Project New Collaboration Forms (Projekt Nye Samarbejdsformer). Partnering has primarily been used in the current industry structure where teams are created for each project and then taken apart after-wards. Partnering in a Danish context is “typically” not a contracted form, but instead used as a supplement to general contracts forms (Høgsted and Olsen, 2006). The form of

collaboration in “partnering” is a far-reaching concept in the Danish construction industry with many possible components and weightings.

EBST (2002) defines partnering for the first time in a Danish context as "*Collaboration between two or more parties, which is based on dialogue and trust rather than opposition and mistrust*". (EBST, 2002) Partnering Working Group (Arbejdsgruppe Partnering) (2003) defines partnering later in a State-of-the-Art Report, which differentiates partnering from other forms of collaboration and strategic partnerships: "*The concept of "partnering" refers to a form of collaboration in a construction project when implemented with a common objective, formulated joint activities and based on common economic interests*". (Arbejdsgruppe Partnering, 2003)

The joint activities can be the kick-off seminars, workshops etc., and common economic interests may be in the form of agreements for the distribution of risks and benefits and incentives for achieving the essential objectives of the project. These are defined as mandatory elements and additional partnering elements may also be used as shown in Table 3-2. The characteristics of the definition are that items such as these should be weighted and composed as the parties want. If the contractor is involved in the program or design phase phase, it is characterized as early partnering, and when involved in the detail design- and execution phase, it is characterized as late partnering (Arbejdsgruppe Partnering, 2003). Arbejdsgruppe Partnering (2003) did also prepare a preamble for the collaboration form: "*The reason for partnering is the desire to create a transparent business environment and to optimize the construction process and product by setting up a partnership based on dialogue, trust and openness and with early involvement of all parties' competencies. Partnership is established as a minimum between client, consultant and contractor*".

Table 3-2 Partnering elements in collaboration derived from archival exploration of experimental project reporting's. Items used in over half of the projects are marked with an A and items used in less than half of the projects are marked with a B

Erhvervs- og Boligstyrelsen (2003) endorses the definition of partnering given by Arbejdsgruppe Partnering (2003), but defines a number of common features regardless of composition and weighting of elements. They consist of an active client, involvement of contractors' knowledge in design, and client, consultants and contractors collaborating on optimizing the economy, the scope and quality, open interaction incl. economics between developer and construction companies, and a collaboration or partnering agreement which among other things describes the common objectives and framework for collaboration and tools for monitoring collaboration. Table 3-2 shows additional elements. Erhvervs- og Boligstyrelsen (2003) does not consider methods of collaboration as partnering if the contract is awarded on the basis of the detail project or later. Bygherreforeningen (2004) has defined partnering as a policy aimed at its members and other professional clients:

"*The Client Association considers partnering as a form of collaboration with early involvement of all parties competencies. Partnership is established as a minimum between client, contractor and consultant in the design. The object of partnering is essentially a project optimization in program and scheme phase, in order to create a better starting point for the construction process and thus a better end product*" (Bygherreforeningen, 2004). Several cooperation's in the construction industry, which according to Bygherreforeningen (2004) are sound and characterized by mutual trust and common understanding between the parties, are the reason for the policy. EBST (2006) does not define partnering, but agrees on the definitions by Erhvervs- og Boligstyrelsen (2003), Arbejdsgruppe Partnering (2003) and Bygherreforeningen (2004). It is added that it is of common economic interest that all parties' financial interests are taken into consideration. For this purpose financial incentives can be used. Note, Table 3-2 presents a number of elements that can be included in partnering to a greater or lesser extent.

The publication Partnering in Practice is developed by the trade organizations Danish Construction Association, Danish Architectural Firms, Association of Consulting Engineers and TEKNIQ which endorses the definition of partnering by Arbejdsgruppe Partnering (2003) and stresses that the form of collaboration based on common objectives and open and honest communication, which help to create mutual respect and trust (Dansk Byggeri et al., 2005). Party interests should be subsumed under the joint project, namely to complete construction in an economical and time-efficient manner where the possibility of conflict is reduced. The collaboration is characterized by human relationships and thus attitudes, opinions, and positions more than rules. In partnering there is a successive detailing of the project conditions, opportunities, and economy as well as the parties' obligations.

PARTNERING IN PRACTICE

Arbejdsgruppe Partnering (2005) conducted a study of how partnering is used in Denmark through an evaluation of the use of the concept. The study included a total of 122 projects executed as partnering projects in the period between 2001 and 2005. Respondents were mainly clients and contractors, but did also include consultants, architects, engineers and others. The projects were distributed with approximately 65% new buildings and about 30% renovation, the remaining projects were construction and operation and maintenance. In 60% of projects early partnering was used, and in 40% of the pro-jects late partnering was used. The dominant form of contract was D&B (55%) followed by general contracts (28%), and only a few projects were carried out in trade or other contract form. (Arbejdsgruppe Partnering, 2005) Partnering elements that were used on over 75% of the projects were the kick-off seminar, common goals, and open books. However, foremen, subcontractors, authorities and suppliers only attended in kick-off seminar / workshop on very few of the projects, reflecting the fact that they often had not been designated.

Common building site facilities were used in more than 50% of the projects. There is usually a steering committee on the projects, and in 79% of the cases it is considered necessary to establish a project team consisting of project managers from the involved companies. Dialogue based conflict resolution models was part of the partnering agreement in around 90% of projects, but have not been widely used (only in 27% of the cases). In over 65% of the projects, there has not been an agreement on continuity of key persons. Likewise, it has not been customary with a joint project office (16%). (Arbejdsgruppe Partnering, 2005) Items used in over half of the projects are marked with an A in Table 3-2 and with a B if used on less than half of the projects. The definitions and the associated descriptions make it clear that the partnering concept claims a wide variety of elements that may or may not be used, see Table 3-2. Common to the definitions is that it is a form of collaboration based on common objectives, project, and establishment of a partnering agreement. The collaboration is based on dialogue, trust, openness, and respect. All parties' capabilities, especially the contractors, should be involved early in the process, and the agreement should be established as a minimum between the client, consultants, and contractors. The means are common activities and common economic interests. Partnering in the Danish construction industry requires a developer that is active by virtue of the decision to implement the project in partnering and participation in a dialogue with the selected parties (Høgsted and Olsen, 2006). A partnering agreement is drawn up as evidence of the collaboration form and the selected items recorded thereon.

3.2.4. PARTIAL CONCLUSION

The experience of partnering in the Danish construction industry has often been positive, but has not been reused or developed. The focus on partnering in research has also transformed from development and implementation into a focus on trust, feasibility, benefits, means of implementation, and barriers to implementation, indicating an acceptance of the partnering concept as it is and instead a focus on why there are problems using it in practice. The partnering potential seems to be exploited and exhausted making the need for a new approach to collaboration in the construction industry evident. The development of collaboration in the Danish construction industry appears to be stalled. The industry has long been running in circles trying to develop new forms of collaboration, and partnering is no longer the answer in the author's optics. The concept of partnering is rejected and substituted with new starting point, from scratch, to identify an appropriate method of collaboration. The goal of future research is to examine how collaboration between the construction industry parties can be performed efficiently and effectively thus creating quality products that contribute to value creation in the Danish built environment.

Through an elaboration of the collaboration issues in the Danish construction industry, it became clear that partnering was not a necessary part of the new

definition. Thus, a relatively large amount of resources was used to ensure a good understanding of how work with collaboration previously has been done and what is needed now. It can be considered as an exploratory, problem identifying, and diagnosing preliminary investigation with the aim of exploring the phenomenon of partnering because of the vague and non-unique definition. Future research will focus on exploring the elements from Table 3-2 and the underneath mentioned themes:

- Synergy
- Competencies
- Motivation
- Incentives
- Ways of conduct
- Communication
- Interdisciplinarity
- Common goals
- Conflicts
- Personal relationships
- Values
- Development
- Community
- Conflicts "in the hinterland"
- Business goals
- Project goals
- The building process

The full detail of the themes can be seen in Appendix A3.

The themes were derived from a contraction of the above identified aspects and elements in partnering and collaboration through the past two decades in the Danish construction industry. Themes will be included in a sequential study where they will go through a verification process.

3.3. DEFINING COLLABORATIVE ELEMENTS

In the quest of defining collaborative elements the themes from Section 3.2 will be included in a study where they will go through a verification process. The themes derived from a contraction of the identified aspects in collaboration through the past two decades in the Danish construction industry were examined to conclude on which of the themes are actually encompassed in effective and efficient collaboration. This verification process will generate collaborative elements. There will be a fixed focus on which of the themes and elements that is theoretically included in an effective and efficient collaboration and how these relate to practical implication in collaboration in the industry. The next aim is to verify the elements through a survey. The full research approach in can be seen in Appendix B – Paper 3

3.3.1. INTRODUCTION

When Latham (1994) first looked at "efficiency, performance, team work and fairness", terms such as alliancing, partnering, and joint ventures become common. Many definitions for the terms of partnering, alliancing, and joint ventures are provided by the literature (Lazar, 2000; Naoum, 2003; Nyström, 2005, 2008; Lahdenperä 2012). Collaboration was, however, often used as an umbrella term for the aforementioned (Wilkins, 2012). Conversely the literature did not and still does not contain any comprehensive lists of elements involved in collaboration. By now there are several sources making references to elements, but no research was found to establish the relative importance of the elements to each other (on a project base), making these elements situational. A constant change in the use of the word collaboration in the construction industry has initiated research producing an overview of the aspects that could be involved in collaboration by reading the literature on partnering, alliancing, and joint ventures. Further research identifies the current status of the word. Most important but still missing is research that would produce a definition of collaboration as a set of elements or even components of combined elements which by different use would be relevant to different situations in the construction industry, making the industry more efficient and effective.

The industry has experienced criticism from the environment, public bodies, and construction organizations for many years. Building Political Task Force (2000) highlights problems with productivity, innovation, and quality in the industry. Kristensen (2012) adds problems with high cost, long production time, lack of development of appropriate companies, and building processes as the cause. Høgsted and Olsen (2008) named this industry development as a vicious circle. The reasons were and are price competition, which lead to limited development. The consequence is an industry in stagnation. When poor product and process

innovation occur, it is a natural consequence that productivity suffers. The result is an industry bound by its own traditions. The construction industry forms the basis for the environment and the culture we live in and is an essential input in daily life. The industry is typically among the largest in the respective countries and likewise in Denmark with up to 9% of GDP (Statistics Denmark, 2013) and contributes significantly to the welfare with a product that exists for many years as a part of daily life. The outcome and consequences of low development and productivity are not only costs during production of construction projects; it also affects the societal context in the form of products that do not give users the best possible conditions. A positive development in the industry, so that the products meet the real needs of users, will also benefit society.

For decades, self-interest, mistrust, and a large amount of failure have haunted the construction industry and are barriers to innovation. They prolong the process and affect the products, which is why there is a clear need to reverse the mindset to the contrary so the requested value can be created in the future built environment. It requires strong ethics, cohesion in the delivery, and focus on value. Collaboration can be observed in this context as a mean to reach the target.

As a response, elements contributing to what later are defined as Efficient and Effective Situational Collaboration (EESC) was uncovered. This meant identifying element which would contribute positively or negatively depending on the situation and ultimately defining sets of components composed of the different elements facilitating the best possible circumstances for EESC

The findings of this research should provide insights to the objectives highlighted in R3.

(R3) Which elements contribute positively or negatively to the building process according to the parties in the industry?

3.3.2. EXPLORING THE THEMES THROUGH INTERVIEWS

This Section reports findings from 16 qualitative interviews focusing on exploring the themes from Section 3.2.4 and elements as seen in Table 3-2. The advantage of qualitative interviews is that they enable further clarification of questions. This is why qualitative interviews are deemed appropriate as a bearing for this evidence based first part of the study. The first version of the interview guide can be seen in **Fejl! Henvisningskilde ikke fundet.**. Another important aspect is response willingness which tends to be bigger, and confidential questions are answered more often. Data is thus qualitative empirical data that can be typified and verified

through a survey in a later study. Therefore, focus is on induction; production of a model on the basis of observations. The data was systematized and used to establish a model.

The purpose of the interviews was to understand the informants through their lifeworld. The informants were selected so that they had experience in collaboration in the construction industry in the early stages. The author has background knowledge of collaboration and is thus partially theory-driven, but has a very open approach that wires to the phenomenological method.

The interviews took place using an interview guide prepared based on the author's acquired background knowledge about collaboration. The interview was semi-structured as deemed appropriate for the purpose and thus to ensure that the necessary knowledge was acquired.

Interview questions and their sequence were not strictly predetermined, and it is the interviewer's discretion and tact that determines how much to follow up on the informant's responses and how close the interview guide was followed. The interview was manually controlled by the informant, and follow-up questions were asked to ensure that questions in the interview guide were covered. The method was chosen to increase reliability, because stories or opinions opened up by informants themselves often tend to be more immediate and honest. (Kvale and Brinkmann, 2009) The interview guide was developed as a more nuanced picture of collaboration became clear to the author. The interview guide for the first and last interviews has many similarities, but the questions are more nuanced and targeted as the author learns how to prompt the desired narrative. The content and form of the interview guides changed as the process progressed. It was decided that sufficient interviews had been carried out when no new aspect was obtained from the final interview.

SYSTEMIZING THE DATA

The observations made through the interviews transformed into concepts, and relationships were found between these concepts. The interviews were addressed with a focus on their meaning. Throughout the interviews condensation and interpretation of the informant's opinions were made to ensure correct interpretation since this allowed the informant to confirm or deny. After further condensation of meaning, sense coding, and meaning interpretation based on transcription of the interviews, the implicit meaning of the informants' statements can be prepared.

First a condensation of the interviewees’ opinions was made so that the message stands clear. The interviewees’ statements were condensed through several steps. First the analysis begins with a read-through of the entire transcription several times so that the author becomes immersed in the data (Elo and Kyngas, 2008). Then the text is divided into meaningful units, which are condensed and abstracted to a

textual code (open coding). In the process, the text is kept as a whole so that the codes can be understood and determined in relation to the whole context. These codes are then abstracted into categories which express the manifest of text content, that is, what the text says. From the categories further abstraction is made, and themes appear (systematic coding and analysis) (Andersen, 2008) (Kvale and Brinkmann, 2010). Finally the themes that dominate the natural meaning units are reformulated so the statements thematically come from the interviewees' point of view, through the author's understanding. These express the underlying meaning of the text, that is, the latent content in the transcribed interview text that can be described as what the text is talking about (Graneheim, Lundman 2004).

Categories were produced based on a transcription of the interviews and coding of them into meaning. The vertical analysis forms the basis for the preparation of a category system where meanings are processed which generates facets of collaboration in the construction industry. The category system forms the basis of a horizontal analysis, based on the categories seen across the opinions in the interviews. The horizontal analysis thus produces knowledge about aspects of collaboration in the form of the elements. Through the vertical and horizontal analysis collaboration in the construction industry was described in practice. This will form the basis for identifying key elements of the Efficient and Effective Situational Collaboration.

INTERVIEWS

Interviews were conducted in order to gain insight into the complex form of work in a project in the construction industry. These interviews were intended to identify characteristics of collaboration in practice through the parties' viewpoint. The qualitative research interview was chosen as it allows uncovering each party's personal experience of collaboration in construction projects. The goal was to identify a common set of elements across the parties' experiences.

The relatively small number of interviewees that the qualitative interview and the consumption of resources have allowed can make it difficult to ensure that the selected group is representative for members of project teams in the construction industry. The numbers of people interviewed are weighted unevenly to achieve a satisfactory representation. There are a total of 16 interviews conducted.

There was a preponderance of clients because of the client role as initiator and facilitator of the construction process. Two private clients were chosen as they are not subject to Offers Act and the Public Procurement Directive and thus free to choose their partners. There are three public clients because they are subject to the aforementioned and are not always free to choose their partners. The advisers (Engineer, Architect, and Client Advisor) are selected from major corporations in Denmark and only two are from small companies. The engineers and architects are

represented with broad skills in design and construction management. Contractors are not widely represented, as their influence in the early stages is limited.

The focus of the theoretical issues in collaboration relates to social capital, professional skills, and the framework for collaboration. To ensure appropriate questions and useful answers, focus was on characteristic features of the construction industry, which the author believes influence the collaboration (Paper 1, Appendix B). To ensure the validity of the interviews, the questions were prepared on the basis of a study primarily of literature in order to create a broad understanding of the phenomenon of collaboration and to identify the primary factors in theory characterizing collaboration (Paper 1, Appendix B). Each theme is thus coupled to a theory, as shown in both Appendix A4 and Paper 3, Appendix B.

3.3.3. PARTIAL CONCLUSION

Elements can now be formulated. The elements are assessed as important in Effective Collaboration, which is the output of more than 2,000 minutes of interviewing. The elements support each other to some extent and thus are related, but are considered here as individual elements. The elements are as follows:

Capabilities

a. Possess the appropriate professional skills for the job and generalist thinking
b. Respect for each other and each other's professionalism, openness to suggestions and participation in dialogue
c. Comply with agreements
d. Constructive and holistic behavior

Facilitation of collaboration

e. Aligning expectations with a focus on success goals and metrics
f. Smooth initial progress in the first stages and solid focus on achieving project goals
g. Common framework of understanding through dialogue

The parties act in a project

h. Understanding other parties' motives for the project
i. Understanding other parties' roles and benefitting from it
j. Understanding other party's needs during the process
k. Pragmatic interpretation of project documentation (for the good of the whole)
l. Honest and trustworthy behavior

Communication

m. Formulations suitable for the purpose and party
n. Select communication media with care and careful use of e-mail

Interpersonal relations

o. Relationship between parties through face to face meetings

p. Trust and control (a party's credibility)
q. Attention to the parties' personalities and the chemistry between the parties
r. Parties should feel heard and responsible for the project
s. Parties should have a reasonable attitude as parties influence each other
t. Collaboration on a professional level and not with emotions

The framework

u. Budgeting so that parties are paid according to their real performance
v. Choosing the right form of contract so the client gets the right product
w. Early involvement of the contractor when the project is well-known and still subject to change
x. Client brief or project documents will determine the collaboration

A good client brief in D-B contracts and good project material in both a general and a trade contract make collaboration easier because there usually are no problems with misinterpretations.

It is a prerequisite for a good process that the client can make decisions based on advice, pay a fair price for what is made, and set up appropriate conditions. To sum up, effective collaboration is based on good economy with the possibility of repeated cooperate by doing a good job.

Architects, engineers, and contractors do traditionally work based on established patterns, which are significant for the construction process. The architect wants chrome facades, the engineer wants it kept easy and simple, and the contractor wants to make profit. On the basic of this budgets are exceeded and projects needs to be reduced and changed for better or worse. Clear and good project material is a prerequisite for good collaboration, because shortcomings and ambiguities are interpreted in favor of different parties. Knowledge about the needs of others creates better projects whereas trying to maximize the outcome to one self creates conflicts.

Decisions and actions are rooted in economics, because it is all about money. A good process is characterized by good economy and vice versa. In a bad process the parties' cut down in services, because they are financially under press and the outcome is inferior results. The construction process sets the framework under which the collaboration is progressing and it is characterized by a successive involvement of architect, engineer, and contractor. This integration is difficult to manage so that the really good projects can be created. Lack of integration is mainly caused by the traditions in the construction process design.

The different parties must possess certain skills to facilitate collaboration in the first place. Professional skills are the foundation for collaboration where parties should be generalists rather than specialists in order to ensure consistency in the project. They must have respect for each other and each other's skills and be open and honest. The client must not delay the process and thus have an understanding of the project costs and thus a willingness to pay.

When the parties are communicating, a game is going on between them about tactics and people. The end justifies the means of communication, and a failure to act as desired can change the tone from polite to tough. The medium of communication is primarily e-mail. E-mail can be easily misunderstood and create conflicts, thus making the phone an easier medium to communicate through. It is necessary to meet face to face at times, because communication is faster and easier. Fostering a common framework of understanding from the start is necessary to avoid basic misunderstandings.

Relationships are created between people when they meet and cooperate. Relationships create trust, which is important for collaboration. Previous relationship from other projects is a major factor when the parties are selected for a project. A lot of energy is used on the building relations in the beginning of a project. The energy used is proportional to the parties' mutual acquaintance in-between. There is no open talk about values and goals at project start-up, although this may facilitate the process, rather they arise along the way as the relationships are built. Key personnel throughout a project are important in order to get an optimum process because it is impossible to transfer all knowledge and project rhythm as it is based on people.

There must be fairness in collaboration from all parties. Common ground for all the interviewees was that the best incentive to do a good job is proper payment. Goodwill plays a central role for the parties as this will make them work extra to care for their own reputation, which in turn means they can get new projects. The interviewees all felt that creating good products and to feel like a part of the project on a personal level motivated them. The parties' approach has to be constructive and solution-oriented so that the project can be solved jointly. Parties must be amenable and not the opposite, because it leaves room for collaboration and goodwill between the parties. It is a necessity that agreements are respected especially in terms of time and quality.

Construction projects are carried out by people, and there are, obviously, some human challenges that are difficult to handle. As humans we affect each other's behavior and if one party behaves in bad way, others usually adopt this exact same behavior. Chemistry between people enhances or impedes collaboration. Chemistry is absolute and cannot be changed, which is why bad chemistry can result in the replacement of a party. The success of collaboration depends on the parties and as

people primitive human behavior follows. This can have both a positive and a negative effect.

3.4. ASSESSMENT OF COLLABORATIVE ELEMENTS

Based on the findings from the interview process, the theoretical perspectives from literature study, and the initial pre-study on lessons learned the collaborative elements can now be assessed using a survey. Survey as a method was chosen because of the wider spread in respondents, this will help verify and ensures that the initial elements from the interviews are valid.

3.4.1. INTRODUCTION

Collaboration takes place on many levels among several professions and the implementation varies dependent on the project and location. The parties collaborating are the clients, client's advisors, architects, engineers and contractors. They are dominant players in building projects and central actors in the collaboration. This part of the study is based on 16 prior interviews of the parties. A holistic approach to collaboration was taken and it was studied on the three systemic levels: Company, Project and Individual level. The interview questions emerged from theories on the three levels. Collaborative themes in the informant's worlds were identified by generating systematic nodes. The nodes constitute guiding themes: Structure, Group, and Personal. The nodes facilitate an analysis of the informant's notions; the full detail of the findings can be seen in Paper 4, Appendix B.

Traditions and the Process constitute the structure in which collaboration takes place. It outlines the parties' interests, the project economy, and the construction processes. Capabilities and Relations between people constitute the group. It outlines the parties' competences, ability to communicate, mutual relationships, and development as a group. Fairness and Human Nature constitute the personal aspect of collaboration. It outlines the motivation and orientation of the individual parties. Besides, it outlines the primitive behavior of humans. Note that 24 preliminary elements in EESC were identified in the analysis, see Section 3.3.3. The purpose of this step is now to verify the elements, which was done in a survey among 57 parties i.e. clients, client's advisors, architects, designers, and contractors. The verification of the elements should give the first insights to research question R4:

(R4) How should different elements facilitating effective and efficient collaboration be composed into components, depending on the situation and how are these specifically complementary to each other?

The full research on this topic can be seen in Appendix B - Paper 4.

3.4.2. DATA COLLECTION

Results from the qualitative interviews from Section 3.3 were used to construct the clarifying questions in the survey. The purpose of the interviews was to understand the informants through their life-world. The informants were selected so that they have experience in collaboration in the construction industry in the early stages. The author has background knowledge of collaboration and is thus partially theory-driven, but have a very open approach that has wires to the phenomenological method.

The interviews took place using an interview guide (**Fejl! Henvisningskilde ikke fundet.**) prepared based on the author's acquired background knowledge about collaboration. The interview was semi-structured, as deemed appropriate for the purpose and thus to ensure that the necessary knowledge was acquired. Interview questions and their sequence were not strictly predetermined and it is the interviewer's discretion and tact that determines how much to follow up on the informant's response and how close the interview guide was followed. The interview was manly controlled by the informant and follow-up questions were asked to ensure that questions in the interview guide were covered. The method was chosen to increase reliability, because stories or opinions opened up by informants themselves often tend to be more immediate and honest (Kvale and Brinkmann, 2009).

Based on interpretation of the interviews a survey was prepared with the aim of verifying previous conclusions (see **Fejl! Henvisningskilde ikke fundet.**). The strength of the survey is that it can reach a larger group of respondents and thus verify the results through a larger audience. The survey was prepared in SurveyXact and was digitally distributed. Time is a scarce resource today and to strengthen the respondents' interest and thus maximize the number of completed surveys, the purpose and the respondents’ advantages from attending was presented, it is easy to read and no more than 10 minutes should be allocated. (Andersen, 2010) The survey was prepared on the basis of the identified elements. The questions were transformed into everyday discourse and control questions were embedded to insure validity. The survey was structured such that it starts with attention-grabbing and impersonal questions, and finishes with more thought-provoking and personal. The scale is a psychometric scale which have five single-pole levels shifting from " Strongly disagree" to " Strongly agree" or "Very important" to "Not important" and there is always an opportunity to respond "Do not know" so that false positive results are avoided. "Do not know" were coded as missing and therefore deleted in the processing of data. The scales have five response categories and thus a center that makes it easier for respondents to answer. There use of closed questions is to ease the data processing. (Andersen, 2010)

The questions focus on opinions, since the aim is to assess the phenomenon of collaboration from the results of the interviews. The questions sought to be focused, neutral and relevant; moves out of only one dimension thus recalling only one information, is balanced and does not encourage respondents to certain answers, and concerns the respondent's own experiences and references. The questions context effects have been considered, so that the questions are being asked in a specific order to remedy the context effect when appropriate. The questions are formulated so that they are short containing only the desired information while it is easily legible. (Olsen, 2006) The respondents were contacted by phone and Email. The survey was anonymous and answered digitally by following a link in an Email and data was entered directly into an electronic database. The responses were treated quantitatively, after which they are interpreted. The interpretation was done by changing the five values in the scale to three values; a positive, neutral and negative. The background questions or variables helped identify patterns in the responses. The result was a verification of the elements found in previous study which completes the sequential design.

SETTING UP THE SURVEY

The survey begins with an introduction and has a light transparent layout in which the respondent may submit a statement relating to the pre-identified elements. The survey is divided into topics so that the respondent can easily figure out what the questions are all about. The survey was prepared based on the analysis of elements in practice from previously conducted interviews.

3.4.3. FINDINGS

The verification was based on a total of 57 responses, among the participants as follows. The distribution of respondents was considered acceptable, taken into account that on construction projects there are usually more engineers and contractors than of the remaining parties. The distributions are as follows: 6 professional clients, 4 client advisors, 20 consulting engineers, 7 architects, 17 contractors and finally 3 parties that could not be placed in the aforementioned categories.

The questions are all crossed with respectively with the party, preferred form of contract and experience. When found relevant they were crossed with other background variables. There are generally no sign of that experience plays a role in what is considered important in good collaboration and therefore it is not apparent from the following. Only unique patterns are included to considering the population size, at the same time the distribution of respondents accordingly taken into account. Respondents are evenly divided in terms of working with public and private projects.

A number of questions where identified were the parties had different views. For the remaining questions, there was no clear trend and thus not dependent on the variables. The identified patterns can be seen in Paper 4, Appendix B, and will be elaborated in the following.

3.4.4. PARTIAL CONCLUSION

The use of theories in the previous Section makes the effects and structures of the elements visible and elaborates on how these specifically complementary to each other. The theories touch specific parts of the elements and thus the structures that constitute the active parts of the elements which will help enhance collaboration. Through the evaluation of the structural coherence of the elements components become visible; these components are thus helping form the backbone of the model for Effective and Efficient Situational Collaboration, EESC. The conclusion will pick up on and articulate how the elements and their structures are composed to the following preliminary components.

Derived from the theoretical processing of elements G and O it became clear that dialogue face to face creates a common framework of understanding through interaction (repetitive behavior and reaction). Behavior and ways of expression accordingly to a subject makes the relation to this particular subject or content visible to other parties. In order to establish a common framework of understanding, the parties must understand each other's relation to the content and to each other. This is best done through interpersonal dialogue due to the frequency by which the parties are able to act and react and eventually reach a common understanding. All this is about building *Relations* which is the first of eleven components in EESC.

Walking though elements J an S it became abundantly clear that all parties are responsible for creating social capital thus meaning that every single person on a project has to contribute, otherwise it will not be generated. Mutuality must be present to establish trust and credibility and the parties must respect the norms and customs that are created on the project through group development. A party's unwillingness creates imbalance with only two outcomes, either this unwillingness is spread to the other parties or with the result that the unwilling party is expelled. A party must be willing to accommodate the needs of others in the belief that their own needs are met by them and vice versa which gives us the second component *Mutuality*.

Elaboration on elements A and C showed that failure to comply with hygiene factors and proper satisfaction of needs is decisive when it comes to development motivation. It is a prerequisite for motivation that social needs in terms of relationships between parties exist. The relationship is weakened when agreements are not respected or parties are not skilled and professionally qualified for the job; it

degenerates the ability to cooperate if the third component, *Basic Needs*, is not meet.

Form elements L and P we got that parties create trust between each other in the form of reciprocity. Complying with obligations and related expectations credibility is achieved. It is essential that the expectation of a party is consistent with the obligation of the other. It is also important that there is a balance between actions and reaction, is a game of giving and taking in the right amount as it goes both ways. Taking too much or giving too little does not create trust and goodwill. Trust can be replaced by control, but control alone does not create the needed social capital required for good collaboration. What is needed is correspondence between obligations and expectations thus giving us the fourth component *Corresponding obligations and expectations*.

From elements I and Q we learned that different roles may advantageously be defined using the DISC behavior model; this can help clarify and understand each other's typical behavior; why parties do what they do in different situations and relationships. A DISC test makes it possible to better understand one’s own and others' behavior. The parties' differences are also their strengths in collaboration when they are utilized to create better solutions. The parties must therefore be aware that their DISC profiles are different and this is an area to be exploited. Strengths-based practice is a collaborative process allowing parties to work together to determine an outcome that draws on the different strengths and assets of the parties, *Knowledge about and use of strengths* is both the key and the fifth component.

Elements N and M was all about communication and when it comes to communicating an achieving the desired effect of a message, the channel in which the message brought must be chosen appropriately. When communicating face to face parties has the most dimensions enabling them to understand the messages, but without the relational context it is difficult to communicate and understand the message correctly. When using telephone as a media it’s all hear and no see opposite Email which is all see and no hear, this makes it difficult relating to other than the content and the sender is dependent on that the recipient's state of mind and understanding of context is coinciding.

Email should only be used to communicate messages that do not require more than one dimension to understand, for example, a square is not a rectangle they are both quadrilateral. Understanding a message is in all respects subjective, but face to face makes it easier to achieve the same understanding than all other forms of communication characterized by the individual's own understanding. When sending a message some thought should be given on who the receiver is and what effect is sought. The parties are in different situations, as they have different backgrounds, needs, goals, perceptions and external pressures why they need to express them in

different ways to achieve the desired effect. A message is affected by physical and mental noise, defense mechanisms, content and chosen media. All this must be considered to successfully target communication thus achieving the desired goal. This makes *Targeted communication* the sixth component.

From element F we got Forming, Storming, Norming and Performing as one of the essential parts in achieving desired goals on a project. Focus on achieving goals can only be attained when the parties in the project has established standards and norms in the group. You can set up rules from the start, but they might first be considered as appropriate norms when or if the parties can relate to them. Conflicts is inevitable and considered as clashes between opinions, attitudes, values, working methods, borders, trades, etc. Conflicts are opportunities for development, because consensus in this way can form in terms of norms. If conflicts are settled in a positive manor, they are normative thus enabling parties to solely focus on the task beforehand. *Norming* equals performing and is thus the seventh component.

Direct motivation as in element B and R is created on a project through responsibility, status and recognition. Parties must therefore show respect; be open, listen, give each other time to talk and status. The parties will also feel a direct motivation through performance. Propulsion is required and product satisfaction is necessary as the parties describe direct motivation as seeing progress in the project and to deliver a good product. All parties must follow the same pace by performing as expected. *Direct Motivation* drives the project onwards and so it becomes our eights component.

When theorizing element U it became evident that the parties reflect on what expectations they have and if the rewards match the effort before deciding whether to make the effort. This fact, however, is a problem for the parties since they in many cases aren’t paid according to the actual performance. The parties' expectation that a given effort leads to the desired performance is usually not present as the necessary effort is often too large and achieving the desired performance fails to appear. So what is needed is a fair relationship between the input necessary to achieve the desired performance, and the performance. This can be granted by a satisfactory payment (Bejder & Wandahl, 2011). The parties do not feel motivated by incentives when there is no correlation between goals and performance. Targets and goals needs to be setup correctly to motivate. The keyword and ninth component is therefore *Satisfactory Payment*.

Summing up elements E, H and T we get that satisfying a set of requirements is the goal of an action and that the existence of a number of coinciding requirements (goal) between the parties is the basis for collaboration and at the same time that coherence between the organizational requirements in the project organization and the organization must comply with personal goals and contributions. It can be

difficult for the parties to know each other's goals, as the motive behind an action isn't directly related to the action.

The parties must consciously share aspects of them, i.e. motives for action, so that the other parties are aware of and has the necessary knowledge to understand the motives; this enables one party's goal to intersect with others thus harmonizing different goals in a subset of goals. The motive for an action should be guided by bounded rationality rather than emotion and irrationality, since it is the individuals' best chance to make a rational decision. The point is that goals or "part-goals" must to some extend be shared by all parties and controlled by rationality, giving us *Shared Goals* as the tenth component.

Derived from the discussion of elements D and K, it became clear that parties would overall gain the most by showing and acting out of trust, which should be effectuated. The parties should be able to see which behavior is most rewarding for everyone, and be prepared to act accordingly. They must believe in that the other parties will act the same way before inclining an opposite and harmful response thus facilitating only rational decisions. A trusting and trustworthy behavior gives the best return for all but demands that all parties are convinced so. Social relations can in this context be instrumental in creating coinciding actions. The parties need to create more value when they cooperate, but to do so, actions need to be harmonized, and the eleventh component is therefore *Harmonized Actions*.

3.5. SITUATIONAL DETERMINATION OF COMPONENTS

With the ambition of transforming the components into an applicable model, and in the acknowledgement that the framework needs to be situational, the components were linked to contract forms via a survey. The survey was set up to measure both the degree to which the components were already in use within the selected contract form and how well it facilitates effective and efficient collaboration. This makes it possible to draw conclusions about which components that need more effort to facilitate and improve collaboration. This provides a quantification of the situational linkage between components and effective and efficient collaboration. The following Section is based upon Paper 5 in Appendix B.

3.5.1. INTRODUCTION

The starting point of this part is the previous steps where a large investigation with 16 interviews, 57 follow-up surveys and a thorough theoretical processing had determined precisely the component that pushes collaboration to the next level of collaboration. Therefore, it is in this area - providing a quantification of the situational linkage between collaborative components and effective and efficient collaboration - that this part makes its contribution to the thesis. The method and to some extent the findings can be generalized to international collaboration more generally, suggesting the need for a certain focus on specific components would promote effective and efficient situational collaboration. The components from previous steps were not fully developed, which means that they haven't been made situational. This is done by linking the components to selected forms of contracting and construction parties. The components will be linked to a contract form via a survey, which measured both the degree to which the components were already in use within the selected contract form and how well it facilitates effective and efficient collaboration. The findings in this research contributed to research question R5 and R6:

(R5) Which components contribute positively or negatively depending on the situation to the building process and should therefore be integrated into a framework customized to the diverse construction industry as a project organization?

(R6) How are components linked to a contract form so that conclusions about which components that need more effort to facilitate and improve collaboration can be made, thus making them situational?

CONTRACT FORMS AND SITUATIONS

Contract forms can occur in many combinations, and it may be difficult for the project partners to figure out how collaboration can be streamlined from project to project. Furthermore, there are often limited resources on projects and in individual companies to optimize collaboration from project to project. In addition, the involved parties are not motivated to do so, since the gain is not due solely to them even though they bear the greatest costs (EBST, 2011). Therefore, it is the intent of this study to contribute to the project parties' knowledge about the EESC components that work most appropriately in exactly the form of contract with which they have to work. There are currently many specific collaboration tools, but common to them is that they appear very general. The aim of this study is to generate knowledge that is more specific to the individual situation of the project partners. The results of this study may be particularly useful for new project partners who do not have collaboration experience in the selected contract forms.

The contract forms represent the situation or context in which the components are inserted with the aim to identify which specific components that work most appropriately or may have largest impact in the given situation. Contract forms can have vastly different compositions and structures. A D&B contract, for example, is still called a D&B contract, though the contractor only handles around 50% of the trades included in the project. It should be emphasized that the contract forms and their structure represent the exact situation that the EESC components are inserted into and use of EESC should, therefore, be carefully considered in relation to the chosen form of contract.

3.5.2. METHOD

A quantitative study was carried out in the form of a survey and an analysis of the collected data (**Fejl! Henvisningskilde ikke fundet.**). In this regard, a research design which allows the use mixed methods and non-sequential processes to best accommodate the research question was selected. Method used was a survey sent to a group of respondents. Collected data was used to find some overall trends, which subsequently was analyzed. The analysis considered processing of the data both statistically and through interpretations. The collected data was analyzed statistical, but the numbers are not considered the ultimate truth, which is why interpretation was necessary.

QUESTION TYPES

The questions are primarily about "attitude issue". Answering the question of attitude is a representation of a mental phenomenon, which means that there are no control mechanisms available where the answers can be verified. Questions about attitude towards something can be divided into specific and general attitudes whereby question types in this study generally consist of specific attitude questions. In this type of questions, the respondent relates to how something is when the

respondent imagines being in the situation. This allows the respondent to use experience as the basis for the answer. The specific attitude questions in the survey are closed questions, meaning that the respondent cannot answer with a free formulation. Different questions are associated with the same response categories to ensure all elements or an aspect. The response categories and the method for the design of these are described later in this Section.

Words can often have a broad meaning, which means that a word can be understood in several ways. When designing the questions limiting the meaning of words and questions will reduce the context effects (Olsen, 2006). This is done by either clarify specific words or by replacing the word with a word with fewer connotations. As a starting point easily understandable words which are used in everyday language and consisting of a few letters or syllables are used. Quantified adverbs are also avoided. In order to ensure understanding of the response categories, they are designed so that they do not surprise or disrupt the respondent. They act as a natural extension of the question. Since the survey primarily consists of specific attitude questions, response categories need to be balanced. With each answer in a response category, it is possible for the respondent to reply in a 5-point scale, which is divided into "very high level, high level, to some extent, low level and very low level", thus giving the respondent the opportunity to respond in a nuanced and balanced manner. According to Andersen (2013), the response options must be exhaustive in response categories where closed questions are used. This means that the respondent should have the opportunity to choose an option "Do not know" or “Missing experience” if the 5-point scale with the response options is not adequate for the respondent.

The contexts of which questions are a part and in which information is recalled can create measurement problems. This means that questions can change meaning if placed in a new context (Olsen, 2006). In this study, the questions are placed under each corresponding EESC component, which means that the questions are placed thematically. This causes the respondent to answer the questions with the same linguistic influence from the thematic block in which questions are. Overview of components (thematic block) and short version of question themes from the survey can be seen in Appendix A7.

In principle the same parties were used as in the previous steps to ensure consistency between the answers in the previous study and in this follow-up. Furthermore, respondents were selected based on the assessment that clients, architects, engineers/advisors, and contractors are all key players in a construction project which means that the study will include opinions from several different perspectives of a construction project. Respondents are also chosen based on their geographical location in Denmark. The aim is to cover all of Denmark to avoid creating a geographical bias. It is important that the respondents have knowledge of and experience with various forms of contract so that valid result can be obtained.

Finally, to ensure validity the survey was sent out to test subjects in a pre-study, the test group contained colleagues and parties in the construction industry. Feedback was given and a final version of the survey could be made. The full version of the survey can be found in **Fejl! Henvisningskilde ikke fundet.**.

3.5.3. FINDINGS

The survey was distributed electronically to 440 respondents; 151 surveys were answered partly and 174 were fully answered. During the sorting of the dataset all respondents who have only opened the survey without putting in answers were discarded. Further, respondents who completed background questions without answering the rest of the questions were also discarded. After sorting 114 surveys containing over 95% fulfillment, background questions included, resulted in a total of 288 valid responses.

The distribution of respondents experience is as follows: 0-5 years (19 %); 6-10 years (15 %); 11-20 years (26 %) and 20+ years (40 %). Of the respondents 81 % are men and 19 % are women, this complies well with Statistics Denmark (DST, 2015) where 81.1 % of the employed in constructions were men and 18.9 % were women.

The results are presented in Appendix A8 through Appendix A9, where the four forms of contracting are compared for each type of party: Architect; Engineer; Client and Contractor. The Tables, Appendix A8, shows the questions to the left, the survey was designed with a total of 41 questions divided into 8 categories. All of the respondents were put in situations where they had to answer questions from the point of view of a given contract form: Trade; General; D&B and PPP Light. The categories are as follows: K1-K5 refers to Knowledge about and use of strengths (KAUS); D1-D4 is Direct motivation (DM); SP1-SP5 is Satisfactory Payment (SP); H1-H5 refers to Harmonized actions (HA); SR1-SR9 Shared goals (SG); M1-M7 equals Mutuality and Basic Needs (MBN); C1 equivalents Corresponding obligations and expectations (COE); N1-N4 refers to Norming (N).

A quick glance at Appendix A8, Table A8-9 and Table A8-10, and to some extent Appendix A8, shows similarities in the results from case to case, i.e., the distribution differs only little. The consistency is in particularly strong with the contract forms trade and general. Note that the same applies to PPP Light.

Taking another look at, it is seen that responses about PPP Light have the greatest standard deviation and standard error of mean and, likewise, it is seen that responses for PPP Light has the weakest confidence interval of population mean. In many of the cases where the response possibility "Do not know" appeared it was checked significant number times when asked about PPP Light. This is not

interpreted as a misunderstanding of the question, but rather a lack of experience with PPP Light (logical conclusion).

Finally, a two-tailed t test was applied to test for means with a significance level of p = 0.05. The calculated confidence interval represents the interval within which the observed mean with a likelihood of 95% would be situated. The actual interval can easily be calculated by combining the confidence interval and Mean. Hence, K2 for the trade contract would with an accuracy of 95% lie within the range of [3.15; 3.73[. The small standard deviation and standard error calculated validates the results; see Appendix A8.

The results varied from 1.8 to 4.4 and even a difference between responses from different contraction forms of 0.2 is significant. With significant is meant that due to the low variance and standard deviation (see Appendix A8) this expresses a meaningful scope for improvement.

3.5.4. DISCUSSION

In the following sections the survey results will be processed and discussed related to their context and by doing so the different contract forms in which the EESC components are currently used and not used by the individual parties will be addressed. This will help articulate and address in which form of contract individual components are particularly relevant to focus on. As stated previously the components are found in previous studies where a large investigation with over 2000 minutes of interview, more than 50 follow-up surveys, and a thorough theoretical processing has determined the components to be precisely those that strengthen collaboration, effectiveness, and efficiency in the Danish construction industry (Paper 1-4, Appendix B). The following discussions are based on the data shown in Appendix A9.

MUTUALITY AND BASIC NEEDS (MBN)

The EESC component (MBN) is an amalgamation of two EESC components, consisting of ”Mutuality" and "Basic Needs ". The combination has been made since both components contain a certain level of reciprocal fulfillment of involved parties’ individual needs. When the needs of the parties are known, the parties may more easily take each other into account. EESC component "Mutuality" is based on the theory concerning "social capital". According to Robert Putnam (2000), reciprocity or mutuality is a key element of social capital, and he believes that reciprocity can be divided into two types.

The first form is called "balanced reciprocity" and deals with a simultaneous exchange of services among the various parties. The second form of reciprocity is called "generalized reciprocity" and includes the assumption that the good given now will pay back in the future. The generalized reciprocity is stronger than the

balanced reciprocity by creating a community and hence social capital. The generalized reciprocity is more than a stand-alone favor exchange and may only occur in the presence of and communication between several parties over time. (Putnam, 2000)

The general trend is that there is a disagreement among the parties about how integrated MBN is. The advisers, consisting of architects (3.4;3.3) and engineers (3.4;3.5), tend to favor trade and general contracting over D&B (3.2) and PPP Light (3.0). The contractors, on the other hand, tend to point towards D&B contracting (3.5). The client lies between trade (3.4), general (3.4) and D&B (3.3), depending on what is asked for. There is a general consensus among the parties that changes without regard to other parties' professional interests are primarily made in D&B projects (2.9 – 3.6) against (2.4 – 3.1) for trade and general contracts, which is in contradiction to the general trend as the contractor in many respects favors D&B. If MBN is to work, the parties need focus on each other's needs and accommodate them. In particular, the focus should be on social needs since these constitute the relation between the parties. Also, focus on reciprocity is needed, which means that collaboration in shifts should meet individual needs of the various parties, thereby not only one-sided favoring of a single party’s need. Favors must be reciprocated to create "social capital", and the parties must work from the belief that a good deed done now will be repaid in the future.

As seen by the results, it seems that MBN is not functioning optimal in D&B contracts since project changes without regard to other parties' professional interests are made. The lack of consideration for the players' professional interests in the D&B contract can be interpreted as parties do not respect each other's needs and do not accommodate these. There should be a special focus on the social needs as theory shows that individuals feel more responsible and respectful if their needs are met (Paper 3 and 4, Appendix B). Participants on a project should not primarily focus on their own needs, but instead focus on the overall picture and all participants’ needs. If this is put in order, it will create joint profits and a "win-win situation" where no participant ends up as the loser in the economic game.

Incentive agreements can in this respect be used as a tool to stimulate collaboration. By setting up an incentive agreement, the parties have to develop some common goals on the project, and these goals can only be achieved if the parties show an understanding of each other's needs and heightened reciprocity. It may, therefore, be useful for the client to invite the designers and contractors to enter into an incentive agreement. It is seen here that the client and contractor somewhat believe that incentive agreements improve collaboration. This opinion is not shared by the advisers, and especially the architects are skeptical about incentive agreements. This means that especially the advisers have to be convinced that it pays off to work towards common goals through incentive agreements in order to improve collaboration.

Social needs are weakened when agreements are not met or if the cooperating parties are not professionally qualified (Paper 2 - 4, Appendix B). According to results there are disagreements between the respondents about where the highest level of compliance is found. The advisors believe that the agreements are respected to a “lower level” in D&B (3.2 – 3.8) and “high level” (3.6 – 4.0) in trade and general contract projects which the client backs up (3.9) against (3.2 - 3.6). The contractor believes that agreements are respected more in D&B (3.8) and, to a lower degree, in trade contracts (3.5). A general, positive consensus among parties about compliance with the agreements exists when using general contract. These responses suggest that there may be problems regarding compliance of agreements primarily in trade and D&B contracts. The parties must, therefore, be aware that especially complying with agreements in trade and D&B contract are important in order to gain and not to weaken social capital.

The contractor believes that needs of other participants (3.3) in the D&B contract are greatly taken into account - which is contradictory to answers about where the contractor believes that project changes are made without regards to other parties' professional interests (3.1). This can be interpreted like the contractor is aware that there is no regard shown to other parties' needs when working under a D&B contract.

A likely cause to the agreement about project changes without regard to academic interests in D&B may be that this contract form typically does not include any detail project when the contract is signed. This means that the contractor post-contractually chooses advisors and that project planning takes place in parallel with the execution, which means that the client and the client advisors’ influence is minimized. The contractor is free to “change” the project in order to optimize own profit, and this will not give the contractor an incentive to take other parties’ interests into account.

Project changes are most often associated with conflicts, which may impede the collaboration between the players. Disputes about project changes are often associated with economy and additional fees. This type of conflict may be a possible reason as to how the parties respond, especially in D&B projects (2.9 – 3.6) against (2.4 – 3.1). It should be mentioned that the contractor believes that this issue is also present in trade contracts (3.1). If participants charge additional fees to each other based on project changes, it may indicate that players do not share the belief that the favors are reciprocated (economically). To support this assumption results from (HA) are included where an imbalance between giving and taking is expressed. It is seen that the advisors and the clients do not believe that there is a balance between giving and taking in the D&B contract, totally contradicting what the contractors express. The focus needs to be on dealing with the project changes without just charging extra every time the opportunity arises. This approach to project changes will increase the social capital.

CORRESPONDING OBLIGATIONS AND EXPECTATIONS (COE)

There is disagreement about to which extent honesty, trustworthiness, and transparency is present, ranging from (2.6 – 3.7). These three keywords are important areas and key outcome when implementing the component COE. Furthermore, the general picture is that architects and engineers tend to prefer trade and general contracting whereas the contractor tends to prefer D&B. The client is in all respects relatively neutral, meaning that there is no clear trend in the responses. Overall, general contracting (2.9 – 3.1) is doing well by all parties assessed from the point of COE.

To ensure trustworthiness and transparency, it is important that the participants meet the demands and expectations placed on them and that they work toward a common good. According to the results contractors do not feel that honesty, trustworthiness, and transparency are present in projects under trade (2.6) and general contracts (3.1). This may be due to the fact that contractor does not feel that the client advisers comply with their obligations. Inadequate project material is a sure presence when general obstacles for better construction projects are identified and is why contractors to a “low degree” experience that project documentation is adequate in trade and general contracts. Inadequate project material will certainly raise a number of questions from the contractor. If the group of advisers do not take action correcting the project documentation and respond to clarifying questions, it may be perceived by the contractor as non-compliance with obligations.

Opposite to the contractors we have the group of advisors experiencing low levels of honesty, trustworthiness, and transparency in D&B contract (2.6;2.7). This may be due to the fact that the advisors in this situation are legally governed by the contractor and, therefore, does not have the same influence as in trade and general contracts. The D&B contractor typically performs design management, construction management, quality control, and project monitoring thus saving consultant fees, which may cause the advisers to feel less control over the project and the quality.

The advisers (2.2;2.6) can also experience a lower degree of control as the D&B contract is based on only a client brief, which the contractor often intends to optimize for their own benefit at the expense of solutions and materials. This is confirmed by the results where advisers express just this (2.2;2.6). The advisers’ experience less control in D&B, and they may feel that the contractor does not fulfill their obligations. This could indicate that there is no balance between the expectations and obligations among the parties, which is supported by the data showing no effort applied to the creation of balance between expectations and obligations (2.6;2.8) (H4). This makes it difficult for the parties to comply with their obligations and poses the risk of sub-optimization in the process. The EESC component COE can help the parties build trust and reduce control. Control is in many respects a necessity and a requirement, but it should be reduced to a minimum and be replaced by trust-based collaboration. The obtained results show

that the parties do not agree with where the potential for trust-based collaboration is greatest. The contractor is convinced that it is more possible to limit the control and use trust basis for collaboration in a D&B project. The groups of advisers do not agree on this as they believe that the possibility is greater in trade and general contracting. A possible reason for the contractors' belief is, in principle, that the degrees of supervision and control of collaboration in a D&B project are determined by the contractor. The same applies in trade and general contracts where the group of advisors is the coordinating part, which means that the consultant is responsible for coordination between the various contracts. This allows the advisor to take initiatives that ensure a trust-based collaboration. This assessment shows that the different parties are not aware of in which form of contract it pays to work based on trust.

NORMING (N)

There is an agreement on the relevance of key persons on projects (4.1;4.4). However, there are still a few who do not believe that key persons are important, especially in PPP light projects (3.7-3.9), which seems illogical since the PPP constitutes a long-term collaboration. In any type of project with a longer time span and especially in PPP light, a lot of information is in danger of being lost or overlooked if key persons are replaced. When parties enter into a long-term collaboration, they will be more likely to build close relationships and norms. The effect of the norms will be reduced drastically if key persons are to be replaced as a new figure needs to be accepted and involved in the existing norms. (Paper 3, Appendix B)

Essentially this means that the project group has to undergo parts of the storming phase before the same efficiency is achieved, as before replacement (Tuckman, 1965). A new key person can have similar skills, but can in no way reprocess the same knowledge about the project and has not been involved in creating the norms. The parties must be aware of this if a key figure is replaced. The awareness of norms and the influence they have are not obvious for the parties, hence the level in responses (2.7-2.9). It seem as if they do not understand the conceptual meaning of the term, thus lacking the ability to understand the radical importance that establishment of norms can have on the effectiveness and efficiency of a project. This definitely leaves room for improvement. The results indicate that the respondents are not aware that a conflict can be used to form new collaborative norms (2.7-2.9). In the survey conflicts are defined as being a dispute to which the parties are willing to find a solution, thus forming and storming into new norms. Conflicts in construction projects are inevitable when the parties interact, precisely the reason why they should be utilized. It was found in previous study (Paper 2 - 4, Appendix B) that norms are a fundamental element of effective collaboration, which is why parties should pay more attention to exploiting the conflicts to form new collaborative norms so as to achieve effective collaboration and thus making the EESC component (N) applicable on all forms of contracting.

KNOWLEDGE ABOUT AND USE OF STRENGTHS (KAUS)

Clients and architects find it more probable that other party' strengths can be utilized in trade (3.7) and general (3.6) than in D&B (2.9) contracts. The engineers are fairly neutral in this case, but do, however, predominantly favor the likelihood of utilizing strengths in general contracts (3.2) against trade contracts (3.3). In summation there is a general consensus among parties that knowledge about and use of other parties strengths (KAUS) are in short supply in all forms of contract.

There is likely a link between the interdisciplinary use of strengths and the parties' perception of each other. The results suggest that the parties have a fixed position on how they perceive each other's behavior see K1, K2, K3 and K5. In particular it is seen that the contractor expresses that the architect is not realistic about the budget in trade contracts (2.3). The engineer agrees (3.0), but tends to think that this is a problem in D&B contracts (2.9). The client's responses are interpreted as neutral and in general thinks the architect is realistic about the budget in general, trade, and D&B contracts (3.1-3.3). The general picture here is that the responses indicate that the parties are biased. This means that the parties see each other as stereotypes that act in a particular way. This preconception of each other's behavior can probably be linked to the types of contract and construction specifications used in the industry. This means a fixed view and a biased perception of the services to be provided and how the phasing in the process should be divided. The parties are thus locked by some fixed roles and limited by some static construction phases. Alternative types of contract forms could be a possible solution.

For KAUS to be successfully implemented and function optimally in all contract forms, there are several things that need attention. Biased attitudes need to go and no more stereotypes. Before the opportunity to exploit each other's strengths can even exist, a shared understanding of each other's behavior must be present. To achieve a better understanding of each other's behavior and actions, it is advantageous for the entire project team to use a personality test before starting a project. When using tests like DISC and Belbin, behavioral patterns should emerge; this should give the parties a better position to understand actions and behavior. This new insight in behavior preferences can be used to put together an effective team for a construction project. However, it is often the case that the parties cannot select whom to work with, but with the right focus on KAUS parties may more easily adapt to each other.

DIRECT MOTIVATION (DM)

Note that the results show that advisers prefer trade (3.9; 4.2) and general contracting (3.9; 3.9) and D&B is the situation in which they experience the least motivation (2.8-3.1). Responses from the contractors show the diametrical opposite as they clearly prefer D&B (3.8) against all other forms of contract (3.0-3.6). Overall, it is problematic that respondents experience situations where they are not motivated. The client hires and pays the different parties to meet fulfill tasks which

they ought to be motivated by if they receive a satisfactory payment. The lack of motivation may be explained by the lack of compensation SP, rated as low as (2.7). Assuming that the primary purpose of a construction project is to satisfy the client, D&B seems like the most problematic one (2.9-3.7) in contrast to (3.3-4.3) for all other contract forms. The clients achieve the least fulfillment of goals in D&B and PPP Light contracts (3.1; 2.0); this opinion is also shared by the consultants (3.0 – 2.4). D&B is the contractors' preferred form of collaboration, but there are still a proportion of contractors that do not prefer D&B. This indicates that the D&B contract has a number of shortcomings in relation to DM. Contractors should be the party with the greatest motivation in D&B.

There is coherence between the parties' lack of satisfaction with the final product in D&B contracts and the parties' motivation. The proportion of advisors who responded "low levels" of satisfaction and motivation with D&B are high. The purpose of highlighting this particular coincidence is that the client might experience greater satisfaction with the final project if the advisers were more motivated and took more responsibility and ownership. Their commitment can help improve the satisfaction and motivation.

If the client wants maximum attention to user requirements and value, a set of competitive conditions could be a set such that the price only weighted 25% while the qualitative criteria weighted 75%. Weighting of qualitative criteria could, among other things, ensure that architects become more involved in key decisions. As the theory has shown (Paper 3 - 4, Appendix B), personal status is one of the factors that increase the individual's motivation. The dialogue-based approach between the advisors and the D&B contractor will, therefore, undoubtedly give advisers an increased sense of status and recognition thus reinforcing motivation. The above mentioned aspects strengthens the basis for focusing on DM, as it is vital to ensure status, responsibility, ownership, and satisfactory payment to enforce motivation on a project.

SATISFACTORY PAYMENT (SP)

When asked about satisfactory payment (SP), each party has its opinion. The architects and engineers advocate for trade (3.3; 3.5) and general (3.3; 3.4), whereas contractors advocate for general and D&B contracts (3.2). All parties, however, agreed that there generally is too little time to carry out the projects (2.3-3.3). In the question concerning the preparation of realistic budgets only the client group believes that this is fulfilled in all four forms of contract (3.4-3.6) compared to (2.5-3.2). In relation to improving collaboration, SP will be an important factor since projects in most cases will include parties who feel that the value of the reward does not match the effort or the value of the reward does not depend on the effort. In both cases, the consequence will be a reduction in the level of collaboration, which is why a particular focus on this component is relevant.

From the author's point of view the problem is that in a typical construction project we have a client who does not know the real costs of things; a client who has a strong focus on self-interest and without social awareness. Along with this, the architects, engineers, and contractors all have their own impression of which contract form that honors their services most satisfyingly, and this fact locks the parties in different tracks, making it impossible to create a reasonable collaboration. Different perceptions of the realism of a budget and most economically advantageous contract form for the individual can cause a situation where one or more parties during the project will be required to enter into an economic compromise. This is out of consideration for collaboration not appropriate. If the parties beforehand have the biased perception that their effort will not be paid satisfactorily, it creates a breeding ground for unmotivated parties.

The lack of satisfactory payment due to underestimated budgets (consciously or unconsciously) from the clients' side is up for discussion. It may be noted that the causes can be many and range from unpredictable events during the course of the project, changing needs, changing material prices, poor project documents, and changing competition situation over a relative short period.

HARMONIZED ACTIONS (HA)

One of the general trends for the current status of harmonized actions is that clients (3.5; 3.5), architects (3.6; 3.6), and engineers (3.4; 3.5) all have positive feedback on trade and general and negative for D&B (3.2; 2.9; 3.1) and PPP light (2.7; 2.8; 2.9). However, the overall perception is that there is a relatively large amount of interpretation (for own benefit) of the contractual and project documents (3.0-3.7).

The clients, architects, and engineers are all convinced that the contractual basis (H3) and the project documents (H5) seems most comprehensive in trade (3.0-4.0) and general (3.4-3.8) contracts, which in itself is not surprising. Contractors believe the opposite, that contractual relationship and project documents are more comprehensive in D&B, which in itself makes sense. The clients do not disagree with this, but highlight both trade and general contracts as contract forms with the most adequate contracts (3.6; 3.6). Despite this, there is a tendency for the parties to believe that documents are interpreted (negative) most in the trade (3.5) and general (3.7) contracts.

It is ascertainable that all except the contractors agree that trade and general contracts contain the most precise contractual content and project documents. Despite this fact, it seems that the respondents' experience is that documents are misinterpreted most in trade and general contract.

The above mentioned suggests that the solution is not a stronger focus on producing more comprehensive project documents as there is a tendency to intentionally misinterpret them in every form of contracts. From the author's point of view,

parties should instead of striving for overly well done project documentation think more about the way in which they organize and facilitate collaboration.

Responses in the survey clearly link the perception of how harmonized actions are and where the parties' influence is greatest. To no one's surprise increased influence and power in a construction project will often result in the greatest possible chance of making profits, thus giving the winning parties a high sensation (HA). When players strategically try to maximize their power and profit, not seeking the optimum solution for all, Nash equilibrium cannot exist thus leaving out HA. It must be concluded that HA should be a focal point in all tendering and contract forms.

SHARED GOALS (SG)

The results show no consensus on establishing shared goals (SG). The contractor and client find a low degree of SG in trade contracts (2.7-3.3). Architects and engineers believe that SG is not present in D&B projects (3.0-3.2). The contractors favor D&B (3.5), engineers favor trade general (3.5), architects favor trade contracts (3.5) closely followed by general contracts (3.4), and the client favors general contracts (3.4). Throughout the questions the overall trend is that architects, engineers, and clients express that shared goals are favored in general and trade contracts, and contractors in D&B. The engineers and contractors are positive about SG in PPP light (3.3; 3.3). All parties point to the fact that positive relations promote better collaboration (3.6-4.1). The most striking is the similarity between the client (3.7-4.0), architect (3.6-4.0), and contractor (3.7-4.0). Note that the client and the architect do not believe to the same extent as the contractor that positive relations in D&B affect collaboration (3.6-3.7) against (4.0). They prefer trade contracts (4.0) where contractors have the opposite position (3.7) and engineers prefer general contracts (4.1).

There is divergence in the parties' attitude towards common goals and positive relations. They all agree that positive relations have an impact on collaboration, but the results indicate that the parties fail to develop common goals thus positive relations. This is especially the case in D&Bs. Depending on the size of the D&B project, it is a great responsibility that the client entrusts in the contractor as the contract is often based on only a vague client brief. Shared goals are an important aspect especially in this situation since positive relations and shared goals are the basis for achieving mutual understanding and thus improving collaboration. Common understanding is likely to be relevant in a D&B, since it ensures that the D&B contractor understands the client's requirements and wishes so that these get incorporated into the project. Building collaboration on strong relations, thus, understanding motives and actions in the project should make the parties more tolerant and honest, which is likely to have a positive effect on collaboration.

It is surprising that there are relative large differences in the responses about relations and how the respondents think frequent meetings create relationships and mutual understanding. Relationships are created when the parties meet face to face (Paper 3, Appendix B). Perhaps the reason for the difference of opinion is that the parties do not use the meetings actively to form relationships and achieve common understanding. If the communication is not active, meaning not listening actively and asking clarifying questions, a meeting will only inhibit the development of common understanding. The clients, architects, and contractor agree that positive relations affect collaboration, but at the same time acknowledge that they to a “low degree” use time to create positive relations. If respondents agree that positive relations have an impact on collaboration, they should devote more time to this thus focus on SG since it promotes the aforementioned. When asked if singular goals concerning only one party are consistent with common goals, there are a number of disagreements. Not surprisingly, the advisers do not think that these goals are consistent in D&Bs, thus favor trade and general contracts in contrast to the contractors. What amazes the most is that neither of these two parties expresses that one party's goal is consistent with common goals in any of the contract forms. Congruence between goals is essential if we are to create cohesion between the parties and that they together are to function. This fact just underpins the importance of utilizing SG in all contract forms.

3.5.5. PARTIAL CONCLUSION

On the basis of the discussion it can be concluded that the following general trends exist and affect the EESC concept. Contractors prefer D&B whereas advisors are of the opposite opinion and partly also the developer. The advisers prefer trade contracts, which the contractors do not. The closest to a consensus on where EESC components currently are applied is within the general contract. General contracts do still contain a number of challenges, which means that this form of contract cannot be considered the final solution to the creation of Efficient and Effective Situational Collaboration (EESC). The results are interpreted as meaning that the parties favor the contract form with which they achieve the greatest impact and in which their needs are satisfied most. Contractors prefer D&B and advisors prefer trade contracts. The clients predominantly prefer general and trade contracting.

All EESC components in earlier studies are found relevant to all forms of contracting; however, it was unclear which components could be most relevant to improve in different forms of contracts. A table was created (Table 3-3), to elucidate the EESC components that are currently in use and on which special attention should be paid in a given situation. The purpose of the table is to illustrate the situations in which the parties had found special needs of EESC components in order to improve collaboration and thus the overall efficiency and effectiveness.

Table 3-3 Target areas for improvement of collaboration structured in form of contract, party and question group. The notation (!!!) means "need high degree of improvement", (!!) means "need medium degree of improvement" etc.

		Client				Architect				Engineer				Contractor			
	Contract Form	Trade	General	D&B	PPP Light	Trade	General	D&B	PPP Light	Trade	General	D&B	PPP Light	Trade	General	D&B	PPP Light
Component	KAUS	!	!	!!	!!	!	!	!!!	!!!	!	!!	!!!	!!	!!!	!!	!!	!
	DM	!	!	!!	!!!	!	!	!!!	!!!	!	!	!!	!!!	!!	!	!	!!!
	SP	!	!	!!	!!!	!!	!	!!!	!!!	!	!	!!	!!	!!	!!	!!	!!
	HA	!	!	!!	!!!	!	!	!!	!!!	!	!	!!	!!	!!	!!	!	!!
	SG	!!	!	!!	!!	!	!	!!	!!	!	!	!!	!!	!!!	!!	!	!
	MBN	!	!	!!	!!	!	!!	!!	!!	!	!	!	!!	!!	!	!	!!
	COE	!!	!!	!!!	!!	!	!!	!!!	!!	!!	!!	!!!	!!!	!!!	!!	!!	!
	N	!!	!!	!	!!	!!	!!	!!	!!	!!	!!	!!	!!	!!!	!!	!	!

Note to Table 3-3, quick reminder: *Knowledge about and use of strengths (KAUS), Direct motivation (DM), Satisfactory payment (SP), Harmonized actions (HA), Shared goals (SG), Mutuality and basic needs (MBN), Corresponding obligations and expectations (COE), Norming (N).*

Target areas are represented by (!!!), (!!) and (!). The notation (!!!) illustrate that improvement by focusing on this particular component will have a large and almost direct effect on the overall effectiveness and efficiency of a project. This particular component should be given special attention. The notation (!!) illustrates that the EESC component to some extent is already in play, but can be improved. Illustrated by (!), this means that the EESC component is greatly used already and should only be improved in the quest for excellence if other areas do not require improvement. Components a arranged in order of parties and forms of contract so that each cooperating party can be aware of areas for improvement in given forms of contracting. When looking at the results from trade contracts in Table 3-3, it is clear that the contractors do not believe that any of the EESC components is in play, which is why the main proportion of components is marked with (!!!). This means that in future trade contracts parties should focus on all eight EESC components to improve collaboration with the contractor. The advisers and clients place themselves partly opposite, expressing that most components can be and are in use in trade contracts. However, the advisors express that the formation of norms between the parties can be improved, and that more work is needed to gain knowledge about the use of each other's strengths and matching obligations and expectations, which is a premise for preparing common goal. In addition, the engineers clearly do not believe that there is an understanding of their strengths and that these are underutilized in trade contracts.

The clients have partially the same opinion as the group of advisors, although they are more neutral. According to the clients trade contracts constitute the situation that produces the greatest satisfaction with the end product, which should be kept in mind when projects mainly are about satisfying the client as a customer. Common to all responses is that they do not experience norming and correspondence between obligations and expectations in any contract forms. Parties are encouraged to clarify how norms are formed and how obligations and expectations can be aligned with these. The EESC components should, therefore, form an integral part of all future projects regardless of contract form. Contractors utters that all EESC components are not properly used in both trade and general contracts. Contractors finds, however, that N and MBN are taken more into account in general contracts than in trade contracts. The advisors are more ambivalent about the general contract. The advisors are not directly dissatisfied with general contracts, but there are EESC components, such as COE and N, which do not receive the proper attention. Similarly, the advisors responded that the EESC components COE, N, and KAUS require improvement. To sum up, parties should in general contracting work with COE, N, and KAUS.

Table 3-3 shows that the advisers' experience that the majority of EESC components are neglected in D&B and PPP projects. The only positive thing that can be pointed out is that MBN and SG(R) are not completely neglected as the rest of the components. The clients prefer trade and general over D&B contracts, and PPP is not even on the scoreboard according to the responses. The only components in D&Bs not needing any concern are HA, SG(R), N and MBN. The client believes, however, that the EESC components SP, DM, and KAUS require improvement while COE is absent and requires special attention in future collaboration. The contractors prefer D&B projects, but it should be noted that the contractors continue to believe that KAUS, COE, and SP need focus. In D&B contracts, the parties should work with the EESC component COE as the parties agreed that this component is not implemented enough. The parties generally agree that norms are in short supply. It will be advantageous in all forms of contract and to all parties to undertake activities designed to involve the EESC component N.

Although the EESC components are divided and assessed separately, it should be mentioned that all EESC components are interdepended which means that a single EESC component cannot be optimized without regard to the other EESC components. This means that parties should be aware that optimizing a single EESC component may affect the function of other component. For example, parties cannot form norms and shared or common goals without first having formed basic mutual relations and so on. The study has shown that parties generally agree that the general contract is the contract form, in which applying EESC components have the best starting point for success.

3.6. THE EESC FRAMEWORK

The structures of the elements have been identified by theorizing them. The empirically identified elements were tied to a suitable theory and divided into eight components, see Figure 3-1. The theories made it possible to identify the structures of the elements and thereby clarify which set of elements that should be combined in to components, thus be a part of EESC.

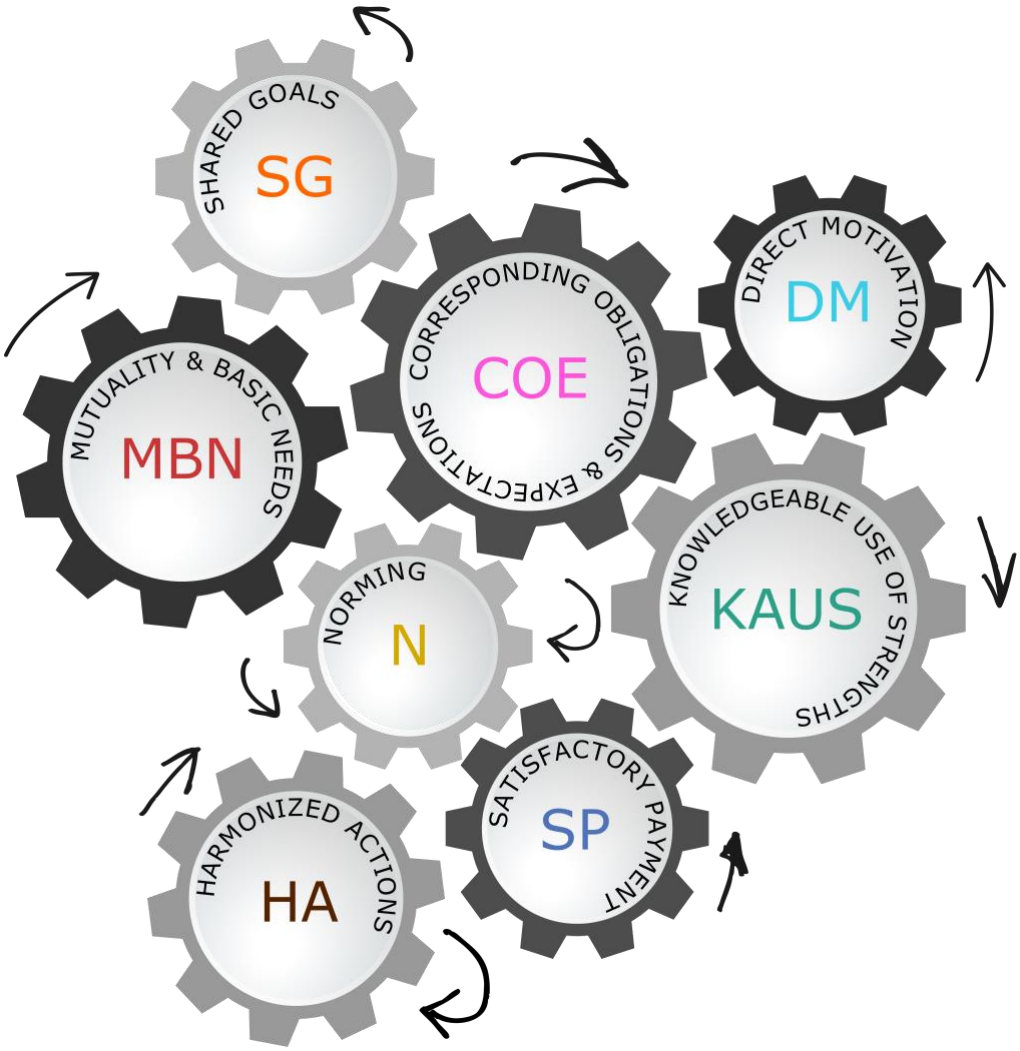

Figure 3-1 EESC "Clock" Work where components work as cogwheels setting EESC in motion

The components work as cogwheels in a clockwork setting EESC in motion, Figure 3-1. They support each other e.g. Mutuality & Basic Needs will set the speed up in the EESC cogwheels and relieve the stress on other components. Relationships between people constitute most components of EESC. It is braced by individual behavior and the choices the individuals make for themselves. Mutuality & Basic Needs gives the largest torque followed by Norming, Harmonized Actions, and Knowledgeable use of Strengths. Direct Motivation constitutes another torque in EESC in terms of satisfying reimbursement.

The effectivity of EESC is heightened by Harmonized Actions, because it aligns the parties' energy and Shared Goals in terms of positive relations and conflict resolution. Three components are termed as crucial in EESC: Mutuality & Basic Needs in terms of the parties' professional skills, Satisfactory Payment in terms of satisfying economy on the project and Corresponding Obligations & Expectations in terms of trust, interest and transparency on the project.

The extent to which EESC is effectuated depends on the composition of the system. The parts, components, can be put together in different ways corresponding to different combinations of EESC making it situational. How the exact composition of the components should be in different situations, differs from project to project. The right composition of EESC should be chosen for each particular case depending on the parties, because EESC is dependent on behavior. Unhealthy behavior will lead to unhealthy collaboration creating less value. Using the components in EESC will help create value in the processes and products in the build environment.

The greater the torque, the higher the efficiency and effectiveness of the collaboration. The different degrees of efficiency correspond to different situations where EESC are used. All gears gives torque to EESC and there is a link between all the components, the components support each other.

The construction industry tends to value low biddings and this creates little room for collaboration, since the economy is of great importance to the collaboration. It is a prerequisite for EESC that there is a satisfactory economy. Performance descriptions (Danish: Ydelsesbeskrivelser) can for example be considered as an obstacle, as they follow the "traditional" construction process and stages. Thus, there may be a need to develop new legislation and general conditions in the construction industry. The development of even more applicable ICT tools does also have an impact. For the time being, the current ways of doing "business" is not exacting for EESC.

Considering value creation on a y-axis and the level of contracting on an x-axis this shows a converse proportionality, see Figure 3-2. Value is considered as processing

problems into value for the society, the construction industry and users. Contract work is considered as the opposite.

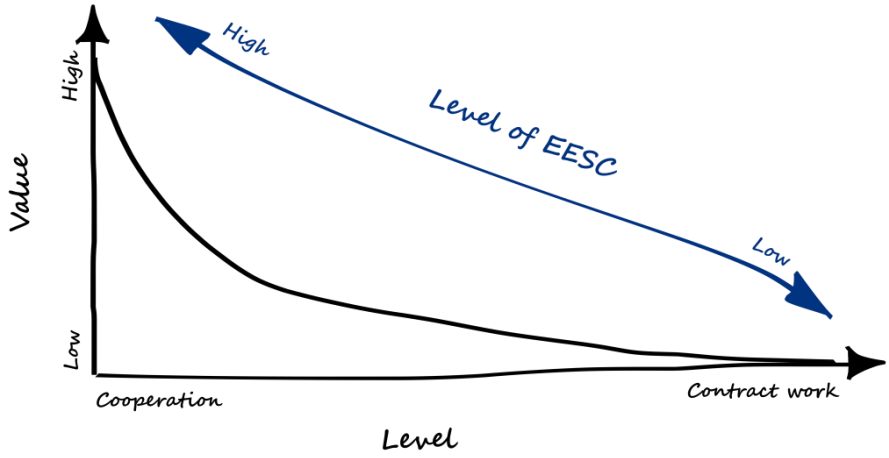

Figure 3-2 Illustration showing proportionality between value creation and level of contract work versus collaboration and level of EESC.

The right kind of EESC is selected depending on the collaboration of parties participating in the project. This is the case because the EESC depends on the behavior and when the right behavior is not present, this will be supplemented by contracts. It is the author's impressions through this study that a contract between the parties is inevitable. But through the period of collaboration the parties can choose between looking in the contract and looking each other in the eyes.

To give an example of how EESC can be used in practice a "poster" has been prepared with the eight components (Figure 3-3). The poster shows which areas, components, the client or project team should be particularly aware of. The numbering is practical and does not suggest a hieratical order. Similar posters have been prepared for the other parties and can be found in Appendix A13. The poster shows eight components (1-8) and under each component, on the basis of Table 3-3, a set of four round markings.

The markings represent different forms of contract. If one or more forms of contract are marked under the component, these should be seen as special focus areas. Effectuation of effort in the marked areas imparts to more effective collaboration and thus value creation in the built environment.

However, it should not be construed so as to not get a return by increased efforts in all areas; it merely implies a rationalization of "minimal effort" where the greatest return on effort exists. There must be a plan under each component for what actions

or steps are to be taken. An example of possible actions and steps can see in 0, note that this is just as an example. The hope is to eventually develop a practical manual with specific instructions.

Figure 3-3 Poster with the 8 components of EESC

CHAPTER 4. CONCLUSION AND PERSPECTIVES

This research, on designing a new situational framework for value optimization in the build environment, in the Danish construction industry, gave some valuable insights, in both the practical and academic fields of research. Collaboration is vital to construction projects effectiveness and efficiency. It seems that regardless of context and scope, collaboration is consistently attributed to be an essential determinant of success, effectiveness and efficiency in construction projects. However, there has been almost no empirical work done to assess, objectively, the importance of collaborative components on various aspects of collaboration. Also, there has been, as yet, less to none work done to quantify explicitly the extent to which different collaborative components, in relation to other components, improves construction project effectiveness and efficiency. Therefore, it is in this area - providing a quantification of the linkage between collaborative components and effective and efficient collaboration that this study makes its contribution by raising the hypothesis: "*Effectiveness and efficiency in the building process can be improved; this can be achieved by improving collaboration through a new situational framework for value optimization in the build environment*". The contribution of the Ph.D. project is therefore a new situational framework for improving collaboration and value optimization in the build environment termed EESC Framework (Efficient and Effective Situational Collaboration Framework). The possible impact of the new framework is considered an important addition to the industry. Efficient and effective collaboration is crucial in the attempt to improve the performance and value optimization in the build environment. The EESC Framework is presented in Section 3.6.

The findings were based on a study in the complex and unpredictable nature of the construction industry and process. The construction process is affected by different unpredictable and characteristic factors such as shift in locations, parties, types of contracting and projects making the process complex. All of these aspects affected the conditions for designing a new situational framework, EESC, for value optimization in the build environment, thus they had all to be accounted for in the design of a framework, applicable to the industry.

In Section 3.1 it was found that partnering gained increasing popularity within the construction industry for achieving better value for money. In the era 2002 and 2012, 142 papers related to partnering studies in construction were published in these journals. An in-depth review of the papers indicated that research interests in partnering have been increasing steadily throughout the years, thus taking a turn from a theoretical to at more solution-oriented research on review of partnering

development and application as well as benchmarking and overcoming barriers. The overview provided a solid reference platform to gain more insight into partnering related issues and trends, thus an overview of the development of construction collaboration and collaboration in the academic field were gaps and new trends in research, as referred to previously, provide promising ideas for further research. Again, the initial aim in the thesis was to work with partnering as a set of elements and components, and the target was a definition that would help partnering organizations to make informed choices about these elements and components. But, the partnering potential seemed to be exploited and exhausted making the need for a new approach to collaboration in the construction industry evident. The development of collaboration in the Danish construction industry appeared to be stalled. The industry has long been running in circles trying to develop new forms of collaboration, and partnering is no longer the answer. Evidently, through an elaboration of the collaboration issues in the Danish construction industry, it became clear that partnering was not a necessary part of the new definition. Thus, a relatively large amount of resources was used to ensure a good understanding of how work with collaboration previously has been done and what is needed now. The concept of partnering was rejected and substituted with a new starting point, to identify an appropriate method of collaboration. The goal became to examine how collaboration between the parties could be performed efficiently and effectively thus creating quality products that contribute to value creation in the built environment. Through preliminary investigation where the outset was to explore previously obtained knowledge in the field of collaboration using partnering as a lens to uncover collaborative themes were derived, see Section 3.2. The themes were a contraction of identified elements in partnering and general collaboration through the past two decades in the Danish construction industry. The themes, that later was examined to conclude on which of the themes that actually encompassed in effective and efficient collaboration were as follows:

- Synergy
- Competencies
- Motivation
- Incentives
- Ways of conduct
- Communication
- Interdisciplinarity
- Common goals
- Conflicts
- Personal relationships
- Values
- Development
- Community
- Conflicts "in the hinterland"
- Business goals
- Project goals
- The building process

In the quest of defining collaborative elements in Section 3.3 the themes from Section 3.2 were included in an interview study. The study consisted of 16 qualitative interviews focusing on exploring the themes from Section 3.2.4 and elements as seen in Table 3-2. The interviews took place using an interview guide prepared based on the author's acquired background knowledge about collaboration.

The interview was semi-structured as deemed appropriate for the purpose and thus to ensure that the necessary knowledge was acquired.

The observations made through the interviews transformed into concepts, and relationships were found between these concepts. The interviews were addressed with a focus on their meaning. Throughout the interviews condensation and interpretation of the informant's opinions were made to ensure correct interpretation since this allowed the informant to confirm or deny. Besides the list of elements seen in Section 3.3 it was found that the ability that the client can make decisions based on advice, pay a fair price for what is made, and set up appropriate conditions is a prerequisite for a good process. Also, that a good client brief in D-B contracts and good project material in both a general and a trade contract make collaboration easier because there usually are no problems with misinterpretations.

Moreover, architects, engineers and contractors do traditionally work based on established patterns, which are significant for the construction process. The architect wants chrome facades, the engineer wants it kept easy and simple, and the contractor wants to make profit. On the basic of this budgets are exceeded and projects needs to be reduced and changed for better or worse. Project material is a prerequisite for good collaboration, because shortcomings and ambiguities are interpreted in favor of different parties. Knowledge about the needs of others creates better projects whereas trying to maximize the outcome to one self creates conflicts. A good process is characterized by good economy and vice versa. The process sets the framework under which collaboration is progressing and it is characterized by a successive involvement of architect, engineer, and contractor. I also became evident that the different parties must possess certain skills to facilitate collaboration in the first place. Professional skills are the foundation for collaboration where parties should be generalists rather than specialists in order to ensure consistency in the project. They must have respect for each other and each other's skills and be open and honest. The client must not delay the process and thus have an understanding of the project costs and a willingness to pay.

Also, relationships are created between people when they meet and cooperate. Relationships create trust, which is important for collaboration. Previous relationship from other projects is a major factor when the parties are selected for a project. A lot of energy is used on the building relations in the beginning of a project. The energy used is proportional to the parties' mutual acquaintance in-between. Key personnel throughout a project are important in order to get an optimum process because it is impossible to transfer all knowledge and project rhythm as it is based on people. Common ground for all the interviewees was that the best incentive to do a good job is satisfying payment. Goodwill plays a central role for the parties as this will make them work extra to care for their own reputation, which in turn means they can get new projects. The interviewees all felt that creating good products and to feel like a part of the project on a personal level

motivated them. The parties' approach has to be constructive and solution-oriented so that the project can be solved jointly. Parties must be amenable and not the opposite, because it leaves room for collaboration and goodwill between the parties. It is a necessity that agreements are respected especially in terms of time and quality.

In Section 3.4 findings from the interview process, the theoretical perspectives from literature study, and the initial pre-study on lessons learned the collaborative elements could now be assessed using a survey. Survey as a method was chosen because of the wider spread in respondents, this helped verify and ensure that the initial elements from the interviews were valid. The survey reached a total of 57 responses and the distribution of respondents was considered acceptable. Using theories made the effects and structures of the elements visible and elaborated on how these specifically are complementary to each other. Through the evaluation of the structural coherence of the elements components became visible. A total of eleven components were identified; Relations, Mutuality, Basic needs, Corresponding obligations and expectations, Knowledge about and use of strengths, Targeted communication, Norming, Direct motivation, Satisfactory payment, Shared goals and Harmonized actions, at a glance the components are summarized in the following bullets:

- Relations cover repetitive behavior and reaction. Behavior and ways of expression accordingly to a subject makes the relation to this particular subject or content visible to other parties. In order to establish a common framework of understanding, the parties must understand each other's relation to the content and to each other. This is best done through interpersonal dialogue due to the frequency by which the parties are able to act and react and eventually reach a common understanding.
- Mutuality must be present to establish trust and credibility and the parties must respect the norms and customs that are created on the project through group development. A party's unwillingness creates imbalance with only two outcomes, either this unwillingness is spread to the other parties or with the result that the unwilling party is expelled. A party must be willing to accommodate the needs of others in the belief that their own needs are met by them and vice.
- Failure to comply with hygiene factors and proper satisfaction of basic needs is decisive when it comes to development motivation. It is a prerequisite for motivation that basic social needs in terms of relationships between parties exist.
- Complying with obligations and related expectations credibility is achieved. It is essential that the expectation of a party is consistent with the obligation of the other. It is also important that there is a balance between actions and reaction; a game of giving and taking in the right amount.

Taking too much or giving too little does not create trust and goodwill. What is needed is correspondence between obligations and expectations.

- The parties' differences are also their strengths in collaboration when they are utilized to create better solutions. The parties must therefore be aware that their profiles are different and this is an area to be exploited. Strengths-based practice is a collaborative process allowing parties to work together to determine an outcome that draws on the different strengths and assets of the parties.
- Targeted communication is important since a message is affected by both physical and mental noise, defense mechanisms, content and chosen media. All this must be considered to successfully target communication thus achieving the desired goal. The parties are in different situations, as they have different backgrounds, needs, goals, perceptions and external pressures why they need to express them in different ways to achieve the desired effect.
- Norming equals performing and a focus on achieving goals can only be attained when the parties in the project has established standards and norms in the group. You can set up rules from the start, but they might first be considered as appropriate norms when or if the parties can relate to them. Conflicts is inevitable and considered as clashes between opinions, attitudes, values, working methods, borders, trades, etc. Conflicts are opportunities for development, because consensus in this way can form in terms of norms.
- Direct motivation drives the project onwards and is created on a project through responsibility, status and recognition. Parties must therefore show respect; be open, listen, give each other time to talk and status.
- Satisfactory payment equals a fair relationship between the input necessary to achieve the desired performance, and the performance. The parties' expectation that a given effort leads to the desired performance is usually not present as the necessary effort is often too large and achieving the desired performance fails to appear. Targets and goals needs to be setup correctly to motivate.
- It can be difficult for the parties to know each other's goals, as the motive behind an action isn't directly related to the action. The motive for an action should be guided by bounded rationality rather than emotion and irrationality, since it is the individuals' best chance to make a rational decision. The point is that goals or "part-goals" must to some extend be shared by all parties and controlled by rationality.
- Harmonized actions help parties to create more value when they cooperate. Parties would overall gain the most by showing and acting out of trust, parties should be able to see which behavior is most rewarding for everyone, and be prepared to act accordingly.

With the ambition of transforming the components into an applicable model, and in the acknowledgement that the framework needs to be situational, the components were linked to contract forms via a survey in Section 3.5. The survey was set up to measure both the degree to which the components were already in use within the selected contract form and how well it facilitates effective and efficient collaboration. This made it possible to draw conclusions about which components that need more effort to facilitate and improve collaboration.

All EESC components in earlier sections were found relevant to all forms of contracting. A table was created (Table 3-3), to clarify which of the EESC components that are currently in use and on which special attention should be paid in a given situation. The purpose of the table was to illustrate the situations in which the parties had found special needs of EESC components in order to improve collaboration and thus the overall efficiency and effectiveness. In general future trade contracts parties should focus on all eight EESC components to improve collaboration with the contractor. The advisers and clients place themselves partly opposite, expressing that most components can be and are in use in trade contracts. However, the advisors express that the formation of norms between the parties can be improved, and that more work is needed to gain knowledge about the use of each other's strengths and matching obligations and expectations, which is a premise for preparing common goal. In addition, the engineers clearly do not believe that there is an understanding of their strengths and that these are underutilized in trade contracts.

According to the clients trade contracts constituted the situation that produces the greatest satisfaction with the end product, which should be kept in mind when projects mainly are about satisfying the client as a customer. The clients prefer trade and general over turkey contracts, and PPP Light is not even on the scoreboard according to the responses. The only components in D&Bs not needing any concern are *harmonized actions*, *shared goals*, *norming* and *mutuality and basic needs*.

Also, the advisers' experience is that the majority of EESC components are neglected in both D&B and PPP projects. The client believes, however, that the EESC components *satisfactory payment*, *direct motivation*, and *knowledge about and use of strengths* require improvement while *corresponding obligations and expectations* is absent and requires special attention in future collaboration. The contractors prefer D&B projects, but it should be noted that the contractors continue to believe that *knowledge about and use of strengths*, *corresponding obligations and expectations*, and *satisfactory payment* need focus. In D&B contracts, the parties should work with the EESC component *corresponding obligations and expectations* as the parties agreed that this component is not implemented enough. The parties generally agree that norms are in short supply. It will be advantageous in all forms of contract and to all parties to undertake activities designed to involve the EESC component *norming*. Common to all responses is that they do not

experience norming and correspondence between obligations and expectations in any contract forms. Parties are encouraged to clarify how norms are formed and how obligations and expectations can be aligned with these. The EESC components should, therefore, form an integral part of all future projects regardless of contract form. Contractors utters that all EESC components are not properly used in both trade and general contracts. Although the EESC components are divided and assessed separately, it should be mentioned that all EESC components are interdepended which means that a single EESC component cannot be optimized without regard to the other EESC components. This means that parties should be aware that optimizing a single EESC component may affect the function of other component.

As a final part of the thesis the EESC framework was produced. The empirically identified elements were tied to a suitable theory and divided into eight components. The components work as cogwheels in a clockwork setting EESC in motion.

The author feels confident that effectiveness and efficiency in the building process can be improved and this can be achieved by improving collaboration through the new situational framework for value optimization in the build environment, EESC.

The eight individual components support each other e.g. Mutuality & Basic Needs will set the speed up in the EESC cogwheels and relieve the stress on other components. Relationships between people constitute most components of EESC. It is braced by individual behavior and the choices the individuals make for themselves. Mutuality & Basic Needs gives the largest torque followed by Norming, Harmonized Actions, and Knowledgeable use of Strengths. Direct Motivation constitutes another torque in EESC in terms of satisfying reimbursement. The effectivity of EESC is heightened by Harmonized Actions, because it aligns the parties' energy and Shared Goals in terms of positive relations and conflict resolution. Three components are termed as crucial in EESC: Mutuality & Basic Needs in terms of the parties' professional skills, Satisfactory Payment in terms of satisfying economy on the project and Corresponding Obligations & Expectations in terms of trust, interest and transparency on the project.

In practical application and to give an example of how EESC can be used in practice a "poster" has been prepared with the eight components (Figure 3-3). The poster shows which areas, components, the client or project team should be particularly aware of. Similar posters have been prepared for the other parties and can be found in Appendix A13.

In light of this conclusion the author is convinced that it could be necessary to form a new contract form in the future. The new contract form should aim at meeting all the demands of project participants; it should be both generic and specific at the

same time, making it situational, preferably based on EESC components. A contract form involving all of the EESC components does not exist presently. Future development of such a contract form could be based on a setup similar to trade and general contracts. The investigation has shown that parties generally agree that the general contract is the contract form, in which applying EESC components have the best starting point for success.

4.1. DELIMITATIONS AND FUTURE RESEARCH

The presented research in the thesis is with a limited number of interviewees and respondents. Even though the results are generalized, the respondents do not cover all different categories of construction projects and parties. Besides the abovementioned limitation regarding project and parties, the study is limited to take place in Denmark. Research on collaboration in the Danish construction industry may not be universally relevant even if it is, strictly speaking, universally valid. In the effort of making research in construction management science as valuable as possible, it is important to consider relevance as well as validity. It is not sufficient simply to ask whether the research of one country is valid internationally; rather, it is important to begin by identifying the concerns and particular circumstances in a given country, to ask what are the most important and interesting questions for study, and to determine how best to study them. The question should not simply be: "Are construction management theories that interest us valid elsewhere?" but "How can we best understand management as it exists around the world?" (Kangas, 2003).

Also, the EESC framework has not been tested on-site but only been validated by a limited group of experts whose feedback positive as well as negative has helped in improving the EESC framework. Continuous improvement is still important in order to achieve excellence.

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APPENDICES

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Appendix A1. Assessment of research design

Step 1 - Literature Review		
Internal validity	*Credibility*	Peer examination; see Lincoln and Guba (1985). Discussing the research processes and findings with supervisor.
External validity	*Transferability*	Not relevant.
Reliability	*Dependability*	Thorough/Dense description of the used methods and process, discussion of findings continuously throughout the process with other researchers as a peer examination approach. Peer-examination of methods, method is reviewed and discussed with the supervisor.
Objectivity	*Confirmability*	Assessment of the process, findings, interpretations, etc. by supervisor.

Step 2 - Lessons learned in the construction industry (Archival/document analysis)		
Internal validity	*Credibility*	Discussing the research processes and findings with supervisor.
External validity	*Transferability*	Not relevant.
Reliability	*Dependability*	Thorough/Dense description of the used methods and process, discussion of findings continuously throughout the process with other researchers as a peer examination approach. Peer-examination of methods, method is reviewed and discussed with the supervisor.
Objectivity	*Confirmability*	Assessment of the process, findings, interpretations, etc by supervisor.

Step 3 - Defining collaborative components in an effective and efficient collaboration in a construction project		
Internal validity	*Credibility*	Triangulation of data sources, by interviewing 3 different site-managers. Peer examination; see Lincoln and Guba (1985). Discussing the research processes and findings with supervisor. Minutes checking, by enabling

		participants to read, make comments and approve own statements, see Lincoln and Guba (1985).
External validity	*Transferability*	Demographic considerations, where multiple "mangers" form different companies and parties were interviewed. Comparison of the informants (age, employment, geo. location, experience, etc.) in relation to ensure a variety of the informants.
Reliability	*Dependability*	Dense descriptions of the research methods, allowing other researchers to follow the decision trail and to audit the results, see Guba (1981). Thorough description the characteristics of the respondents/informants. Peer-examination of methods, see Lincoln and Guba (1985). Method is reviewed by the supervisor.
Objectivity	*Confirmability*	Reflexive analysis on the researchers influence on the process and the findings, to avoid bias and guided answers in the dataset and seek towards neutrality, see Guba (1981). Triangulation of data sources through interviewing different respondent with different characteristics. Documenting the procedures for checking and rechecking the data throughout the study. Data reduction and analysis products (quantitative summaries, compacted notes, hypotheses). Data reconstruction and synthesis products (thematic classifications, interpretations, inferences)

Step 4 - Quantitative assessment of collaborative components in an effective and efficient collaboration in construction

Internal validity	*Credibility*	Ensured that the same person did only participate once. Using an electronic survey to expand the sample.
External validity	*Transferability*	Demographic considerations, the selected participants did cover all different organizational levels and thereby contribute with different experience to production control.
Reliability	*Dependability*	Dense descriptions of the research methods, allowing other researchers to follow the decision trail and to audit the results, see Guba (1981). Peer-examination of methods, see Lincoln and Guba (1985). Method is reviewed by the supervisor.

Objectivity	*Confirmability*	Following a questioning technique to avoid affecting the responses. Documenting the procedures for checking and rechecking the data throughout the study. Question Wording.

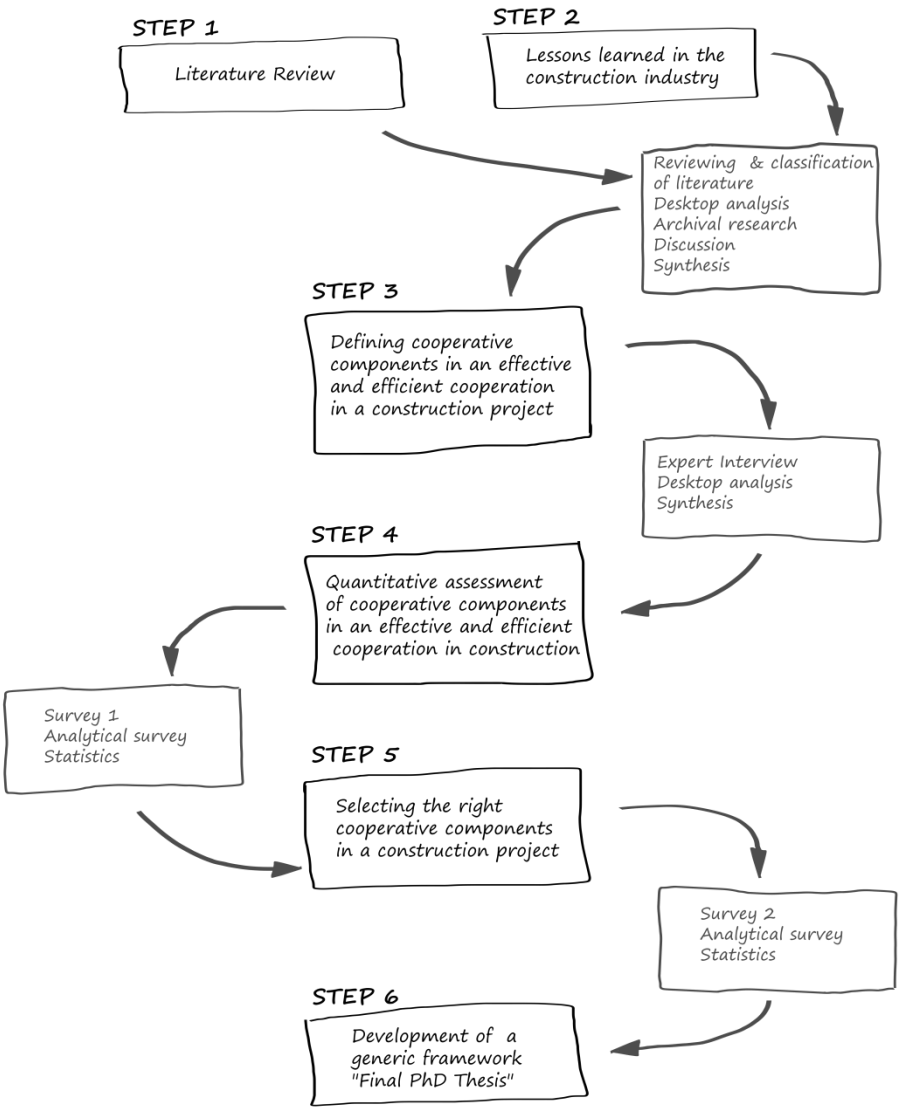
Step 5 - Selecting the right collaborative components in a construction project

Internal validity	*Credibility*	Ensured that the same person did only participate once. Using an electronic survey to expand the sample.
External validity	*Transferability*	Demographic considerations, the selected participants did cover all different organizational levels and thereby contribute with different experience to production control.
Reliability	*Dependability*	Dense descriptions of the research methods, allowing other researchers to follow the decision trail and to audit the results, see Guba (1981). Peer-examination of methods, see Lincoln and Guba (1985). Method is reviewed by the supervisor.
Objectivity	*Confirmability*	Following a questioning technique to avoid affecting the responses. Documenting the procedures for checking and rechecking the data throughout the study. Question Wording.

Step 6 - Development of a generic framework

Internal validity	*Credibility*	Triangulation of methods, by applying 3 different research approaches. Theoretical knowledge to the subject of interest (literature review). Peer examination; see Lincoln and Guba (1985). Reflexive analysis assessment from the supervisor to handle possible perspectives of bias from the investigator.
External validity	*Transferability*	Ensured during the research processes.
Reliability	*Dependability*	Dense description of the research methods, the research design and the research paradigm. Methods, research design and paradigm are reviewed by the supervisor.
Objectivity	*Confirmability*	Ensured during the research processes.

Appendix A2. Structure



Appendix A3. Themes from archival exploration

Table A3-1 Themes derived from archival exploration of experimental project reporting's

Appendix A4. Themes and theory

Table A4-2 Table showing relations between themes and theory

Appendix A5. Code tree

Table A5-3 code tree of categories that bundle meanings and opinions of significant aspects in collaboration

Appendix A6. Results from survey 1

Table A6-4 Table showing the finding form the first survey, respondents' perception of the importance of the elements, Scale 1-5; 5 is most important.

Elements		Professional clients	Client advisors	Consulting engineers	Architects	Contractors	Other
Capabilities							
A	Possess the appropriate professional skills for the job and generalist thinking	4,1	3,5	4,0	4,0	3,9	4,0
B	Respect for each other and each other's professionalism, openness to suggestions and participation in dialogue	3,7	4,2	3,8	3,8	3,7	3,9
C	Comply with agreements	4,2	4,2	4,2	4,2	4,3	4,3
D	Constructive and holistic behavior	4,1	4,5	4,2	4,4	4,2	4,2
Facilitation of cooperation							
E	Aligning expectations with a focus on success goals and metrics	3,6	3,8	3,7	3,8	3,9	3,4
F	Smooth initial progress in the first stages and solid focus on achieving project goals	3,7	4,1	3,8	4,0	3,9	3,7
G	Common framework of understanding through dialogue	3,3	3,2	3,2	3,3	3,4	3,1
The parties act in a project							
H	Understanding other parties' motives for the project	3,1	3,3	3,3	3,4	3,4	3,3
I	Understanding other parties' roles and benefitting from it	3,5	3,4	3,3	3,3	3,4	3,2
J	Understanding other party's needs in process	3,3	3,4	3,0	3,3	3,1	3,2
K	Pragmatic interpretation of project documentation (for the good of the whole)	3,3	2,8	3,0	3,1	3,2	2,6
L	Honest and trustworthy behavior	3,7	3,9	3,9	4,2	4,4	3,7
Communication							
M	Formulations suitable for the purpose and party	3,5	4,1	3,5	3,7	3,3	3,7
N	Select communication media with care and careful use of Email	3,8	3,6	3,6	3,6	3,8	3,1
Interpersonal relations							
O	Relationship between parties through face to face meetings	4,0	4,3	3,9	4,1	4,0	3,5
P	Trust and control (a party's credibility)	3,7	3,8	3,6	3,3	3,8	3,0
Q	Attention to the parties' personalities and the chemistry between the parties	3,7	3,9	3,7	3,8	3,9	3,9
R	Parties should feel heard and responsible for the project	4,0	4,4	4,1	3,9	4,3	3,8
S	Parties should have a reasonable attitude as parties influence each other	3,8	4,1	3,9	3,7	4,0	3,7
T	Cooperation on a professional level and not with emotions	3,7	3,7	3,7	3,9	3,9	4,0
The framework							
U	Budgeting so that parties are paid according to their real performance	3,6	3,4	3,6	3,6	3,7	3,0
V	Choosing the right form of contract so the client gets the right product	3,4	3,4	3,2	2,9	3,3	2,6
W	Early involvement of the contractor when the project is well-known and still subject to change	3,2	3,7	3,2	3,1	3,6	3,4
Other							
	Good economy	3,7	3,5	3,7	3,9	3,7	3,3
	Bad economy	3,5	3,8	4,0	4,0	4,3	3,7
	High quality project documents	3,7	3,3	4,2	4,1	3,9	4,0
	Client makes timely decisions and understands economy	4,4	4,5	4,5	4,1	4,5	4,5

Appendix A7. Overview of components

Table A7-5 Overview of components and short version of question themes from the survey

Table A7-6 Respondents' agreement in questions about different conditions, Scale 1-5; 5 is strong agree and 1 is strong disagree.

Appendix A8. Results from survey 2

Table A8-7 Comparison of statistic measures, standard deviation, standard error and the result from applied t test for the Architects. Sig. (2-tailed) is less than .05

Table A8-8 Comparison of statistic measures, standard deviation, standard error and the result from applied t test for the Clients. Sig. (2-tailed) is less than .05

Table A8-9 Comparison of statistic measures, standard deviation, standard error and the result from applied t test for the Engineers. Sig. (2-tailed) is less than .05

Table A8-10 Comparison of statistic measures, standard deviation, standard error and the result from applied t test for the Contractors. Sig. (2-tailed) is less than .05

Appendix A9. Summarized results from survey 2

Table A9-11 Comparison of results from the survey structured in form of contract, party and question group. Mean for each component is also shown.

		Client				Architect				Engineer				Contractor			
		Trade	General	D&B	PPP Light	Trade	General	D&B	PPP Light	Trade	General	D&B	PPP Light	Trade	General	D&B	PPP Light
KAUS	K1	3.3	3.3	3.3	3.1					3.0	3.0	2.9	3.0	2.3	2.5	2.7	2.9
	K2	3.9	3.8	3.4	3.2	3.4	3.5	2.8	2.8					3.3	3.2	3.2	3.4
	K3	3.4	3.2	2.4	2.7	3.6	3.0	2.0	2.4	3.6	3.1	1.9	2.7				
	K4	3.4	3.5	3.3	3.7	3.7	3.6	2.9	2.9	3.2	3.3	3.2	3.5	2.5	2.8	3.4	3.8
	K5					3.6	3.5	2.7	2.8	3.4	3.5	2.5	2.7	2.8	2.9	3.1	3.6
	Mean	3.5	3.4	3.1	3.2	3.6	3.4	2.6	2.7	3.3	3.2	2.6	3.0	2.7	2.9	3.1	3.5
DM	D1					4.0	3.8	2.5	2.1	3.9	3.8	2.8	2.1	2.8	3.3	3.7	2.5
	D2					4.1	3.9	3.1	2.4	3.7	3.7	3.2	2.6	3.1	3.5	3.8	2.6
	D3	3.8	3.8	3.1	2.0	4.3	4.0	2.9	2.4	4.0	4.0	3.0	2.6	3.3	3.8	3.7	2.5
	D4					4.3	3.9	2.7	2.7	4.1	3.9	3.3	3.0	3.0	3.7	4.0	2.7
	Mean	3.8	3.8	3.1	2.0	4.2	3.9	2.8	2.4	3.9	3.9	3.1	2.6	3.0	3.6	3.8	2.6
SP	SP1					3.3	3.4	2.7	2.5	3.5	3.4	2.9	3.2	3.1	3.3	3.3	3.4
	SP2					3.8	3.9	3.5	3.3	3.9	3.8	3.4	3.2	3.3	3.6	3.8	3.5
	SP3					3.1	3.2	3.1	2.9	3.3	3.4	2.9	3.2	3.0	3.4	3.5	3.3
	SP4	3.2	3.2	2.9	2.2	3.1	3.0	2.5	2.3	3.3	3.3	2.6	2.3	2.5	2.8	2.6	2.3
	SP5	3.6	3.5	3.3	3.4	2.9	3.0	2.5	2.5	3.3	3.2	2.6	2.8	2.6	2.8	2.8	3.1
	Mean	3.4	3.3	3.1	2.8	3.3	3.3	2.8	2.7	3.5	3.4	2.9	2.9	2.9	3.2	3.2	3.1
HA	H1	3.4	3.6	3.2	2.5	3.9	3.8	3.1	2.7	3.3	3.6	3.3	2.7	2.6	3.3	3.8	2.8
	H2	3.5	3.6	3.1	3.4	3.2	3.3	3.2	3.1	3.5	3.5	3.3	3.0	3.7	3.6	3.4	3.5
	H3	3.6	3.6	3.2	3.2	3.6	3.6	2.8	3.1	3.4	3.4	3.1	3.2	3.0	3.2	3.1	3.4
	H4	3.2	3.4	3.1	2.4	3.6	3.2	2.6	2.7	3.0	3.2	2.8	2.7	2.4	3.1	3.4	2.6
	H5	3.5	3.4	2.9	2.2	4.0	3.7	2.8	2.6	3.8	3.8	2.9	2.7	2.5	2.7	2.8	2.3
	Mean	3.5	3.5	3.2	2.7	3.6	3.6	2.9	2.8	3.4	3.5	3.1	2.9	2.9	3.2	3.3	2.9
SG (R)	SR1	3.1	3.3	3.4	3.5	3.2	3.1	2.4	2.8	3.2	3.2	2.8	3.7	2.2	2.9	3.3	3.8
	SR2	3.5	3.6	3.4	2.6	3.7	3.5	3	2.8	3.6	3.7	3.2	3.1	2.8	3.3	3.5	3.0
	SR3	3.3	3.4	3.2	3.4	3.3	3.1	2.4	2.8	3.5	3.5	2.9	3.6	2.6	3.1	3.4	3.4
	SR4	3.3	3.4	3.0	2.9	4.3	4.2	3.7	3.3	4.0	3.9	3.4	3.5	3.0	3.6	3.9	3.9
	SR5	3.0	3.2	3.1	2.7	3.6	3.5	3.1	3.2	3.2	3.4	3.5	3.2	2.6	3.3	3.5	2.9
	SR6	3.5	3.5	3.3	2.9	3.6	3.5	3.3	3.2	3.5	3.7	3.4	3.1	3.0	3.5	3.5	3.1
	SR7	4.0	4.0	3.7	3.2	4.0	3.9	3.6	3.5	4.1	4.1	3.9	3.5	3.7	4.0	4.0	3.4
	SR8	3.4	3.5	3.4	3.0	3.8	3.6	3.4	3.4	3.4	3.4	3.3	3.1	3.0	3.4	3.5	3.1
	SR9	2.3	2.4	2.6	2.7	2.4	2.3	2.3	2.3	2.4	2.5	2.4	2.5	1.8	2.5	3.0	3.1
	Mean	3.3	3.4	3.2	3.0	3.5	3.4	3.0	3.0	3.4	3.5	3.2	3.3	2.7	3.3	3.5	3.3
MBN	M1	3.1	3.3	3.1	2.8	3.4	2.9	2.6	2.6	3.2	3.1	2.9	2.7	2.3	3.1	3.3	3.0
	M2	3.5	3.3	3.3	3.0	3.3	3.2	3.3	3.0	3.3	3.3	3.5	2.9	3.6	3.6	3.4	3.0
	M3	2.8	2.7	2.9	3.1	2.4	2.8	3.6	3.0	2.8	2.9	3.3	2.8	3.1	3	3.1	2.8
	M4	3.6	3.7	3.4	3.1	3.9	3.6	3.0	3.0	3.6	3.8	3.5	3.3	2.8	3.5	3.7	3.2
	M5	3.7	3.7	3.3	2.9	3.6	3.3	3.1	3.1	3.7	3.7	3.3	3.3	3.1	3.6	3.6	3.1
	M6	3.9	3.9	3.6	3.2	3.6	3.3	3.2	3.1	3.9	4.0	3.8	3.4	3.5	3.9	3.8	3.4
	M7	3.4	3.4	3.3	3.0	3.6	3.7	3.7	3.4	3.3	3.4	3.7	3.2	3.4	3.6	3.6	3.2
	Mean	3.4	3.4	3.3	3.0	3.4	3.3	3.2	3.0	3.4	3.5	3.4	3.1	3.1	3.5	3.5	3.1
COE	C1	3.4	3.3	2.8	2.7	3.7	3.5	2.6	2.7	3.6	3.4	2.7	2.9	2.6	3.1	3.2	3.1
	C2	3.0	3.1	3.0	3.2	3.2	3.2	2.8	3.1	2.9	2.9	2.5	2.9	2.3	2.9	3.2	3.4
	C3	2.7	2.8	2.6	2.7	3.0	2.7	2.6	2.8	2.7	2.8	2.2	2.8	2.3	2.7	3.0	3.5
	Mean	3.0	3.1	2.8	2.9	3.3	3.1	2.7	2.9	3.1	3.0	2.5	2.8	2.4	2.9	3.1	3.3
N	N1	4.3	4.4	4.3	3.9	4.3	4.1	4.1	3.9	4.3	4.4	4.4	4.1	3.7	4.1	4.1	3.7
	N2	2.8	2.7	2.9	2.8	2.7	2.7	3.0	3.0	2.8	2.7	2.8	2.8	3.1	2.9	3	2.9
	N3	2.7	2.7	2.9	2.9	2.9	2.9	2.9	3.2	2.9	2.8	2.7	2.8	2.7	2.9	2.9	3.2
	N4	2.9	3.0	3.1	3.2	2.4	2.4	2.2	2.4	2.5	2.7	2.9	3.2	2.6	3.0	3.2	3.6
	Mean	3.2	3.2	3.3	3.2	3.1	3.0	3.0	3.2	3.1	3.2	3.2	3.2	3.0	3.2	3.3	3.4

Appendix A13. EESC Framework

Target areas for improvement of collaboration
Projectteam focus on the Architect

1
MUTUALITY & BASIC NEEDS
- Respect for other parties' needs in the process
- Failure to respect needs of other give rise to conflicts
- Project changes without regard to other parties
- Parties are committed to make the project work
- Adhere to agreements
- Importance of compliance to maintain motivation
- Low professionalism weakens motivation and relations
2
CORRESPONDING OBLIGATIONS & EXPECTATION
- Perceived honesty, trustworthiness and transparency
- Behavior based on interest in the project as a whole
- Can trust limit the extent of control
3
NORMING
- Importance of key figures
- Unwritten rules leads to conflict
- Use of conflict to form new cooperative norms
- Incentive agreements improves cooperation
4
KNOWLEDGEABLE USE OF STRENGTHS
- Architects realism about economy
- Engineer's ability to accommodate the architect's ideas
- Optimizing project at the expense of quality
- Use of strengths (Aesthetics and engineering)
- Clients realism about price and quality
5
DIRECT MOTIVATION
- Opportunity to achieve personal status
- Experienced motivation
- Satisfaction with the final product
- Perceived responsibility and ownership
6
SATISFACTORY PAYMENT
- Achieve a satisfactory compensation
- New projects based on a job well done
- Create economic profits
- Sufficient time to carry out the project
- Realistic budgets
7
HARMONIZED ACTIONS
- Problems and conflicts solved together
- Interpretation of project documents for own benefit
- Adequate and comprehensive contracts
- Balance between give and take
- Project documents are clear and unequivocal
8
SARED GOALS
- Development of shared and common goals
- Professional behavior in conflicts
- Singular goals consistent/in-line with common goals
- Selecting collaborators based on previous relation
- Use meetings actively to form relationships
- Meetings creat of relations and mutual understanding
- Relations contribute to better cooperation
- Relations (workshops) contribute to better cooperation
- Common canteen and other social activities
Trade
General
Desing &Build
PPP Light
Target areas for improvement of collaboration
Projectteam focus on the Engineer

1
MUTUALITY & BASIC NEEDS
- Respect for other parties' needs in the process
- Failure to respect needs of other give rise to conflicts
- Project changes without regard to other parties
- Parties are committed to make the project work
- Adhere to agreements
- Importance of compliance to maintain motivation
- Low professionalism weakens motivation and relations
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- Behavior based on interest in the project as a whole
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- Relations contribute to better cooperation
- Relations (workshops) contribute to better cooperation
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Target areas for improvement of collaboration
Projectteam focus on the Contractor

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